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Authors: Dace Gruberte

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Dace Gruberte

Supervisor: Dr.oec. Aleksejs Melihovs

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Abstract

The background of the study deals with the public financing efficiency and competitiveness of enterprises. The purpose of the study is to assess the impact of the EU structural funds 2004-2006 financing that targeted competitiveness of companies in Latvia, in order to check how the public funds influence the indicators for the productivity of the firms over a 10-year period. The study is built as a quantitative research examining the micro level data of companies' financial statements and using the econometric modelling: log-linear production function regression and linear regressions for difference-in-difference analysis.

The study finds ambiguous evidence for effectiveness of the EU structural funds support: positive causality observed in the whole sample vanishes when dividing data into micro-economically homogeneous groups.

Taking into account the significance of the EU structural funds in the overall mix of public spending it is imperative for the policy makers to strive for best use of the available resources. A more precise targeting could ensure greater impact on competitiveness of enterprises.

Keywords: the EU, the EU structural funds, European Regional Development Fund, public spending, investment efficiency, economic policy, business development, enterprise competitiveness, enterprise productivity

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1. Introduction and research question

Since Latvia's accession into the European Union (EU) in 2004, it is benefiting from the EU Cohesion Policy financing. According to the Treaty on Functioning of the European Union, the Cohesion Policy aims at "reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions" (Treaty on Functioning of the European Union, Article 174).

In the framework of 2000-2006 EU multi-annual budget, Latvia received 625 million EUR of EU structural funds financing for the development needs of its industries and sectors, such as transport, environment, energy, education, R&D, ICT, health care and others. The EU structural funds' financing is the most important public source for development financing of the national economy. For the 2004-2006 period, it accounts for about 1.5% of GDP volume or is about 6% of the state budget revenues during that period of time. During the economic downturn, EU structural funds served as the only source of counter-cyclical fiscal policy, fuelling targeted expansion against the backdrop of contracting policy across the board.

Both the EU Cohesion Policy and the new understanding of the Competition Policy drive the public players to seek efficiency to counterweight the distortion of competition the state aid provides. This efficiency target suggests that supported firms were going to perform well in the general market even without the government intervention, and the state funding merely saves time by imitating what the market forces would take longer to achieve. At the same time the drive towards Growth and Jobs in the new programming period of 2014-2020 is justified by significant adverse social effects the recent financial and economic crisis continues to have on the whole of the EU, not just the peripheral Southern Member States.

Sustainability of investments is among the key principles for the Cohesion Policy investments. That means that the investment should maintain its operation also five years after the completion of the project (Council Regulation (EC) 1260/1999, article 30). However, sustainability is not merely a legal requirement, but also the cornerstone of the Cohesion Policy, as it seeks material improvement to competitiveness, which is only possible when the investments made are used efficiently and for longer periods.

A part of 2004-2006 period funds (156 million EUR) were devoted for the increase of the competitiveness of the private enterprises in Latvia. The main objective for the financing targeted at promotion of enterprises was set as follows: "to promote the creation of new enterprises and raise the competitiveness of existing enterprises by providing the conditions for transition towards knowledge intensive production" (Single Programming Document for

Latvia Objective 1 Programme 2004-2006, paragraph 871). The support to enterprises was provided both as non-repayable grants and recyclable financial instruments. The financing encompassed the soft investments such as training of personnel, marketing measures and participation in exhibitions and fairs, as well as investments in fixed assets in order to create or improve the production or service delivery process of the enterprise.

The study is focused on that part of EU structural funds support to the development of enterprises that was provided in a form of non-repayable grants and was used for acquiring of the new fixed assets for the creation or modernization of the production or service delivery process. Altogether 310 projects submitted by enterprises have benefited from the respective financing whose ERDF part totals at 127 million EUR. While another 116 projects have been rejected and did not get the public funds.

The research question for the study is as follows: ***Are private companies, having received EU funding targeted for introduction of new fixed assets in production, more competitive than companies that had not received the EU funding?***

The study is built as a quantitative research based on micro level data of companies. The competitiveness of the companies is measured by two methods: Cobb-Douglas production function assessing the Total Factor Productivity as an indicator for the competitiveness and difference-in-difference method assessing the changes in performance of similar enterprises. The time horizon of the study covers the years 2003-2013.

The novelty of the research is based in the fact that there is a very limited number of studies in Latvia regarding the EU structural funds impact assessment on enterprises, using micro level data. The existing EU funds' impact evaluations regarding efficiency of the enterprises competitiveness support do not exceed a time horizon of more than two years after the completion of the projects. Extending the time horizon, the ability of companies' performance assessment widens, allowing a judgement on investments efficiency taking into consideration the impact of broader socio-economic changes that is the case for Latvia during 2003-2013. During this decade, the initial robust growth of economy turned info the overheating phase in 2006-2008 and following sharp downturn during 2009-2010. Starting from the year 2011 the gradual recovery came around. Thus, the time horizon of the research study covers very diverse phases of an economic cycle.

The research will fill a part of the gap, providing the evidence for the efficiency of EU structural funds related financing for the support of competitiveness increase in companies. The conclusions of the research can allow the policy makers to increase the policy efficiency as well.

The structure of the paper is composed from the Chapters as follows: Introduction and research question, Review of literature, Methodology, Analysis of results, Discussion of results and policy recommendations, Conclusions, References and Appendices.

2. Literature review

The theoretical framework of the study is based in several concepts. First of all, it relates to the notion of competitiveness of enterprises. The closely related concepts in measurement of competitiveness are Cobb-Douglas production function that estimates the productivity components of enterprise performance, as well as difference-in-difference method for the assessment of enterprise efficiency between similar or comparable groups.

As the study relates to the assessment of impact of public funding, particularly EU structural funds investments, the theoretical framework tackles the efficiency and effectiveness aspects of public finance and reviews several previous EU structural funds' evaluations regarding the impact assessment for the enterprise competitiveness and related subjects.

Competitiveness undoubtedly can be viewed in a much wider perspective than mere modernisation of production equipment. It can encompass not just the production, but also sales and marketing dimensions, as well as availability and productive use of certain production or R&D resources, national and regional regulatory framework and public infrastructure and support, as well as many other factors. The subject of this study, however, is state aid to modernisation of production equipment and related improvements in productivity of enterprises as demonstrated by total turnover. One needs to take into account that even in such framework, not all effects of markets are isolated, as an enterprise can chose to produce below its capacity not to accrue unnecessary warehouse stock – and anecdotal evidence suggests a number of firms did just that.

2.1. Competitiveness concept

The competitiveness concept has been discussed in the economic and management strategy literature; however, over the years the emphasis has been directed towards the different aspects what drives the competitiveness. Thus, the definition of competitiveness notion or the description of competitiveness elements develops over the time as well.

Reviewing the competitiveness concepts, the innovative activities as a key determinant of competitiveness is embedded in Schumpeter's notion of competitiveness established in 30-ties of the last century. According to Schumpeter, the company's ability to innovate is a key for achieving competitive advantage over its rivals (Siudek, Zawojska, 2014). Thus, the innovation in a broader sense is suggested as a key element for the improvement of competitiveness.

The focus of contemporary concepts of competitiveness is directed towards the productivity. According to Porter (Porter, 1998), the "principal economic goal of a nation is to produce a high and rising standard of living for its citizens. The ability to do so depends not on amorphous notion of "competitiveness" but on the productivity with which a nation's resources (labour and capital) are employed. The only meaningful concept of competitiveness at the national level is productivity. A rising standard of living depends on the capacity of a nation's firms to achieve high levels of productivity and to increase productivity over time. (..) A nation's firms must relentlessly improve productivity in existing industries by raising product quality, adding desirable features, improving product technology or boosting production efficiency" (Porter, 1998). Thus, Porter has pointed out to the inter linkage and interdependence of different levels of concept of competitiveness, however strongly focusing on the importance of productivity.

Also for Krugman, competitiveness is associated with the productivity. He puts emphasis for the raising domestic productivity in order to lift living standards, declaring that "raising domestic productivity, not capturing global markets, is what lifts living standards" (Krugman, 1994). In his opinion, "for an economy with very little international trade, competitiveness would turn out to be just another way of saying "productivity" and would have nothing whatsoever to do with international competition" (Krugman, 1994).

As suggested by Barney "the objective of the strategic management process of the firm is to enable the firm to choose and implement a strategy that generates a competitive advantage. A firm has a competitive advantage when it is able to create more economic value than rival firms" (Barney, 2006). According to Barney some of the most common accounting ratios for the characterizing firms' performance are profitability ratios (ROA, ROE, gross profit margin, earnings per share), liquidity ratios, leverage ratios, activity ratios (Barney, 2006).

Some of the studies strongly emphasize the multi-tier nature of competitiveness. It is declared that "competitiveness can be considered at different levels of aggregation: firm, industry, and country. The different dimensions of competitiveness are strongly related: for example, a country's competitiveness factors are determinants of its firms' international competitiveness. On the other hand, the most evident aspect of a country's international competitiveness is represented by its firms' competitiveness in comparison to other countries' firms" (Depperu, Cerrato, 2011).

In literature, the notion of innovation often is being discussed as a crucial driver for the increase of competitiveness. Technological change is one of the main engines of

competition and "many of today's great firms grew out of technological changes that they were able to exploit" (Porter, 1998). "Firms create competitive advantage by perceiving or discovering new and better ways to compete in an industry and bringing them to market, which is ultimately an act of innovation. Innovation here is defined broadly, to include both improvements in technology and better methods or ways of doing things. It can be manifested in product changes, process changes, new approaches to marketing, new forms of distribution, and new conceptions of scope" (Porter, 1998). For Porter innovation is the result of unusual effort.

"It is widely acknowledged that technological change and innovation are the major drivers of economic growth and are at the very heart of the competitive process" (Cainelli et al., 2006). According to the study *"Innovation and economic performance in services: a firm-level analysis"*, "innovative activity of a firm is likely to be reflected in its level of productivity rather than in the short-term rate of growth of this variable, which is affected by the state of the business cycle or by the contingent behaviours of firms". The study concludes that "innovating firms out-perform non innovating firms in terms of both productivity and economic growth. Furthermore, productivity in services is associated not only simply with the presence of innovation, but also with the level of financial commitment to innovation and the type of innovation activity performed. Productivity differentials among firms and sectors emerge as being affected by the innovation efforts of firms and, crucially, by the amount of resources devoted to the internal generation and adoption of ICTs (both software and hardware)" (Cainelli et al, 2006).

Regarding the new perspectives on innovation, Prahalad discusses the migration from the traditional innovations to the experience innovations that would both improve efficiency and co-create value (Prahalad, 2004).

2.2. Measurement of competitiveness

Cobb-Douglas production function

Cobb-Douglas production function is a traditional approach for measuring of productivity that according to the discussed theoretical concepts of competitiveness could be treated as a key element for driving the competitiveness. Cobb-Douglas production function can be used as a relatively straightforward formula of classical factors of production labour and capital, with all other explanatory power sweeping into the Total Factor Productivity (TFP). Yet, the function is flexible enough to allow for introduction of other factors to explain production,

chipping away at the bulk of TFP, like the time to gauge impact of technological development or to account for external shocks such as economic crisis.

The newly acquired modern equipment must be more efficient than the old, and therefore it can be expected that the efficiency of the capital used by the firm is higher. To assess the productivity of capital, the study uses the Cobb-Douglas function, as described by Hall, Mairess and Mohnen (2009). The Total Output is explained by the capital and labour – and the unexplained variation is summed up in the Total Factor Productivity. It is represented by equation as follows:

$$Q_{it} = A_{it} * L^{\alpha}_{it} * K^{\beta}_{it},$$

where Q represents the total output the company has produced in a given period of time, A represents TFP, L represents the labour input for the production process, K represents the physical capital input being used in production process in company, coefficient α measures the productivity of labour, coefficient β measures the productivity of capital.

It can be expected that increased efficiency of the capital that the firm acquires can be demonstrated in both – the capital productivity coefficient β (as it is a direct measure of capital efficiency/productivity) and the total factor productivity (because not all effects of the newly acquired capital can be captured in the β).

Difference-in-difference approach

To assess the effect of the EU structural funds support on the performance of the company receiving the funding the study applies the difference-in-difference method. The method foresees comparing identical firms that have and have not undergone "treatment" which in this case is provision of the EU funding.

The overall idea of the method is to observe the difference in performance between the two groups of firms: a group that received "treatment" (support from the structural funds) and a control group – firms that did not receive such support. Hence, a researcher can observe the difference in performance of a single firm pre- and past-treatment – and then compare this with difference in performance of another firm, calculating the difference between these differences.

When using the difference-in-difference analysis the most significant challenge is "fundamental problem of causal inference" (Holland, 1986): a process of selecting the firms to populate the control group, deciding on what constitutes an identical firm to the one that received the treatment. Failure at this stage will produce in-built bias that will inevitably alter the results of the analysis.

Hujer and Caliendo (2000) refer to "unobservable factors" that influence both the success of a firm's project application and its superior performance after implementation of the project. Those factors might be the size of a firm, its age representing experience, its performance in the previous years, and its specific experience in other public support programmes in the past.

Similar problem was encountered by Bukovska and Kozlova (2009) in identifying the effect of structural funds on firms in especially assisted territories, whose analysis produced unflattering results. They selected "identical" firms to those receiving treatment from the general population based on the set of factors like turnover and capital.

This study follows approach that is somewhat more liberal: it is assumed that the market players have better information than researchers do. So the decision to apply is used as an indicator that the firm complies with selection criteria and is in the position to carry out an expansion. Firms both in treatment and outside treatment differ significantly among themselves – they are large and small, old and newly established, they operate in different sectors of economy, so the analysis also utilises a possibility to divide firms into more homogenous groups. Discussion on the data describes grouping of firms in more detail.

2.3. Efficiency of public support

One might imagine that a government is seeking to improve both competitiveness of individual firms in its economy and the overall national competitiveness. The Cohesion Policy also puts forward a socio-economic dimension, trying to achieve the greater good of socio-economic change around the projects supported by the Policy.

The decision on regulatory provisions for the allocation of the public funds is taken by governments. Politicians of all stripes debate effectiveness and efficiency of government policies to stimulate competitiveness of their economies. Academia pitches in enthusiastically driven by thirst for knowledge or their own agendas and beliefs.

Government argues addressing market failures. Opposition often claims belief in market and suspicion of government's wisdom and integrity. Indeed government has a lofty ambition on their hands:

- Identify the market failure,
- Analyse reasons for the failure to occur,
- Come up with a plan to motivate market players' desirable actions,
- Ward of abuse of assistance in the form of over-financing the assistance, providing unwarranted assistance and a myriad other ways,

- And, finally - purge itself of side-lining (corruption, political rent-seeking etc.).

Effectiveness of the structural funds is a tremendously important as the Cohesion Policy became the largest EU policy by financial size in 2014 (http://ec.europa.eu/budget/mff/figures/index_en.cfm) reaching 366 billion EUR and overcoming the clearly ineffective but highly politicised Common Agriculture Policy. The European Commission informed in 2005 that in the period 2000-2006 the direct enterprise support amounted to 21 billion EUR (Communication form the Commission. Third progress report on cohesion: Towards a new partnership for growth, jobs and cohesion, 2005).

Sometimes the plan to stimulate a specific set of economic sectors fails in its design, as was the case in Japan when the Ministry of Industry and Trade provided a wide-ranging system of business support that cannot be unequivocally judged successful (Dick, 1995) when even the rise of the semi-conductor industry is not directly attributable to the government support.

Closer to home, a research of per capita income dynamics in EU-15 did not produce evidence for catching up of lagging regions in spite of significant funding invested (Boldrin and Canova, 2001). The glimmer of hope was allowed by Total Factor Productivity model showing some explaining power to growths in labour productivity in the supported regions.

The research carried out on order of the Italian Ministry of Education and Research found positive relationship between the assistance provided and growth of turnover (Pellegrini and Centra, 2006). The origination of the research funding might suggest a brighter outlook was in the books, however.

It might be useful to note that a number of research papers produced in the SSE Riga assessed wisdom of the support by the EU structural funds in Latvia (Bukovska and Kozlova, 2009) as well as its integrity (Babaicevs and Bobilevs, 2007). The research of 2007 found correlation between donations to political parties and success of project applications, casting a shade of doubt on the institutions involved in providing enterprise support. The 2009 research on the other hand found no improvement in profitability of the firms supported by the ERDF in especially assisted territories of Latvia, suggesting efficiency of the government intervention is sub-optimal.

One of very few evaluations commissioned by the Latvian government is the “Mid-term evaluation on implementation efficiency of NSRF priorities, measures and activities in the EU funds programming period 2007-2013” performed by „Agile&Co” Ltd (http://www.esfondi.lv/upload/01strukturfondi/petijumi/2011_BK_zinojums.pdf). It is

optimistic regarding efficiency of the structural funds, positively assessing absorption rate and achievement of targets of output and result indicators.

2.4. Framework identified

The theoretical concepts of nowadays most often emphasize the productivity as a key element for the increase of competitiveness. That could be measured as Total Factor Productivity using Cobb-Douglas production function equation. In addition, difference-in-difference method could add the assessment of productivity aspects between the similar groups of companies.

Lack of studies of productivity improvements resulting from the structural funds' support may be explained by relatively short time since Latvia's accession to the European Union – in fact, the data for medium-term analysis only exists for a few years.

This study is focusing on individual firms and their performance across the period where the economic boom gave way to financial and economic bust. Therefore for the purposes of this study, competitiveness will be assessed as improvements in productivity of firms – their ability to efficiently use the capital they obtained with assistance of the EU structural funds.

Such efficiency gains will be gauged by comparing relative performance of the firms benefiting from the EU structural funds assistance against the firms that applied for the assistance but failed to receive the funds. Parameters assessed in the research are Total Factor Productivity and Capital Efficiency in the Production Function, as well as Return on Equity and Turnover to Equity Ratio estimated in the framework of difference-in-difference analysis.

3. Methodology

The study was based on analysis of micro level data of two groups of companies – companies benefiting and not benefiting from the EU structural funds financing. The company level data used referred to the financial statements' positions as follows: net sales, net profit, fixed assets, equity and personnel costs. The examination of data was done, using Cobb-Douglas production function equation and difference-in-difference method. The production function was a standard issue Cobb-Douglas with Total Factor Productivity, Capital and Labour, without time variation. The regressions for difference-in-difference were constructed making the difference in ROE and Turnover-equity ratio dependant on the instrumental variable of granting the structural funds support. The Chapter in detail describes the data used, theoretical framework for data analysis, measurement of variables and data validity issues.

3.1. Data used

The scope of the study was set limiting it by the EU funds co-financed Activities whose primarily objective is focused at increase of competitiveness of enterprises by supporting the acquisition or development of new assets, particularly Single Programming Document 2.1.2 Activity: Support to development of pilot models, 2.2.1.1 Sub-activity: Support to private investments into modernising production processes and product lines, 2.2.2 Activity: Support to private infrastructure investments in shared equipment, 2.2.3 Activity: Support to investment in private infrastructure in access to public networks.

In order to construct the experimental group and the control group the set of companies benefiting and not benefiting from the EU structural funds financing was established according to EU funds IT system data (data base of Ministry of Finance vis.esfondi.lv is available for authorized users within EU funds management institutions only). During 2004-2006 programming period, altogether 310 companies had received grant financing for acquisition of new equipment or development of new assets in order to modernize their production or service delivery process. Those companies were selected for the analysis as an experimental group having received EU funds financing. As the total number of the companies is relatively low, no sampling was applied in selection stage of the analysed companies, although some companies were dropped at the level of data processing due to data availability limitations.

The control group of enterprises was established based on the EU funds IT system data regarding the rejected projects list. Those companies during 2004-2006 programming period have applied for the EU structural funds financing aiming for acquisition of new

equipment; however their projects did not succeed in getting the public funds. The total population of control group is formed of 116 companies. The same as for the experimental group, at the companies' selection phase no sampling was applied, although some companies were dropped at the level of data processing due to data availability limitations.

The company level financial data was collected from LURSOFT data base, partially by ordering and purchasing the data set (regarding the data for net sales, net profit, fixed assets, equity), as well as manually combing the financial reports of the companies (regarding the data for personnel costs which is the subject of Income Statement annex and thus not accessible in other way than manual collection). LURSOFT data base of companies is formed from the original documentation of financial statements of companies (Annual Report, including Balance Sheet, Income Statement, Cash Flow Statement) submitted to the Company Register of the Republic of Latvia (https://www.lursoft.lv/lv/uznemumu-registrs).

The companies' financial data used in study concerns the period 2003-2013. The three reference years were used for each of company:

1. *t=1*, 1st reference year – the year before the approval of the project that would provide the baseline evidence before the start of the project. As the calls of proposals have been launched several times the year before the approval of the project varies between 2003 and 2006.
2. *t=2*, 2nd reference year – the year when the project concluded (or it was planned to conclude it – in case of control group) that would provide the evidence on the gained potential in terms of fixed assets acquired. The 2nd reference year varies between 2005 and 2008.
3. *t=3*, 3rd reference year – 5 years after completion of project (or 5 years after estimated project completion in case of control group) that would demonstrate the resulting potential that was possible due to the implementation of the project. The period is in line with the regulatory provisions for the ensuring of sustainability of the EU structural funds co-financed projects results operation according to Council Regulation (EC) 1260/1999, article 30, section 4. The 3rd reference year varies between 2010 and 2013.

As the reference period concerns years 2003-2013 the currency used in data set is LVL (Latvian Lats), the exchange rate is 1 EUR = 0.702804 LVL.

In addition, statistical data of Central Statistical Bureau of Republic of Latvia has been used:

1) Monthly labour costs per employee by kind of activity according to NACE for converting the personnel data into the personnel costs (http://www.csb.gov.lv/statistikas-temas/metodologija/menesa-videja-un-reala-darba-samaksa-36412.html).
2) Purchasing parity index (PPI) - for converting of equity from the current prices into constant prices (http://www.csb.gov.lv/statistikas-temas/paterina-cenas-galvenie-raditaji-30385.html).
3) Consumer price index (CPI) - for converting the net sales from the current prices into constant prices (http://www.csb.gov.lv/statistikas-temas/metodologija/paterina-cenu-indekss-34431.html).
4) Investment deflator - for converting the net income from the current prices into constant prices (http://www.csb.gov.lv/statistikas-temas/metodologija/nefinansu-investicijas-ceturksnu-dati-36203.html).

3.2. Groups for analysis

For the analysis purpose the data set of companies was structured into eight groups. The division was based on industry parameters, size of the companies, as well as the duration of operation of the companies. The groups as follows were created, each of them encompassing sub-groups of benefiting and not benefiting companies.

1) All enterprises. The group that is comprised of all enterprises that has applied for the EU structural funds financing for the acquisition of new assets.

The industry split was done based on the NACE one-digit data level. Three groups of companies were established in relation to the actual information for their main type of business as the historical enterprise level data on NACE classification is not available in LURSOFT:

2) AB companies by NACE. The group was comprised of the companies whose main type of business activity is codified as A (Agriculture, hunting and forestry) and B (Mining and quarrying).
3) CFJ companies by NACE. The group was comprised of the companies whose main type of business activity is C (Manufacturing), F (Construction) and J (Information and communication).
4) Other companies by NACE. The group was comprised of the companies whose main type of business activity is not coded as A, B, C, F and J. Those companies mainly represent the service industries.

As there were no available data in LURSOFT data base on the average number of employees at the time of submission of projects applications, the split regarding the size of the company was made taking into the consideration the data on net sales a year before the project's submission (Income Statement data). The threshold of 2 million EUR (rounded to 1.4 million LVL) was applied for the split. As a result the groups as follows were established:

5) Big companies. The group encompassing the companies whose actual annual sales at the moment of project's submission was above 2 million EUR.
6) Small companies. The group encompassing the companies whose actual annual sales at the moment of project's submission was below 2 million EUR.

It seemed useful to divide the companies into two groups, as the size of a firm can be an important explanatory factor in its capacity to interact with a government, including its ability to understand the regulatory requirements and prepare a qualitative project application (as suggested by Criscuolo et al., 2007). The size of a company might also influence assessment of its project application, as a larger firm can be judged more stable and more capable to implement a modernisation project.

The split by the companies' duration of operation was made based on the assumption that a certain set of the companies might have been established for the clear purpose of applying for the EU funding. As the information regarding the EU structural funds' financing and provisional calls for proposals were publicly available starting from the year 2003, the split for the companies' duration of operation was made between years 2002 and 2003. Thus, the following groups were created:

7) Old companies. The group where the companies are founded from 1991 till 2002 according to their registration date in Enterprise Register of Republic of Latvia.
8) New companies. The group where the companies are founded starting from 2003 till 2007 according to their registration date in Enterprise Register of Republic of Latvia.

Appendix 1 includes the detail data on breakdown of benefiting and not benefiting companies by the companies groups created. Some of the groupings contain sub-optimal number of units, e.g. A and B industries benefiting and not benefiting companies, and not benefiting companies in grouping split by size. This diminishes the quality of regressions analysis.

3.2. Theoretical framework

For the analytical framework for assessment of competitiveness differences of companies benefiting and not benefiting from the public financing two methods were used, respectively - Cobb-Douglas production function and difference-in-difference.

Cobb-Douglas production function

The effect of newly acquired modern assets in company's performance primarily is associated with change in total factor productivity (TFP). According to Cobb-Douglas production function, the total output (Q) depends on TFP (A), capital input (K) and labour input (L). It is represented by equation as follows:

[1] $Q_{it} = A_{it} * L^{\alpha}_{it} * K^{\beta}_{it}$,

where *Q* represents the total output the particular company *i* has produced in a given period of time *t*, *A* represents TFP of company *i* for the time period *t*, *L* represents the labour input of company *i* for the production process in period *t*, *K* represents the physical capital input being used in production process in company *i* in period *t*, coefficient α measures the proportion of labour, coefficient β measures the proportion of capital.

For the calculation purposes the equation is being rewrote using natural logarithms and converting it to linear form:

[2] $q_{it} = a_{it} + \alpha l_{it} + \beta k_{it}$

The research seeks to identify the effect of provision of additional capital in a form of production equipment and other related assets. Since anecdotal evidence suggests that some firms kept the old equipment on line and used the new and old equipment simultaneously, it is rather realistic that the capital efficiency indicator will not be able to capture the entirety of the effect, so part of the explanatory power will be transferred to the TFP. Therefore, both capital efficiency and TFP are useful in explaining the effect of structural funds on performance of the benefiting firms here.

Difference-in-difference approach

For the assessment of comparable company groups benefiting and not benefiting from the EU funds financing the difference-in-difference approach was used. The change in ratios of Turnover-equity and Return on Equity (ROE) was used for the examining the differences between the groups of companies.

Both dependent variables here are ratios to equity because the structural funds programme provided the benefitting firms with capital injection and it is therefore important

that the capital is part of the denominator to ensure comparison across the firms receiving the injection and those going on their own is valid. Turnover (net sales) and net income on the other hand are obvious choices for gauging performance of an enterprise, turnover showing the growth in size of an operation and net income depicting efficiency of utilisation of assets a firm has in its disposal.

Turnover-equity ratio measures the rate of return on invested capital in comparison with the net sales generated. It refers to how efficiently the shareholders capital has been deployed for generating the revenues.

It was assumed that the change in Turnover-equity ratio over the periods of time is determined by a certain Constant and dummy variable describing whether the company has benefited from the financing. It was possible to apply the measurement for three different intervals of period of time as represented by equations:

$$[3]\ \frac{Net\ sales_{i,t=2}}{Equity_{i,t=2}} - \frac{Net\ sales_{i,t=1}}{Equity_{i,t=1}} = C + \beta D_i$$

$$[4]\ \frac{Net\ sales_{i,t=3}}{Equity_{i,t=3}} - \frac{Net\ sales_{i,t=1}}{Equity_{i,t=1}} = C + \beta D_i$$

$$[5]\ \frac{Net\ sales_{i,t=3}}{Equity_{i,t=3}} - \frac{Net\ sales_{i,t=2}}{Equity_{i,t=2}} = C + \beta D_i,$$

where *C* represents the constant depicting baseline growth of net sales between the years, and β represents coefficient for the capital injection dummy.

ROE measures the rate of return on invested capital in comparison with the net income generated. Thus, the generated income from a given shareholders equity shows the efficiency of the performance of the company.

The same as for Turnover-equity it was assumed that the change of the ROE over the periods of time is determined by a certain Constant and dummy variable describing whether the company has benefited from the financing. It was possible to apply the measurement for three different intervals of period of time as represented by equations:

$$[6]\ \frac{Net\ income_{i,t=2}}{Equity_{i,t=2}} - \frac{Net\ income_{i,t=1}}{Equity_{i,t=1}} = C + \beta D_i$$

$$[7]\ \frac{Net\ income_{i,t=3}}{Equity_{i,t=3}} - \frac{Net\ income_{i,t=1}}{Equity_{i,t=1}} = C + \beta D_i$$

$$[8]\ \frac{Net\ income_{i,t=3}}{Equity_{i,t=3}} - \frac{Net\ income_{i,t=2}}{Equity_{i,t=2}} = C + \beta D_i,$$

where C represents the constant depicting baseline growth of Net Income between the years, and β represents coefficient for the capital injection dummy.

3.4. Measurement of variables

Cobb-Douglas production function

For the Cobb-Douglas production function equation the following data has been used for the measurement of variables:

1. The total output of the company that was produced in a given period of time (Q_{it}) was measured by the annual net sales figure from the Income Statement (row code 010) of the company in a given financial year.
2. The physical capital (K_{it}) was measured by fixed assets book value represented in the Balance Sheet (row code 100) of the company in a given financial year.
3. Labour input (L_{it}) for $t=1$ and $t=2$ reference years (period 2003-2008) was measured by the total personnel costs of the company that were counted as a sum of salary and social tax contributions component for the cost of goods sold, sales costs and administrative costs. For the $t=3$ reference year (period 2010-2013) labour input data was constructed by using the annual average number of staff (annual report data) and applying the statistical data on average annual gross salary for the respective year using breakdown by NACE (http://www.csb.gov.lv/statistikas-temas/metodologija/menesa-videja-un-reala-darba-samaksa-36412.html). Thus, for the homogeneous assessment of the labour input (L_{it}) the staff figure was converted into the figure that as possible closely relates to the annual personnel costs. In effect, all the variables in the model were transferred into monetary units, which make for more intuitive interpretation of results of the regression analysis.

As the figures taken from the financial statements are expressed in current prices, for the more accurate comparison they were converted into constant prices, using Consumer price index (CPI), 2010=100 (http://www.csb.gov.lv/statistikas-temas/metodologija/paterina-cenu-indekss-34431.html).

According to financial statements, some of the data positions showed the actual value '0' (personnel costs, fixed assets). While it is feasible for a firm to operate with '0' fixed assets on balance sheet, it is hard to imagine an enterprise working without employees. At the same time the companies in the sample claim to be operational, so this study assumes that it is the owner-employee situation. Therefore, the companies were not excluded from the calculation, but for the logarithmic formula purposes, the smallest possible economic value of 0.01 LVL was introduced.

The financial values of reference years was compressed into three groups forming accordingly *t=1* or 1st reference year data, *t=2* or 2nd reference year data and *t=3* or 3rd reference year data.

The data on constant prices has been transformed into natural logarithms and using EViews software the regressions were developed. Log-linear regression using Ordinary least squares method was used for estimating the indicators.

Difference-in-difference approach

For difference-in-difference measurement the following data has been used:

1. For the measurement of change in ratio of Turnover-equity between the reference years the respective net sales data from the company Income Statement (row code 010) has been used. The equity measurement data represents the equity position of Balance Sheet (row code 530).
2. For the measurement of change in ROE between the reference years the respective net income data from the company Income Statement (row code 180) has been used. The equity measurement data represents the equity position of Balance Sheet (row code 530).
3. The instrumental variable for benefitting from the structural funds' assistance / receiving capital injection in the form of production equipment is a basic dummy construction taking values of 1 in case the firm benefitted and 0 in case of firm that did not receive the EU funding.

In order to convert financial statements data expressed in current prices into the constant prices the deflators described in 3.1 Chapter were used.

The financial values of reference years was compressed into three groups forming accordingly *t=1* or 1st reference year data, *t=2* or 2nd reference year data and *t=3* or 3rd reference year data.

Linear regressions using Ordinary least squares method were used for estimating indicators.

3.5. Validity

The validity of the study could be hindered by several factors related to the data internal reliability and data availability, as well as methodology as such.

From the methodology point of view there could be established another control group – those companies who never applied for the EU structural funds financing, however are comparable (by industry, size etc.) with the companies who applied for the funds. Thus, it would widen the opportunities of analysis for performance efficiency and would allow the comparison in broader perspective.

It could be acknowledged that net income might pose a challenge for validity of data since, as Sauka and Putnins (2011) suggested that two thirds of Latvian firms underreport their profits. The research therefore uses total output in Cobb-Douglas analysis and net sales as a companion dependant variable in the difference-in-difference regressions.

The financial data as such credibility could be treated from the perspective on their examination from the external audit. The Law on Annual Reports governs the development of Annual Report (comprised of Financial Report and Management Report) for the companies registered in Republic of Latvia. According to article 4, part 3, "the Annual Report should present a true and fair view of the company's assets, liabilities, financial position, profit or loss and cash flow".

The Law on Annual Reports is setting certain conditions under which the Annual Report should be examined by external audit – i.e. the ceiling for asset value, annual net sales and number of staff. During 2003-2005 the ceiling for asset value estimated at 100 000 LVL (142 000 EUR), the ceiling for annual net sales was set at 200 000 LVL (284 000 EUR), while the ceiling for the staff figure was 25. The ceilings have been gradually increased and starting from year 2014 the particular figures were set at 400 000 EUR for asset value, 800 000 EUR for net sales and 25 for the staff. If any 2 out of 3 conditions are met, the obligation to comply with the requirement on external audit is binding. The dominant majority of companies being researched fulfil the criteria for the obligation of external audit, thus increasing the credibility of the data used in the study.

The data availability that could influence the results of the study relates to the several aspects:

1) The mandatory inclusion of the annual average number of personnel (which together with working hours is the usual parameter for measuring the labour) in Annual Report is binding starting from year 2009 only. Until 2009 the information on number of personnel

in Annual Reports is not homogeneous. The option used in study for estimation of labour component was collecting the data on personnel costs of the company by revising the annex to the Income Statement, as costs of personnel form a part of positions of Income Statement, such as costs of goods sold, sales costs and administration costs. The derivation could occur as a result of manual counting of data from pdf files of scanned Balance Sheet annexes.

2) There are missing Annual Reports (not submitted, not available, the file is broken) for several companies for the reference years in LURSOFT data base. As a result of this the total population of the companies benefiting from the financing has been reduced till 241 firms. The group of non-benefiting companies in a result of non-availability of input data has decreased to 107 enterprises.

4. Analysis of results

The results of the analysis are structured according to the defined groups of companies and described based on the methodological framework, particularly the results of regression of TFP estimations of Cobb-Douglas production function and difference-in-difference measurement results. The detailed results of regressions are included in Appendix 2.

4.1. Results for all companies group

The regression results for the estimation of TFP for all companies group showed the evidence that for *t=1* period TFP coefficient for benefiting companies is 1.38 that is below the not benefiting group which was assessed at 1.51, however taking into account the standard error rate TFP for the both groups could be considered as equal. The capital efficiency coefficients are quite similar as well, accounted at 0.44 and 0.41 respectively. That suggests that enterprises in both groups treated and non-treated are similar.

For the *t=2* period the TFP has decreased for both groups, nevertheless the coefficient for not benefiting group has stayed at significantly higher level (1.34) in comparison with benefiting group (0.38). The similar tendency was observed for the capital efficiency coefficient – the decrease was estimated for both of groups; however, the coefficient stayed at higher level for the not benefiting group. That could be explained by adaptation time and effort required to fully utilise new equipment and find new markets.

When arriving at *t=3* period TFP coefficient for benefiting companies has improved and reached 0.74, while for the not benefiting companies the TFP continued to drop till 0.39. Capital efficiency showed the same trend arriving at 0.59 and 0.30 accordingly. It could be concluded that at the ultimate measurement phase benefiting companies have surpassed the productivity of not benefiting companies. The main reasons for that could be that new equipment was fully operational and marketing effort caught up.

Difference-in-difference estimations showed negative coefficient of -3.58 for benefiting companies for change in Turnover-equity ratio assessing the change between *t=3* and *t=1* while the coefficient for the same time frame for all companies accounted at 0.49. However the standard error rate exceeded the value of the coefficient, thus acknowledging the inconclusiveness of the observation.

As concerns the measurement of change in ROE over *t=1* and *t=3*, the similar trait was observed. In particular, the coefficient among the supported companies accounted negative -0.22, while the total group assessment still stayed at positive side totalling at 0.10.

The standard error rate exceeded the coefficient values, not finding the convincing relationship.

4.2. Results for industry split groups

The TFP analysis based on the industry split showed different evidence among the sectors. For the largest group – CFJ sectors companies – at *t=1* period the coefficients exceed 1 both for benefiting and not benefiting companies. At *t=2* period TFP coefficient for the benefiting companies decreased, while for the not benefiting companies increased even more reaching the value above 2. At *t=3* the TFP for the benefiting companies was improved till 1.02; the opposite conclusion was evident for the not benefiting companies – the drop of TFP has reached 0.65. It seems to suggest that benefitting companies weathered the crisis more effectively.

The capital efficiency coefficients for the benefiting companies showed gradual increase over three measurement periods of time. For the not benefiting companies the capital efficiency has improved for the *t=2* interval, however at *t=3* period it returned back to *t=1* level. This blip can be explained by the economic boom that took place around the time of end of most projects.

TFP analysis for the company group representing AB sectors showed that at *t=1* period the positive value of TFP for benefiting companies and negative TFP value for not benefiting companies. For the *t=2* period the opposite TFP development tendencies has continued. For the *t=3* period both TFP values were negative, however the standard error exceeded the coefficient value. This inconclusive result could be justified by the very low number of the sample for the AB sectors companies group.

For the capital efficiency coefficient common for the both groups was the downturn of values comparing the *t=1* and *t=2* periods and returning to *t=1* levels at *t=3* interval. Clearly, it is an effect of the boom, when the primary sectors of economy lost competitiveness against the background of soaring land prices and salary levels.

For the service oriented companies group at *t=1* period the benefiting companies group showed lower TFP coefficient in comparison with not benefiting companies, respectively 0.61 and 1.94. At *t=2* interval the coefficient for benefiting companies has become negative, while for the not benefiting companies it has decreased till 1.05. For the *t=3* reference period the coefficient for the benefiting companies has improved till -0.06. In case of not benefiting companies it has continued to decrease however still remains positive. It might suggest that equipment is not as useful in services as it is in industry.

The capital efficiency coefficient has decreased over the time for not benefiting group. The benefiting group improves its performance comparing *t=2* and *t=3* periods, suggesting that the benefitting companies came out of the crisis faster.

In assessing the Turnover-equity change ratio and ROE the standard error rate for the reference periods for all industry groups exceed the coefficient value. Thus, the difference-in-difference approach fails explaining variations in both dependants in all three NACE groupings of enterprises.

4.3. Results for companies duration of operation split groups

Assessing the TFP where the companies split was based on the duration of operation the old benefiting companies have experienced gradual decrease of TFP from 1.69 to 1.00 over the time intervals. Although the initial TFP level for not benefiting companies was almost the same, at *t=2* period not benefiting companies has managed to increase their TFP till 1.91. For the *t=3* period the drop till 0.77 was evident. However, accounting for standard errors, the result was still close comparing both groups of old companies.

The capital efficiency does not show significant changes over the periods, with exception for the drop at *t=3* for the not benefiting companies.

From both types of analysis, one can conclude that EU structural funds' assistance is not necessary for old firms that are stable and can afford to manage their modernisation with their financial means or can attract commercial financing.

In the group of newly created companies the initial TFP level was higher for not benefiting companies – respectively 0.59 and 1.19. At *t=2* interval the TFP coefficient value for the benefiting companies has reached negative value of -1.17 while for the not benefiting companies it was 0.67, however the standard error exceed that value making it inconclusive. The inconclusiveness of result interpretation was noted at *t=3* interval for both of groups.

The capital efficiency for both of groups has improved, comparing *t=1* and *t=3* periods, however the peak of it was reached during *t=2*. Not benefiting companies demonstrated higher capital efficiency for all of intervals. It might suggest that generic support instruments are not very suitable for new firms.

Applying the difference-in-difference method in assessing the change in Turnover-equity and the coefficients, the standard error exceeds the coefficient value so it does not explain the change over the whole period. It was evident that between *t=2* and *t=3* periods the coefficient for old supported companies exceeded the coefficient of all old companies.

The opposite evidence could be observed in a group of newly created companies. Comparing *t=1* and *t=3* intervals, the coefficient is negative (-15.83) for the supported companies, while for the all newly created companies the coefficient is 10.06 and significant. Again, one can see that the old companies demonstrate mild improvements, while the results for new firms again suggest that generic instruments fail to appropriately target their needs.

When comparing *t=2* and *t=3* periods, the coefficients for ROE showed higher value for the supported group of old companies in comparison with not benefiting group, accordingly 0.42 and -0.70, demonstrating a positive effect of the grants.

The results of coefficient measurement for ROE equation for the new company group was inconclusive.

4.4. Results for companies size split groups

The big companies showed rather similar initial coefficient of TFP between benefiting and not benefiting groups. At *t=2* interval the drop of coefficient for benefiting group was observed, however the coefficient of not benefiting group stayed at level considerably above in comparison with the benefiting group. At *t=3* interval the coefficient for both of groups has decreased and the benefiting group was still below the not benefiting companies. Like in the case with old companies, big firms might be better able to take care of their own modernisation on their own terms, rather than follow government criteria and timing.

The capital efficiency has gradually improved for the benefiting group of the old companies over the time and at the *t=3* interval has exceeded the coefficient value of not benefiting companies.

For the small companies group TFP values for not benefiting companies were higher for the first two reference periods, while at *t=3* the evidence was the opposite. However, the standard error rate for not benefiting group exceed the coefficient value making it inconclusive.

The capital efficiency coefficients for the initial interval was higher for benefiting group, the same as it was for *t=3* period. At *t=2* period the coefficient of not benefiting group exceeded the value of benefiting group. Again, it might indicate that small firms have to dedicate a very significant time and effort to implement the modernisations.

The difference-in-difference assessing the coefficients for Turnover-equity ratio change comparing *t=1* and *t=3* showed evidence of better performance of supported companies in big companies' group: 5.67 against -7.96 of the whole population.

The opposite evidence was observed for the small companies' group: -8.29 in comparison with 4.36 of the whole population of small enterprises. It might suggest that small firms overstretched themselves implementing the projects or even took up unnecessary modernisations spurred by the widely publicised opportunity.

Finally assessing the coefficients for ROE change comparing the periods it was inconclusive.

5. Discussion of results and policy recommendations

The Chapter discussing the results of the study is structured into two parts – discussion and reflection of the results obtained, as well as identification and definition of recommendations for the further improvement of EU structural funds management and implementation provisions for the entrepreneurial related support.

5.1. Discussion of results

The research set out to identify medium-term impact of the EU structural funds on the productivity of benefitting firms by employing econometric analysis using publicly available data.

Two methods were used to inform the research results: production function and difference-in-difference estimation. At separate instances, one of the two methodologies failed to explain the variation in dependant variables, but not once both methods failed at the same task, suggesting analysis is possible and can be continued.

The firms' information was divided into groupings according to basic characteristics of the set: treated and non-treated enterprises, big and small firms, old and newly established companies, as well as division into groups according to the main business sector.

Some of the data used was readily available from EU funds IT system of the Ministry of Finance and LURSOFT (standard Annual Report data, like equity, fixed assets, net sales, and net income), but some (estimation of labour input) required manual sifting through the financial reports and homogenisation by using general assumptions on average salaries. There is a risk that net income used in the difference-in-difference analysis might be severely underrepresented, as firms are often motivated to underreport profits for taxation management purposes.

The data available also consists of about three-to-one treated versus non-treated companies, which in some cases, especially when introducing groupings, makes for a sub-optimal size of sample.

Having data on all consecutive years rather than just three points in time, would significantly improve the analysis by explicitly introducing the time parameter that would account for boom and bust in the Latvian economy over the ten years of analysis and purge some of the regression results of this environment effect.

Another useful feature of the time series would be placing the performance of the analysed firms on the actual time-line as opposed to compacting all observations into three points in time. As each of these points can, in real life, be scattered up to three years apart,

complete time series might provide a very useful look into effectiveness of the EU support against the backdrop of the economic cycle.

The Table below shows the summary results of the effect of treatment at the time interval *t=3*.

Table 1. Effect of treatment: Summary

Ratio	All	Industry			Age		Size	
		AB	CFJ	Others	Old	New	Big	Small
TFP, *t=3*	+	0	+	0	+	0	-	0
Capital Efficiency, *t=3*	+	-	+	+	+	*	+	*
ROE, *Δ t=3 – t=1*	0	0	0	0	-	0	0	0
Turnover-equity Ratio, *Δ t=3 – t=1*	-	0	0	+	0	-	+	-

Explanation to the table:

+: Benefiting companies show better results
**: Similar results of benefiting and not benefiting companies*
-: Benefiting companies show worse results
0: Inconclusive

Various groupings produced different and, at times, opposite results suggesting that the support as provided by the structural funds might not be suitable to all types of enterprises.

When analysing all companies in one sample, the EU structural funds support seems to be effective in improving TFP and capital efficiency, but not ROE and Turnover-equity ratio.

Data divided by NACE codes into three groupings according to a traditional approach of splitting primary sector from industry and services showed a variety of outcomes. The primary sector did not in effect benefit from the support – even though the booming real estate and salaries might be one very significant reason. The industry sector, being the prime focus of the programme by design, showed better results, as both TFP and capital efficiency were growing faster in treated firms. The services sector produced mixed results showing better post-crisis performance in the capital efficiency, but not in ROE.

The age and size groupings might be most interesting in their results. When dividing the firms by their age, old companies seem to benefit from the EU structural funds support in much larger extent than new companies.

The size seems to matter. Bigger companies produce conflicting results: TFP dropped, but capital efficiency and Turnover-equity grew due to the structural funds. The small companies on the other hand clearly were worse off after implementing the projects by all accounts.

It seems that the programme was designed in a generic manner and lacked very precise targeting, allowing participation of a very diverse population of enterprises. This both provided the analysis with a rich sample of diverse firms, but also complicated the assessment of project applications by allowing diverse size and content of projects. The analysis performed in this study suggests that a greater degree of targeting is advisable to obtain more pronounced positive effects.

The accelerating economic growth turning into overheating and crisis provided a very turbulent environment for the firms to operate making use of the new production equipment and reaching their existing or new targets with the produce. It created a testing ground for resilience of both firms and their investment decisions that researchers can learn from. The data seems to suggest that overall injection of capital in the form of production equipment allowed the benefitting firms to survive the crisis easier and come out the other end faster than those not receiving the EU structural funds.

Another useful observation is that effort necessary to implement a modernisation project can sometimes be underestimated. Time and effort of management of a company is a finite resource, like any other. It seems highly possible that overstretching this resource was the main reason for smaller companies' weaker performance. This might not only provide additional argument for greater targeting, but also suggest that a system of support to firms implementing modernisation projects might be useful – be it work with the EU structural funds supported projects or those financed by entrepreneurs themselves.

The way forward in improving the understanding of the impact and efficiency of the government provided support is clear – more detailed and more qualitative data.

Future research can benefit from a more detailed information on labour costs of the firms, which can be obtained via a survey. It might be useful to account for a type of productive technologies introduced in the firms, notably their degree of innovation. A greater control group could be very instrumental in establishing a more robust baseline for the treated firms to be compared against.

Availability of fully populated time series will undoubtedly make both production function and difference-in-difference analysis more informative.

An obvious route forward is to extend the research to the performance of the firms supported in the programming period of 2007-2013, where data on post-project performance of the businesses is becoming available.

A more ambitious research extension is possible. It would be very valuable to analyse more types of the EU funds enterprise support that was provided in Latvia in 2004-2006. Adding support to training of personnel of the private businesses could enrich the production function addressing improvements in the labour input. Analysis of marketing effort could also be used to model effect on firms' ability to increase sales without changes to the production technologies.

To conclude, the study failed to identify the proof of the efficiency of the EU structural funds support to enterprises. While the quality of the data could take a part of the blame, it is wise to believe that failure to target assistance to the needs of the beneficiaries is a more important real life factor.

5.2. Policy suggestions

An applied study needs practical implications in order to utilise the newly gained insights into real life.

The results of the study suggest that a greater degree of targeting of the public support programmes is advisable. Universal programmes do not seem to work, failing to address specific needs of specific companies – by assuming that one size fits all the government agencies risk implementing programmes that fit nobody.

Both the amount of firms established in the direct vicinity of Latvia's accession to the EU as well as widely available anecdotes suggests that the supply of public support produced a pull-effect. Not all firms receiving the structural funds' support survived both the rigors of project implementation and the depressing influence of the economic crisis. A lower intensity of public support would disinvite supply-driven projects meaning that only the enterprises actually needing and capable of efficiently utilising the state aid would apply.

The study seems to indicate that the maturity of a firm is an important success factor. It might have to do with greater business experience, more stable management team and paradoxically less of a knee-jerk reflex to apply for public support. Significant financial outlays (up to two million euros per project) might call for more stringent conditions attached to such support, and requirement of experience in the market could be a useful filter.

Frequent failure of smaller and recently established enterprises in implementation of the structural funds' projects can be attributed to lack of experience. However,

implementation of the EU co-financed projects is a fairly specific experience that can be lacking in older and greater-size firms, mostly due to specific and evolving requirements but also because such projects often are a once-in-a-lifetime endeavour for an enterprise and the experience is not easily transferred and institutionalised. Therefore, it might be suggested that a subsidy for fixed assets might be accompanied by a mandatory project manager arrangement.

In respect to the groupings of the companies the worse performance after benefiting from the EU structural funds in relation to all ratios could be observed for the new companies group and small companies group. That means that even though the public financing animated the creation of the new enterprises it does not lead to their sustainable operation. It confirms that the increase of the absolute number of companies (that often are small and micro enterprises) most commonly addresses the employment problems rather than contributes to the competitiveness of Latvian economy. The dual objective of Single Programming Document for promotion of the creation of new enterprises and raising the competitiveness of existing enterprises requires the different types of support. However, even the creation of the new enterprises objective seems less comprehensive, the policy makers should focus not only on facilitation of the enterprise foundation stage, but also the policy should aim at the targeted promotion of the newly founded companies' development.

6. Conclusions

The objective of the study was to assess the effectiveness of the EU structural funds support to enterprises, by estimating causality between benefiting from the EU funds grants and business performance five years after project implementation. It was identified that there are very few studies in Latvia regarding the EU structural funds business support assessment at the micro level, although a significant amount of public resources has been channelled to private companies with the aim of increasing their competitiveness.

The data analysis does not come back with a clear answer as to whether the companies benefiting from the EU funds support has increased their efficiency and become more competitive: the two methods of econometric analysis at times provide no explanation of variation in dependant variables. Some results paint a contradictory picture, e.g. dividing data into groups does not allow to identify the source of positive causality between the support granted and improved business performance that is observed in undivided data sample.

The best results are observed in groups of old firms and enterprises operating in manufacturing, construction and ICT. While manufacturing and ICT seem to be justifiably targeted for support, the market failure requiring support to older enterprises is less obvious.

One might infer from analysis that a more precise targeting would significantly improve effectiveness of EU structural funds support.

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Appendix 1. Breakdown of benefiting and not benefiting companies

Table 1.1. Split of companies by parameters

Company split parameter	Number of benefiting companies	Number of not benefiting companies
All companies:	310	116
Split by industry sector:		
- A and B industries of NACE	22	5
- C, F and J industries of NACE	217	57
- Other industries of NACE	71	54
Split by duration of operation of company:		
- Old companies (founded before 2003)	208	64
- New companies (founded in 2003 and after)	102	52
Split by size of the company:		
- Big companies (net sales above 2 MEUR)	106	21
- Small companies (net sales below 2 MEUR)	204	95

Source: Developed by author based on Ministry of Finance EU Funds IT system data and LURSOFT data

Appendix 2. Results of regressions

Table 2.1 Results of Regressions for TFP and Capital Efficiency

Independent variables	Dependent variable: Logarithm on sales in respective reference year						
All companies		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	241	1.378874	0.192837	0.385863	0.242554	0.740431	0.238531
Capital efficiency for benefiting companies	241	0.446316	0.045168	0.502552	0.062897	0.597234	0.058573
TFP for not benefiting companies	107	1.516875	0.290116	1.338251	0.356202	0.396293	0.345758
Capital efficiency for not benefiting companies	107	0.417051	0.065838	0.716901	0.069459	0.304763	0.057703
TFP for all companies	348	1.423249	0.160112	0.596090	0.198815	0.744724	0.197115
Capital efficiency for all companies	348	0.436416	0.037132	0.580074	0.046368	0.454310	0.041533
Industry split: AB companies by NACE		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	16	0.770578	0.337191	2.779575	1.943613	(0.837296)	1.330957
Capital efficiency for benefiting companies	16	0.979892	0.072037	(0.328760)	0.780140	0.862300	0.253660
TFP for not benefiting companies	5	(0.330951)	0.570534	(3.859082)	1.475235	(0.769673)	2.008510
Capital efficiency for not benefiting companies	5	0.875920	0.117234	0.340899	0.259242	0.916044	0.321345
TFP for all companies	21	0.541644	0.280013	(0.313460)	0.917218	(0.869905)	0.980477
Capital efficiency for all companies	21	0.984763	0.059253	0.580048	0.260061	0.880397	0.178187
Industry split: CFJ companies by NACE		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	179	1.504938	0.213199	0.540199	0.254454	1.027771	0.240219
Capital efficiency for benefiting companies	179	0.345362	0.048065	0.526734	0.064033	0.597911	0.060852
TFP for not benefiting companies	50	1.163546	0.406119	2.179055	0.481385	0.655125	0.447171
Capital efficiency for not benefiting companies	50	0.186585	0.082171	0.910877	0.083103	0.200559	0.085943
TFP for all companies	229	1.440484	0.189141	0.776362	0.231303	1.018837	0.216693
Capital efficiency for all companies	229	0.305800	0.041559	0.647965	0.052154	0.468428	0.050945
Industry split: rest of companies by NACE		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	46	0.611172	0.436155	(0.370297)	0.653256	(0.062022)	0.682345
Capital efficiency for benefiting companies	46	0.822168	0.129669	0.447992	0.172700	0.576538	0.167110
TFP for not benefiting companies	52	1.942268	0.410275	1.057284	0.560524	0.318549	0.577641
Capital efficiency for not benefiting companies	52	0.687430	0.108913	0.455579	0.129490	0.311481	0.086991
TFP for all companies	98	1.317079	0.304227	0.405293	0.410902	0.318287	0.424671
Capital efficiency for all companies	98	0.743915	0.084901	0.407954	0.100675	0.367737	0.076002

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Company age split: old companies		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	157	1.694578	0.195228	1.117977	0.192784	1.006853	0.244879
Capital efficiency for benefiting companies	157	0.661896	0.050406	0.553614	0.051343	0.647988	0.061719
TFP for not benefiting companies	57	1.680967	0.327315	1.918370	0.318288	0.773918	0.382648
Capital efficiency for not benefiting companies	57	0.538533	0.107220	0.655990	0.084171	0.072020	0.067987
TFP for all companies	214	1.682191	0.167110	1.326118	0.166311	1.210270	0.219435
Capital efficiency for all companies	214	0.639338	0.045502	0.577986	0.044209	0.395966	0.049083

Company age split: new companies		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	84	0.591387	0.371562	(1.179046)	0.610818	0.168862	0.469290
Capital efficiency for benefiting companies	84	0.178872	0.075441	0.581112	0.151218	0.494671	0.110130
TFP for not benefiting companies	60	1.196775	0.491585	0.675717	0.710918	(0.081569)	0.603646
Capital efficiency for not benefiting companies	60	0.360114	0.088392	0.712229	0.112436	0.512953	0.094594
TFP for all companies	134	0.786903	0.297006	(0.579736)	0.426603	0.071505	0.366801
Capital efficiency for all companies	134	0.252022	0.057429	0.597281	0.085074	0.506382	0.071149

Company size split: big companies		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	101	2.188505	0.082914	1.475048	0.219014	0.973598	0.243233
Capital efficiency for benefiting companies	101	0.109252	0.028123	0.610821	0.050464	0.860622	0.057954
TFP for not benefiting companies	24	2.571417	0.193842	2.254299	0.450867	1.702364	0.463324
Capital efficiency for not benefiting companies	24	0.620744	0.143784	1.024318	0.115159	0.308757	0.113485
TFP for all companies	125	2.317874	0.081906	1.611658	0.205100	1.335423	0.225920
Capital efficiency for all companies	125	0.133912	0.030166	0.676674	0.048126	0.729272	0.054109

Company size split: small companies		t=1		t=2		t=3	
	N	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
TFP for benefiting companies	140	0.874061	0.299435	(0.410425)	0.410871	0.393577	0.339869
Capital efficiency for benefiting companies	140	0.520699	0.059760	0.519273	0.118550	0.382179	0.085392
TFP for not benefiting companies	83	1.160942	0.391431	1.067247	0.457294	0.019224	0.435855
Capital efficiency for not benefiting companies	83	0.395988	0.079070	0.666623	0.084236	0.309691	0.067685
TFP for all companies	223	0.992891	0.237660	0.059081	0.285179	0.270749	0.266133
Capital efficiency for all companies	223	0.474020	0.047644	0.560360	0.066285	0.339951	0.052828

Table 2.2 Results of Regressions for Turnover-Equity Ratio

Independent variables		Dependent variable: Δ Capital turnover between respective reference years								
All companies	N	Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
		Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	288	(0.177724)	2.430358	0.9418	0.489219	2.808642	0.8618	0.666944	3.741662	0.8587
Among suported companies	242	0.563947	2.793433	0.8402	(3.582794)	3.228229	0.2680	(4.146741)	4.300634	0.3358
Industry split: AB companies by NACE		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	22	0.056476	4.121550	0.9892	7.189984	20.97465	0.7353	7.133508	20.39565	0.7302
Among suported companies	18	2.442804	4.556545	0.5978	(14.32259)	23.18835	0.5438	(16.76540)	22.54824	0.4658
Industry split: CFJ companies by NACE		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	166	(1.935706)	4.451415	0.6642	(0.197151)	3.550900	0.9558	1.738556	5.896538	0.7685
Among suported companies	133	1.306348	4.973090	0.7931	(3.404742)	3.967041	0.3920	(4.711090)	6.587571	0.4755
Industry split: Other industries by NACE		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	69	2.179772	1.758913	0.2196	(5.566022)	2.753433	0.0472	(7.745794)	2.508269	0.0029
Among suported companies	44	(1.682767)	2.202636	0.4476	4.276253	3.448043	0.2192	5.959020	3.141032	0.0621
Company age split: old companies		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	218	2.549389	1.659959	0.1260	(4.506379)	2.952609	0.1284	(7.055767)	3.234000	0.0302
Among suported companies	173	(2.081361)	1.868793	0.2666	2.127957	3.324069	0.5227	4.209318	3.640860	0.2489
Company age split: new companies		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	70	(5.404690)	7.420718	0.4689	10.06412	6.433146	0.1224	15.46881	10.14701	0.1320
Among suported companies	46	5.485036	9.154108	0.5510	(15.83174)	7.935851	0.0501	(21.31678)	12.51723	0.0931
Company size split: big companies		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	133	(2.176093)	1.463611	0.1395	(7.960398)	3.947184	0.0458	(5.784305)	4.060307	0.1567
Among suported companies	111	2.766532	1.602101	0.0866	5.672341	4.320676	0.1915	2.905809	4.444503	0.5144
Company size split: small companies		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2		
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	155	0.738195	3.904144	0.8503	4.361961	3.880491	0.2627	3.623766	5.612665	0.5195
Among suported companies	107	(0.563822)	4.698938	0.9046	(8.291166)	4.670470	0.0778	(7.727344)	6.755275	0.2545

Table 2.3 Results of Regressions for Return on Equity

Independent variables		Dependent variable: Δ ROE between respective reference years								
All companies	N		Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
		Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	288	(0.268125)	0.318995	0.4013	0.101395	0.335693	0.7628	0.369520	0.430746	0.3917
Among suported companies	242	0.326116	0.366650	0.3745	(0.228672)	0.385843	0.5539	(0.554789)	0.495096	0.2634
Industry split: AB companies by NACE			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	22	0.004343	0.251600	0.9864	0.576869	0.556468	0.3123	0.572526	0.570759	0.3278
Among suported companies	18	0.245099	0.278154	0.3887	(0.348199)	0.615199	0.5777	(0.593297)	0.630998	0.3583
Industry split: CFJ companies by NACE			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	166	(0.136029)	0.414721	0.7433	(0.284063)	0.523415	0.5881	(0.148034)	0.608401	0.8081
Among suported companies	133	0.008340	0.463323	0.9857	0.119384	0.584755	0.8385	0.111044	0.679702	0.8704
Industry split: Other industries by NACE			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	69	(0.508921)	0.814224	0.5341	0.337414	0.602466	0.5773	0.846334	0.972760	0.3874
Among suported companies	44	0.942828	1.019629	0.3585	(0.163832)	0.754451	0.8287	(1.106660)	1.218159	0.3669
Company age split: old companies			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	218	(0.302576)	0.124091	0.0156	0.127201	0.386316	0.7423	0.429778	0.382906	0.2629
Among suported companies	173	0.248254	0.139703	0.0770	(0.454294)	0.434917	0.2974	(0.702548)	0.431079	0.1046
Company age split: new companies			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	70	(0.202094)	1.071508	0.8510	0.051933	0.673633	0.9388	0.254027	1.174442	0.8294
Among suported companies	46	0.680039	1.321800	0.6086	0.567925	0.830985	0.4967	(0.112114)	1.448777	0.9385
Company size split: big companies			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	133	(0.089544)	0.135287	0.5092	0.065118	0.393598	0.8688	0.154662	0.388805	0.6914
Among suported companies	111	0.025446	0.148089	0.8638	(0.252194)	0.430842	0.5593	(0.277640)	0.425595	0.5153
Company size split: small companies			Δ t=2 - t=1			Δ t=3 - t=1			Δ t=3 - t=2	
	N	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
C	155	(0.349975)	0.519244	0.5013	0.118022	0.496272	0.8123	0.467997	0.667945	0.4846
Among suported companies	107	0.534619	0.624950	0.3936	(0.183265)	0.597302	0.7594	(0.717884)	0.803923	0.3733