THE EVALUATION OF THE IMPACT OF FOREIGN DIRECT INVESTMENT ON LITHUANIAN ECONOMY USING LAG-ANALYSIS

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Abstract

Purpose – *to determine the particular impact of Foreign Direct Investment (FDI) on the Lithuanian Gross Domestic Product (GDP) through economic activities using lag-analysis, which allows to evaluate the impact on the particular period of time.*

Methodology. The most important aspect for the host country is how quickly FDI starts to affect country's economy as the impact of FDI occurs after a certain period of time (lag) following the investment actions. There are used the lag determination, statistical clustering and visualization methods.While using these methods there were investigated and were pointed out Lithuanian economic activities which have a significant value in attracting FDI.

Results. There was identified the optimum size of lag (certain period of time). Furthermore, there were presented the estimation and the proposals what the government should focus on, on wchi economic activity as one of the most economically perspective. The research showed that the impact of FDI was likely to occur rapidly in energetic sector despite the fact that many other sectors are subsidised by the government.

Practical implications - the issue of Foreign Direct Investment impact is one of the most urgent, tas it is believed to enable the country to attract foreign capital and it allow to increase the country's economic growth technological and political development of the country. There had been done many studies analysing the impact of Foreign Direct Investment on the country's economy and particularly on Gross Domestic Product (GDP). Such studies were made by Alfaro (2003), Blonningen and et al. (2006), Johnson (2006), Kornecki (2007), Qaiser and et al. (2011) and by many other scientists.

Value/originality. Usually scientists use just correlation-regression analysis to evaluate a certain impact but there hadn't been done any research in Lithuania analysing FDI impact using not only correlation-regression but also lag-analysis method. Due to that, there was created the model showing when the certain impact of FDI started to influence country's GDP.This research not only revealed a new study of economical- statistical approach but also distinguished the most useful economic activity for the creation of the country's economic welfare.

The type of the article: Research report.
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JEL Classification: F4, F43.

1. Introduction

Foreign Direct Investment (FDI) is considered to be one of the key drivers for economic growth. Due to this fact, a number of studies have been done to determine its' impact on the country's economic development. Many authors agree that FDI has a positive impact on the host country 's economic growth in the following ways: promoting new jobs, increasing the local country's capital, introducing new technologies and technical experience.

Foreign companies transfer modern management, production management, technology - engineering solutions, organisational management experience while implementing in the local

market of the country. In this way, local business and country' s manufacturing productivity are being promoted to grow up and develop.

The increased productivity of the host country allows to emerge for the changes of the economic growth, which are necessary to ensure the growth of GDP. Investments were explored by different foreign authors in many different ways.

There have been done many studies analysing the impact of Foreign Direct Investment on the national economy and on particular Gross Domestic Product (GDP) over a long time. The majority of research is done in a wider spectrum: the impact of Foreign Direct Investment on the country's GDP is studied without distributing Foreign Direct investment into to the economic activities, and there is no research made on how quickly the impact will occur.

The scientific problem. Different research projects and studies related with FDI impact on economic growth in the scale still don't lose relevance. The choice of the proper economic policy for the   Foreign direct investment into the economic sector or industry ensures the maximum economic efficiency: maximises the productivity and helps to solve the problems of unemployment, increases competitiveness.

The aim of the research – To evaluate the impact of Foreign Direct Investment on Lithuanian GDP through economic activities using lag-analysis, which allows to evaluate the impact on the particular period of time.

The goals of the research:

1. To identify the general impact of FDI on national economic growth, and on different economic sectors and branches in Lithuania.
2. To determine the impact of FDI on the most economically pervious branches of economy or sectors, and to identify the lag of the impact exposure moment.

The Importance of Foreign Direct Investment impact

Direct investments are those investments which form the basis for long-term economic relations and interests between a foreign investor and the direct investment enterprise. This means that foreign investments influence corporate governance.

Scientists while analysing the impact of FDI on the country' s economy usually include gross domestic product (GDP) as the main indicator of economic growth.

It is often argued that in order to reduce the gap from the economically developed countries and to ensure the growth of economic indicators, the higher FDI growth rate is needed.

Foreign Direct Investments are generally considered to be one of the most significant factors leading the rapid and continuous development of the country and increasing the country's productivity. This factor influences strongly the growth of gross domestic product.

Lithuanian authors such as Tvaronavičius and Tvaronavičienė (2008) had made the comprehensive analysis of the benefits of FDI attraction for the entire economic mechanism of development.

The manufacture productivity as a direct consequence of the impact of foreign investment was analysed by such foreign authors Gorodnichenko, Svejnar and Terrell (2007). According to the authors, this affect can be diversified by the methods how the desired positive result is achieved. This implies, that an investor can operate the productivity of local firms – such situation is considered as horizontal affect. On the other hand, investor may operate in a separate branch of the existing suppliers and their performance / productivity – such situation can be considered as vertical impact.

Gorodnichenko *et al.* (2007) in their work had done the empirical analysis of different foreign authors studies and express the opinion that the developing economies attracting Foreign Direct Investment simply will not be able to increase its macroeconomic indicators, due to disability to respond quickly to the changes. Developing countries will encounter such a problem due to a low technological level.

The individual economic sectors, being underdeveloped simply cannot absorb all the new information, and this will reduce the opportunity to grow productivity of the entire country.

Authors Busse and Groizard (2006) express the opinion that the countries which economies are heavily regulated by the state, do not suffer, or suffer just a few Foreign Direct Investment benefits for the country. The authors mention that the host state enterprises become more competitive when they accept a foreign competitor and try to maintain a leading position. Then the company not only takes the best practice from foreign company, but also the technological knowledge. The technological experience lets to rise the country's level of technological development. What is more foreign investors while coming to the country's market reduces the unemployment rate, which allows to increase domestic consumption and as a result, changes in the growth of GDP. Authors emphasize that if the labor market were heavily regulated as the financial system, foreign direct investment wouldn't lead a positive impact on the country's economy life.Lithuanian authors Laškienė and Pekarskienė (2011) analysed in detailed the impact of FDI on productivity of the labor market and carried out the key points.

In terms of FDI impact on the national economy Johnson (2006) notes that Foreign Direct Investment potential depends on the development level of host country. Foreign Direct Investment have the greatest impact on more developed countries, while the less developed countries, exposure is low. The scientist Johnson (2006) still emphasises this fact through the creation of a new technological base.Also more developed countries' technological affects allows to ensure a constant and long-term economic growth.

Many scientists explored numerous positive aspects of FDI attraction: Beugeldsjik and others (2009), Keller (2010), Blind and Jugmittag (2004), Brandl et al. (2007), Davies *et al.* (2006) Eaton and others (2002) and Hattari and Rajant (2011), Qaiser and others (2011) and Javorcík (2004). For example, authors such as Blomstrom and Kokko (2003) emphasise that foreign direct investment in various sectors of the national economy work differently. According to the authors, the greatest profit is created in the services and industrial sectors, the lowest benefit –in the primary production sectors (agriculture).

English scientist Alfaro (2003) put particular emphasis on agriculture as highly problematic sector. Agriculture - the specific branch of country's economy related with a long -term process of reproduction in slow circulation of capital where is required relatively higher capital (both fixed and working) investments, and their payback is longer than in other industries.

In terms of return on investment and the question of their impact on the significance of the national economy, and in particular the country's GDP, scientists tend to compose the models on delayed effects: autoregressive distributed delayed model or a polynomial distributed lag model. In the studies there are chosen subjects for the independent variables and dependent variables. To evaluate and the existence of the communication rellavance - there is used Granger causality test, unit root test (Dickey - Fuller test), as well as a model to determine the significance of calculated F- statistics. Also there is taken the coefficient of determination and the other indicators determining the statistical significance.

Many of Lithuanian and foreign scientists while carrying out the research of FDI impact on the country's economy analyse the such economic stability indicators as well as: inflation rate, export growth, unemployment and others. Scientists Gaphi and Chandran (2008) are still focusing on the the forecasting growth GDP which is influenced by FDI. They distinguish the industry sector as the most essential for the developing economies. The research made by these authors carried out an investigation of the impact of foreign direct investment in the industry sector through the creation of new jobs and technological progress. Authors use the autoregressive distributed delay model (ARDL), which shows that the affects of FDI are revealed only after a longer time. As the reason is mentioned - the host country's technological preparation which let to accept the changes quickly or too slowly if the technological progress in the country is in the low level. Therefore, Gaphi and Chandran (2008) propose to change the country's education system which would ensure the promotion more engineering-oriented scientists. Other scientists Kundan and Qingliang (2010) while using unit root and causality tests consisted of several FDI effect the country's GDP models.

It was found that FDI flows to the host country's economy begins to have a positive effect only after 4 years. Also, the author showed that there is just slight connection between FDI and GDP in not developed economies. The reason of such situation is also technological ill-preparation.

With regard to the importance of FDI on the country's development potential it is important to find not only the resulting effect, but also the determinants of the same investments. Scientists Selelo and Sikwila (2012) while using a number of different econometric methods - the least squares method and vector autoregression model (VAR) was simulated test of causality change. The authors mention the main factors which determine the FDI level in the host country: the experienced labor force, domestic investment, gross domestic product and foreign trade. Unlike the above authors showed results, Selelo and Sikwila (2012) showed that the factors which would influence FDI attraction rather influence short term investments. This means that foreign investors are sensitive to the countries where economic changes are happening very often.

The factors effecting foreign direct investment growth are often treated by the scientists as the indicators that influence the the volume of FDI attraction. Such a research was examined by Adhikary (2012) who explores how FDI operates the host country's exports, the rate of inflation, domestic demand and the country's openness. (export and import ratio). Using the distributed delayed model to an analysis and the causality test, author selects the appropriate data.There is found that during the first year after the attraction of FDI changes just the export volume. The other results showed that indicators of host country's economic development increases at 3 and 4 years after the investments are attracted. To conclude both this and the author previously mentioned, discussed the fact that the impact of FDI starts to appear only after a certain period of time and the determination of exposure time depends on the statistical data used in volume and the statistics - econometric methods.

The overview of the present situation

Empirical research revealed that there are different various opinions how foreign direct investment effect GDP growth. Still there wasn't defined the main model how to evaluate properly the constant effect. Further will be studied the certain period of time (lag) and will be selected the most useful and appropriate method for the further research. To ensure the efficiency of the analysis it is a must to analyse the impact of FDI through the economic sectors. There will be determined the most reasonable sector as well. Willing to carry out the research susccesfully, the dynamics of FDI are analysed and given in Figure 1.
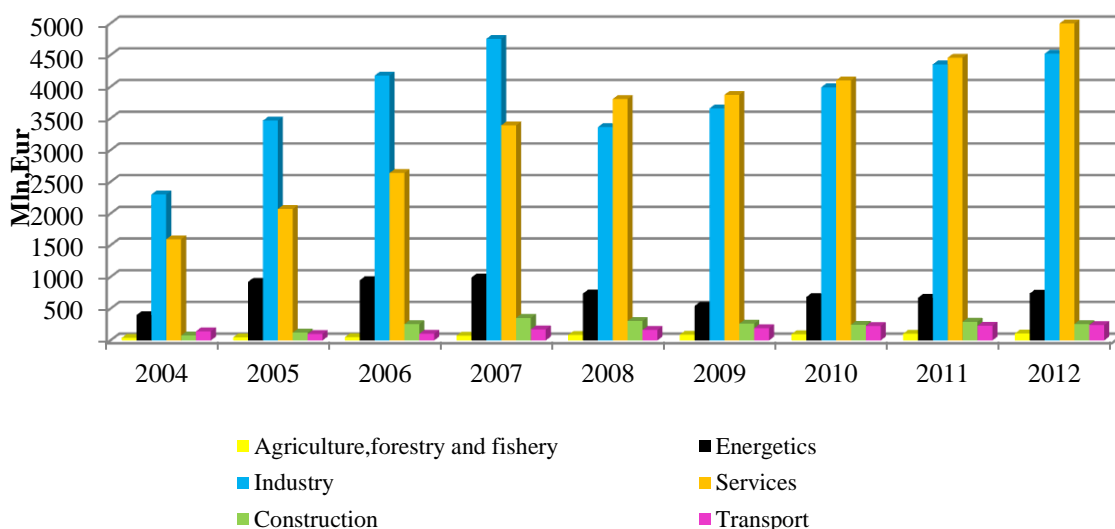

Figure 1. The dynamics of FDI by the sector in Lithuania during 2004–2012
Source: Lithuanian Bank

While assessing the dynamics of FDI 2004 – 2012 it is seen that by the year 2005 there was a moderate rise of FDI around 10-15 per cent annually. Since 2005, there had been a rapid growth of FDI, which lasted until 2008. Particulary, the rapid growth of FDI was in the industry and the financial intermediation and real estate areas. In the construction sector since 2005 FDI had increased by 1.5 time. FDI growth during this period resulted in a high rate of economic growth. Economic and financial crisis has fundamentally changed the appropriately sector for the investmens. Since 2008, a general decline of FDI had been particularly pronounced in industry and construction sector. Eventually the service sector become the leader in attracting FDI. The volume of investment in the construction, agriculture and energy sectors during the period was not very significant.

The most attractive sector for the FDI attraction is - the energy sector. There is shown in Figure 2 that energy sector – is one of the most supported sectors by the Lithuanian government. Lithuanian government adopted a National Energy Independence Strategy in 2012.This strategy seeks to ensure the country's energy independence from the external energy systems.
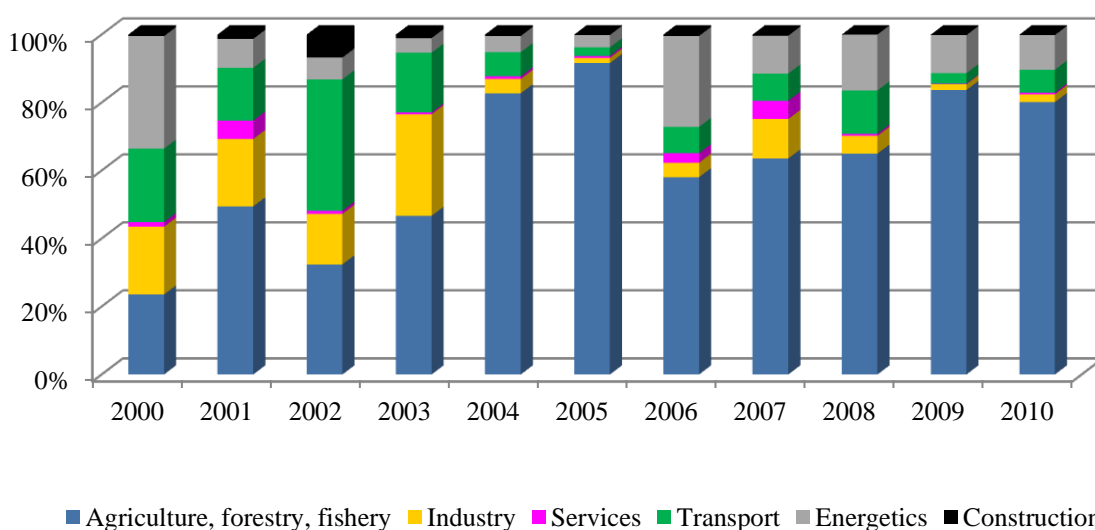

Figure 2. Lithuanian the most subsidised sectors during 2000–2010 years
Source: Lithuanian Bank

Government is forecasting to implement large-scale energy projects attracting foreign investors for the period 2013-2020. Also it is predicted that private foreign investors' investments in 2020 will reach 10-14 billion litas. Currently, the total accumulated investments compile approximately 14 billion litas. In this way, the energy sector has a great possibility to become one of the most susceptible sector for FDI, which will move the economy, stimulate other economic sectors and branches for the development, and there is supposed that will be set up over 5,000 new jobs. The greatest new energy facility - nuclear power has attracted many critical assessments and is now considered to accept or to reject the building, or to postpone it until a new project. This work will evaluate the attracted FDI in launched or projected four energy projects (in Lithuanian - Polish gas pipeline - the estimated amount of 471 million of FDI. EUR Nord Balt - 1.9 billion. LT, LitPolLink - 1 28 billion. E, SDG terminal - about 3 billion euro). Also the long- term impact will be evaluated using lag method. It is known that all the projects will be implemented at 2018, so this research will show how will change the situation if the country implement all the projects successfully and if not.

2. Method

Scientists Gaphi and Chandran (2008) and scientists Kundan and Qingliang (2010) paid a great attention to all the sectors of the economy by using a distributed delay model ARDL and us unit root tests. Lithuanian scientists still haven't performed the assessment of the FDI impact on the energetic sector. In this research there will be used distributed lag method and will be evaluated causility coeficients. Furthermore there will be forecasted the results at the end on 2018.

While using the data of the Lithuania Bank database FDI the year 2004 - 2012, the data is obtained in accordance with NACE 2.2. The data is splitted by the cumulative foreign direct investment of economic activity, which depends on the energy secto. Distributed delayed lag model is constrained by using the STATISTICA program. Eviews software is used for creation of the polynomial lag model.

According to professor Boguslauskas (2004) while researching economic processes it is often needed to evaluate some of the factors of delay performance, considering their values in the previous points in time. That's why lagged models are being constrained.

To complete analysis successfully there is selected a special model mentioned by Karpuškienė (2010) which is - the distributed delayed model (called *Distributed Lag model*), the equation would follow:

$$y_t = \beta_0 + \beta_1 x_1 + \beta_2 x_{t-1} + \theta y_{t-1} + u_t \qquad (1)$$

There: $\beta_1 x_1 + \beta_2 x_{t-1}$ - is distributed delayed (lagged) exogenous variable in X_t time series ;

$\theta_1 y_{t-1}$ - is autoregressive *Yt* member - endogenous variable with a lag.

On purpose to measure the polynomial distributed lag model known as the Almon lag autoregression member there is used Eviews integrated feature PDL. There is used Almon procedure for the model transformation. The transformation is needed to reduce the multicolinearity problem when the parameters necessary for the research will be small and the least square method parameters would be the best and not scrolled.

Almon lag model as an example, can be written as:

$$y_t = \alpha + c_0 z_0 + c_1 z_1 + c_2 z_2 + e_t ; \qquad (2)$$

There: z values are inserted in the following calculation:

$$z_{0t} \equiv x_t + x_{t-1} + x_{t-2} + x_{t-3} ; \qquad (3)$$

$$z_{1t} \equiv x_{t-1} + 2x_{t-2} + 3x_{t-3} ; \qquad (4)$$

Eviews programme lets to trace the equation coefficients and then there is formed the constant model. Befor further research Granger causality test is used to determine whether x is y a cause.

$$X_t = \alpha_2 + \sum_{i}^{n} \theta_i X_{t-i} + \sum_{j}^{m} \delta_j Y_{t-j} + e_{2t} \qquad (5)$$

3. Results

After the accomplishment of the research coefficients of the X test are found. It is known that there can be found that at least one of them is non-zero and can be considered that X Granger causes Y − but it is important to emphasise that this does not say that Y is X result.

Table 1 which is below, provides the information which shows that foreign direct investment in the energy sector effect gross domestic product. The results are based on the F-statistics and significance level = 0.05. Optimal lag is selected 3-year period. While testing the data of Granger test there is determined the statistical significance of the hypothesis:

$$H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = 0$$

Table 1. The results of the Granger test

Hypotesis	The number of lags	F-statistics	Level of significance
GDP does not Granger Cause FDI	1	7.95334	0.03710
FDI does not Granger Cause GDP		1.82893	0.23420
GDP does not Granger Cause FDI	2	1.84809	0.35111
FDI does not Granger Cause GDP		0.39687	0.71589
GDP does not Granger Cause FDI	3	2.53890	0.75231
FDI does not Granger Cause GDP		3.23451	0.04212

Source: adapted by the authors

While striving to identify and analyse how foreign direct investment in the energy sector influences the gross domestic product at the certain point of time (certain period), the lagged model is being constrained and interpreted how will change the data at the certain random intervals.The second table shows the calculation at two stages: first – without energy projects, in the second there are shown the values with submitted energy projects.

Table 2. Coefficients of lagged models

Variable	Relative coefficients of the equation				The start time of the influence, year	The coefficient of determination
	X_t	X_{t-1}	X_{t-2}	X_{t-3}		
FDI(1)	0.36	0.13	0.10	0.16	2	0.95
FDI(2)	0.51	0.17	0.15	0.20	2	0.99

Source: adapted by the authors

Table 3 shows the coefficients' estimates in percentage how much each year the dependent variable will increase due to independent variable.

Table 3. The results of polynomial distributed lag model

Model	Percents of the calculated coeficients				Start time of the impact, year	The coefficient of determination
	X_t	X_{t-1}	X_{t-2}	X_{t-3}		
Polynomial distributed lag model (before energetics projects)	6.1	12.9	51.0	30.0	2	0.95
Polynomial distributed lag model (after energetics projects)	3.0	17.9	46.8	32.3	2	0.99

Source: adapted by the authors

It is important to note that the strongest correlation is then, when the correlation coefficient is from 0.7 till 0.99 value. Thus, the results show exactly the target variable correlation with the dependent variable – GDP which is direct, positive and very strong.

Distributed delay model is usually too rough to assess the impact of foreign direct investment for the country's energy sector. Such kind of model does not exactly estimate the effect on the growth / decline issues, but provides information on the overall impact of trend.

Due to the small amount of the survey data and perhaps the low statistical significance, there is not applied autoregression Durbin - Watson test and there is not applyed the stationary test - unit root test. However, the usage of the logged data helps to solve the problem of simultaneity, since

foreign direct investment effects only after a certain time of the country 's economy. There is used accumulative foreign direct investment but not direct investment flows. Such selection reflect better the current situation. Investment flows represent only the beginning of influence of the period, rather than the ultimate impact. The main results are presented in Figure 3. There is shown how FDI influence countrys's economy through energy sector at the certain period of time.
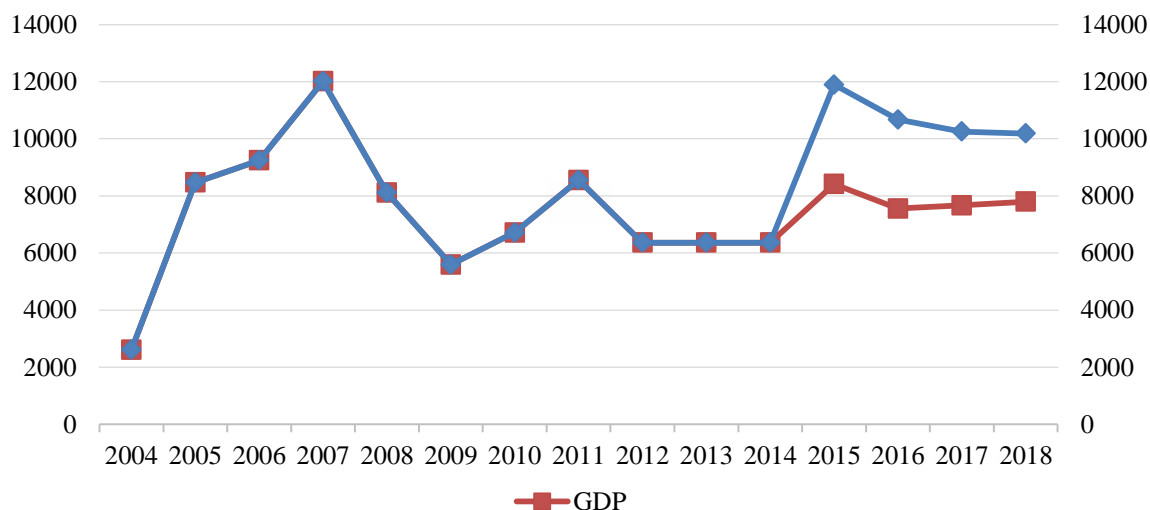

Figure 3. The impact of FDI on country's GDP through energy sector after 2013 year

Source: made by the authors

The differences between two models are identified by a different colour line. In both the case the country's GDP will tend to grow, but foreign direct investment growth will rise just with projects. In the first case, predicted that in 2018 FDI in the energy sector t reach nearly 8000 billion euro. This is the case when the country will implemente all the projects by the year 2018.

Empirical studies have confirmed the theoretical statements about the impact of FDI on GDP growth in the case of Lithuania. The analysis of FDI attraction to Lithuania four energy projects in the period 2013–2018 using polynomial distributed lag method showed a significant and lasting impact of FDI on GDP coverage: attraction of investment in the projects 2.5 billion euro will lead 23.5% percent growth in comparison with the growth of general GDP.

4. Discussion

The research showed that FDI has a significant impact on the country's economic development as FDI is often regarded as one of the most important growth-promoting factor.

Foreign Direct Investment (FDI) is becoming prior aspect in the international communication. Over the long period of time there has been done a number of studies, that analyse the impact of foreign direct investment for the country's economy and particular for GDP. However, the analysis are performed mostly in a wider spectrum.It means that the impact of FDI for GDP is investigated when FDI are attracted to all the branchies of economy not to a certain sector.This paper analyses the impact of foreign direct investment for the country's gross domestic product through economic activities. For the further research there was selected the most subsidised sector – Energy sector. While striving for the national development efficiency in attraction of FDI, it is very important to explore the exposure time of the investments. In this research there are made the calculations which showed, that an optimum lag (a certain point of time) is 2 years, when investments from foreign countries start to affect the countrys economy. Nowadays, when Lithuania attempts to succeed several great energy projects it is important to find out how will change the situation in the future after their implementation. This research showed that Lithuanian gross domestic product will grow 23.5% more then the GDP without Energy projects implementation during 2013–2018 year.This

research allows to make further studies how FDI influence the country's GDP while choosing the different lag for calculations. What is more, this paper allows to embrace the different outlook to the impact of the country's projects implementation, specially energetic sector projects.

References

Alfaro, L. (2003) Foreign direct investment and growth: does the sector matter*?* http://www.51lunwen.org/UploadFile/org20110131090106326 0/20110131090106459.pdf

Bellak, C., Leibrecht, M., Stehrer, R. (2008). Policies to attract foreign direct investment : an industry – level analysis. www.oecd.org/investment/globalforum/40301081.pdf

Blind, K., Jugmitag, A. (2004). Foreign direct investment, imports, and innovations in the service industry. http://ideas.repec.org/a/kap/revind/v25y2004i2p205-227.html;

Blomstrom, M., Kokko, A. (2003). The economics of foreign direct investment incentives.

http://ideas.repec.org/a/kap/revind/v24y2004i2p205-228.html;

Blonningen, B., Davies, R., Wadel, G., Naughton, H.(2006) FDI in space: Spatial autoregressive relationships in foreign direct investment. Retrieved from: http://www.nber.org/papers/w10939;

Busse, M., Groizard, J. (2006). FDI regulations and growth. Retrieved from http://zunia.org/uploads/media/knowledge/Busse1.pdf

Chandran, V.G. (2008). Foreign direct investment and Manufacturing Growth: The Malaysian Experience. *Journal of International Business Research.* Vol 1., No 3. 83-90p.

Clarke, G., Frank, M.B. (1972). Testing Distributed Lag Models of Advertising Effect. *Journal of Marketing Research.* Vol 9., No 3. 298-308 p.

Faruku, A., Asare, B.K., Yakubu, M., Shehu, L. (2011) Causality analysis of the impact of Foreign direct investment on GDP in Nigeria. *Nigerian Journal of Basic and Applied Science*. 9-20 p.

Hattari, R., Rajan, R.(2011). How different are FDI AND FPI inflows? Does distance alter the composition of capital flows. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1797466

Gorodnichenko, Y., Svejnat, J., Terrel, K. (2007).When does FDI have positive spillovers. Evidence from 17 emerging market economies. http://ftp.iza.org/dp3079.pdf;

Grybaitė, V., Tvaronavičienė, M. (2008). Estimation of sustainable development: germination on institutional level. *Journal of Business Economics and Management*, 9(4), 327–334. http://dx.doi.org/10.3846/1611-1699.2008.9.327-334

Johnson, A. (2006). The effects of FDI inflows on host country economic growth. from: http://www.infra.kth.se/cesis/documents/WP58.pdf

Karpuškienė, V. (2010). *Ekonometrinis modeliavimas su Eviews. Praktinis gidas.* http://web.vu.lt/ef/v.karpuskiene/files/2012/11/abEkonometrinis-modeliavimas-su-EViews.pdf

Kornecki, L. (2010). Foreign direct investment and macroeconomic changes in CEE integrating into the global market. *Journal of International Business & Cultural Studies,* 3, p. 1–12.

Kundan, M. P., Qingliang, Gu (2010). A time series analysis of foreign direct investment and economic growth: A case study of Nepal. *International Journal of Business and Management. Vol 5, No 2.* 144-149 p.

Laskienė, D., Pekarskienė, I. (2011). Tiesioginių užsienio investicijų poveikis investicijas priimančios šalies darbo produktyvumui. *Ekonomika vadyba*: 2011. 16, 207-2013

Lietuvos centrinis bankas. Statistika. http://www.lb.lt/statistika

Marcišauskienė, J, Cibulskienė, D (2013). Baltijos šalių makroekonominių rodiklių ir akcijų rinkos kainų tarpusavio ryšio nustatymas. Ekonomika ir vadyba: aktualijos ir perspektyvos. Vol 1. No 29. 51-61.

Ruplienė, D.(2009). Verslo mokesčio dydžio kaip institucinio veiksnio įtaka tiesioginėms užsienio investicijoms. http://archive.minfolit.lt/arch/21501/21671.pdf

Tvaronavičius, V. & Tvaronavičienė, M. (2008). Role of fixed investments in economic growth of country: Lithuania in European context. Journal of Business Economics and Management, 9(1), 57-64. http://dx.doi.org/10.3846/1611-1699.2008.9.57-64

Tvaronavičienė, M. (2006). Investment driving forces afecting Lithuanian economic growth. *Journal of Business Economics and Management*, 7(2), 69–76.