VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS
VERSLO VADYBOS FAKULTETAS
FINANSŲ INŽINERIJOS KATEDRA

Eglė Radzevičiūtė

ASSESSMENT OF FOREIGN DIRECT INVESTMENT BY GRAVITY MODEL APPROACH
TIESIOGINIŲ UŽSIENIO INVESTICIJŲ VERTINIMAS, TAIKANT GRAVITACINĮ MODELĮ

Baigiamasis magistro darbas

Verslo vadybos studijų programa, valstybinis kodas 621N10004
Investicijų valdymo specializacija
Verslo studijų kryptis

Vilnius, 2013

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PATVIRTINTA
Katedros vedėjas
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(Data)

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Vadovas dr. Viktoras Filipavičius _____ _____
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Konsultantas _____ - _____ - _____ - _____
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Vilnius, 2013

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TVIRTINU
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BAIGIAMOJO MAGISTRO DARBO
UŽDUOTIS

2011 10 21Nr. .....
Vilnius

Studentui (ei).....…Eglei..Radzevičiūtei……...…….....….....
(Vardas, pavardė)

Baigiamojo darbo tema: „Tiesioginių užsienio investicijų vertinimas, taikant gravitacinį modelį“
„Assessment of foreign direct investment by gravity model approach“
patvirtinta 2011m. spalio 21 d. dekano potvarkiu Nr. 460vv
Baigiamojo darbo užbaigimo terminas 2013m. sausio mėn. 4 d.
BAIGIAMOJO DARBO UŽDUOTIS:

- susipažinti bei išanalizuoti teorinius tiesioginių užsienio investicijų, gravitacinio modelio, jo taikymo aspektus bei pritaikomumą tiesioginių užsienio investicijų pritraukimo į šalis vertinimui lietuvių ir užsienio autorių mokslinėje literatūroje;
- rasti skirtingų autorių minimus tiesiogines užsienio investicijas į šalis, skatinančius veiksnius bei sugrupuoti juos pagal dažnumą ir galimybes pritaikyti praktikoje kiekybiniams skaičiavimams;
- apžvelgti Baltijos šalių tiesioginių užsienio investicijų situaciją ir išanalizuoti pagal teorinėje dalyje surastus veiksnius tiesioginių užsienio investicijų srautų priklausomybę nuo kintamųjų naudojant grafinę, aprašomąją analizę;
- pateikti gravitacino modelio taikymo praktikoje galimybes, naudojant Baltijos regiono pavyzdį;
- įsitikinti, ar visi teorinėje dalyje minėti veiksniai, naudojami praktikoje yra adekvatūs ir galimi naudoti gravitacinėje lygtyje;
- naudojant gautą gravitacinį modelį pateikti tiesioginių užsienio investicijų Baltijos šalyse prognozę 2012 metams, kaip keičiantis įtakos turintiems nepriklausomiems veiksniams, kis priklausomas veiksnys, nustatyti paklaidą;

Baigiamojo darbo rengimo konsultantai: ……nėra…….....
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Title: Assessment of foreign direct investment by gravity model approach

Thesis language

[ ] Lithuanian

[x] Foreign (English)

Annotation

In the thesis foreign direct investment in the Baltic countries using gravity model have been analysed. The first part of the thesis consists of foreign direct investment definition, the positive and negative influencing factors of foreign direct investment evaluation criteria analysis of the scientific literature and the authors different approaches to them. It is also made a critical evaluation of literature, authors usually distinguishing factors mentioned in different sources that affect foreign direct investment. Also in the first part of the paper theoretically gravity model and its application in practice of direct foreign investment assessment has been described.

In the practical, analytical part the analysis of the chosen 7 most popular parameters from has been performed using the graphical methods. Also analyzed the market size, average wages, education levels, tax burden, economic openness index , GDP per capita and the average disposable income per household member on foreign direct investment in the Baltic countries, using multiple regression and correlation analysis and using a gravity model.

The thesis ends with conclusions and recommendations.

Structure: introduction, theoretical part, practical part, conclusions and suggestions, references.

Thesis consist of: 77 p. text without appendixes, 19 pictures, 34 tables, 55 bibliographical entries.

Keywords: Gravity model,foreign direct investment, market size, average wage, enrolment rate, tax burden, GDP per capita, economic openness index, the average disposable income per household member

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Verslo vadybos studijų programos baigiamasis magistro darbas

Pavadinimas **Tiesioginių užsienio investicijų vertinimas, taikant gravitacinį modelį**

Kalba

lietuvių

× anglų

Anotacija

Baigiamajame magistro darbe nagrinėjamos tiesioginės užsienio investicijos Baltijos šalyse taikant gravitacinį modelį. Pirmoje darbo dalyje pateikiama tiesioginių užsienio investicijų sąvokos, teigiamą ir neigiamą įtaką darančių veiksnių, tiesioginių užsienio investicijų vertinimo kriterijų analizė mokslinėje literatūroje bei skirtingas autorių požiūris į juos. Taip pat atliktas kritinis literatūros vertinimas, išskiriant dažniausiai autorių minimus veiksnius skirtinguose šaltiniuose, kurie daro įtaką tiesioginėms užsienio investicijoms. Taip pat pirmoje darbo dalyje teoriniu požiūriu išanalizuotas gravitacinis modelis bei jo taikymas praktikoje tiesioginėse užsienio investicijoms įvertinti.

Praktinėje, analitinėje darbo dalyje pagal pasirinktus 7 parametrus iš dažniausiai pasitaikančių literatūros apžvalgose išanalizuotas Baltijos šalių tiesioginių užsienio investicijų atvejis naudojant grafinę analizę. Taip pat nagrinėjamas rinkos dydžio, vidutinio darbo užmokesčio, išsilavinimo lygio, mokesčių naštos, ekonominio atvirumo indekso BVP vienam gyventojui bei vidutinių disponuojamų pajamų vienam namų ūkio nariui įtaka tiesioginėms užsienio investicijoms Baltijos šalyse naudojant daugianarę koreliacinę regresinę analizę bei pritaikant gravitacinį modelį.

Darbo pabaigoje pateikiamos išvados ir siūlymai.

Darbą sudaro 2 dalys: įvadas, teorinė dalis, praktinė dalis išvados ir siūlymai, literatūros sąrašas.

Darbo apimtis – 77 p. teksto be priedų, 19 iliustr., 34 lent., 55 bibliografiniai šaltiniai.

Prasminiai žodžiai: gravitacinis modelis, tiesioginės užsienio investicijos, rinkos dydis, vidutinis atlyginimas, išsilavinimo lygis, mokesčių našta, BVP vienam gyventojui, ekonomikos atvirumo indeksas, vidutinės disponuojamos pajamos vienam namų ūkio nariui

(the document of Declaration of Authorship in the Final Degree Project)

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

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(Student's given name, family name, certificate number)

Faculty of business management

(Faculty)

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DECLARATION OF AUTHORSHIP IN THE FINAL DEGREE PROJECT

January 3, 2013

(Date)

I declare that my Final Degree Project entitled „Assessment of Foreign Direct Investment by Gravity Model Approach" is entirely my own work. The title was confirmed on October 21, 2011 by Faculty Dean's order No. 460vv. I have clearly signalled the presence of quoted or paraphrased material and referenced all sources.

I have acknowledged appropriately any assistance I have received by the following professionals/advisers: Dr Viktoras Filipavičius.

The academic supervisor of my Final Degree Project is Dr Viktoras Filipavičius.

No contribution of any other person was obtained, nor did I buy my Final Degree Project.

(Signature)

EGLĖ RADZEVIČIŪTĖ

(Given name, family name)

TABLE OF CONTENTS

ABBREVIATIONS

APEC – Asia – Pacific economic co – operation;

FTA – eng. Free trade agreement;

FDI – eng. foreign direct investment;

GDP – eng. gross domestic product;

GDP per capita – eng. Gross domestic product per capita;

GNP per capita – eng. gross national product;

IMF - eng. International Monetary Fund;

NULC – eng. nominal unit labor cost index;

OECD – eng. Organisation for Economic Co - operation and Development;

ULC - eng. the unit labour costs;

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INTRODUCTION

Relevance of the topic. Today we are raising the question of the global economic recovery, and in particular on the European Union's economic stability, a strong focus on international cooperation, free movement of capital and services, the integration of societies, the promotion of technological innovation and national competitiveness. In order to promote the country's economic growth as one of the most effective tool - distinguished foreign direct investment into the country. Foreign direct investment is a significant factor in many national economies, while extremely valuable to small and little - known world countries.

Problem. Nowadays investigators, economic specialists frequently discussing that one or the other factor could have a negative impact for foreign direct investment flows in the country but sometimes it's just ideas not based on quantatative methods that do not have a mathematical verification and the evaluation model which can be applied in different countries, regions and foreign direct investment flows forecasting.

Aim of the thesis - using specific of gravity models and the factors described in the theoretical part to assess the significance between independent variables and the dependent factor, foreign direct investment by the example of Baltic countries and to suggest a model that could be used for forecasting the foreign direct investment flows in other countries or regions. In order to achieve the main goal of this thesis, it is planned to achieve these **objectives:**

- access and analyze the theoretical aspects of foreign direct investment, gravity models, applicability for foreign direct investment attraction into the country in Lithuanian and foreign authors scientific literature;
- find the factors influencing foreign direct investment in the countries, mentioned in literature of different authors and group them according to the frequency and potential for practical quantitative calculations;
- overview a situation of the Baltic countries on foreign direct investment aspect and to analyze the situation by the independent factors found in theoretical part of foreign direct investment flows using graphical, descriptive analysis;
- to present opportunities of using gravity models in practice as the example of the Baltic region;
- make sure that all the factors mentioned in theoretical part are adequate and available for use in gravitational equation using in practice;

- using an obtained gravity model of foreign direct investment in the Baltic countries, forecast the flows of foreign direct investment for 2012 and find dependent variable change when independent factors are changing, determine an error of calculations;

Research and analysis methods. Scientific literature analysis and synthesis, comparison method, the graphic depiction study, calculation of indicators, paired and multiple correlation and regression analysis. Scientific literature analysis and synthesis helps to summarize the available scientific information, to show the theme features, performance evaluation specifics. Literature sources comparison method is used to analyze the foreign direct investment and gravity models concepts, allows an informative graphical presentation to convey information, the quantatative investigation shows the significance of parameters and help us to find the most dignificant factors wicg could be included in gravity equation.

Thesis structure. The final work consists of three parts. In the first paragraph, "Theoretical part of foreign direct investment and gravity model" is analyzed theoretical aspects of foreign direct investment and gravitational models. In the second paragraph, "Graphical analysis of foreign direct investment in the Baltic States" is analysing a Baltic countries situation by the dependence and spheres between foreign direct investment and the influencing factors which was found in theoretical part. In the third paragraph, "Foreign Direct Investment in the Baltic States regression analysis and gravity model approach" is analysing the selected variables significance and logic by paired and multiple correlation regression analysis conclude with gravitational model and their adoption for the following prediction.

Practical importance of thesis. This analysis in the future could be used to evaluate factors influencing foreign direct investment in the other countries and regions and may be found a model which will be relevant for every country.

1. THEORETICAL PART OF FOREIGN DIRECT INVESTMENT AND GRAVITY MODEL

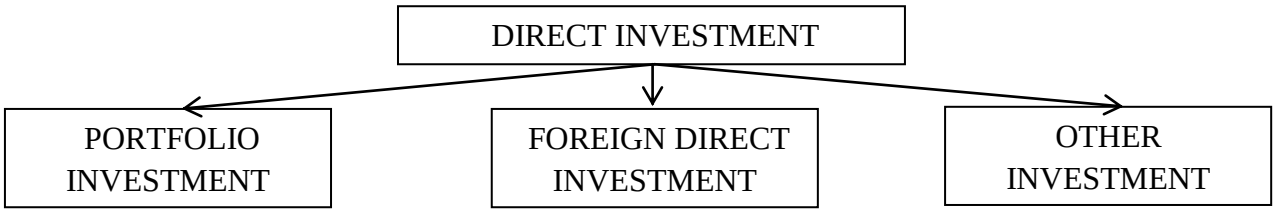
1.1. Definition of foreign direct investment

Foreign direct investments have expired recently very often mentioned both in Lithuania and in other countries seeking to grow economically, to catch up with the most developed industrialized countries of the world.

Investments can be classified into domestic and foreign investment.

Domestic investment – its country`s investment, investment in the country by natural and legal persons. Foreign investment - the foreign states, international organizations, foreign individuals and legal entities investments in the republic.

Analyzing investments, are often confronted with the problem that different treatment of foreign investment and foreign direct investment concept. Foreign investment under the Investment Act called all foreign states, international organizations, foreign natural and legal persons, investments in the republic. Lithuanian Department of Statistics and the Bank of Lithuania, on the basis of the OECD (Organisation for Economic Co-operation and Development - OECD) and the IMF (International Monetary Fund), foreign investments according to functional character fall into three types: 1) direct foreign investment (Foreign Direct investment), 2) portfolio investment (portfolio investment), 3) other investments (V.Navickas, 2003).



Picture 1. Types of direct investment (Navickas, 2003)

Different authors and in different literature foreign direct investment is described differently. Some of descriptions is written in the table below. Most of descriptions are similar and say the same main information that foreign direct investment basically direct foreign investment - this is direct foreign capital flows into the country. These include: shares purchased, reinvested earnings, loans to operators, other capital flows related to investing and investment in the host country's obligations, the organization of the production process in other countries (company subsidiaries, joint ventures and so on.). The most widely accepted definition of FDI is known as “the IMF/OECD benchmark definition” because it was provided by a joint workforce of these two

international organizations with the objective of providing standards to national statistical offices for compiling FDI statistics (Contessi, Weinberger, 2009).

1 table. Definitions of foreign direct investment in different sources of literature (prepared by author)

Purlys Č., Treigienė D. Investment management. 2006. Technika, Vilnius	**Foreign direct investment** – the investment in the country by foreigners (foreign governments, international organizations, foreign natural and legal persons)
Statistics department of Lithuania. Foreign direct investment calculation methodology. 2000. Vilnius	**Foreign direct investment** - according to International Monetary Fund methodology, statistical office of the European Union and the OECD (OECD - Detail Benchmark Definition of Foreign Direct Investment) methodological guidance is such an investment, which forms the basis for long-term economic relations and interests between a foreign investor and the direct investment enterprise
Langvinienė N., Vengrauskas „Tarptautinis verslas“ Kaunas, Technologija, 2004	**Foreign direct investment** - the foreign capital to productive and non-productive, leading to the formation of long-term relationships and interests between foreign investors and companies receiving investment
Ginevičius R., Rakauskienė O., Romualdas P., Tvaronavičienė M., Kalašinskaitė K., Lisauskaitė V. 2005. Eksporto ir investicijų plėtra Lietuvoje. Vilnius	**Foreign direct investment** in a foreign company takeover or the same firm in a foreign country shall set up a subsidiary company. Also, FDI is when the initial investment by another investment or establishing another firm
Jones J., Wren C. 2006. Foreign direct investment and the regional economy	**Foreign direct investment** is the name given to the process where a firm from a country provides capital to an existing or newly – created firm in another country
Washington D.C., 2004. Foreign Direct investment: trends, data, availability, concepts and recording practices	**Foreign direct investment –** is a category of international investment that reflects the objective of a resident in one economy (the direct investor) obtaining a lasting interest in an enterprise resident in another economy (the direct investment enterprise)

Continuation of table No. 1. Definitions of foreign direct investment in different sources of literature (prepared by author)

Caves R.E. 1996. Multinational enterprise and economic analysis	**Foreign direct investment** is the investment made by a company outside its home country. It is the flow of long - term capital based on long term profit consideration involved in international production

1.2. Factors influencing foreign direct investment

If you want to evaluate factors influencing foreign direct investment, you need to make investment climate analysis. This would mean the study and evaluation of a number of factors - social, economic, organizational, legal, political, cultural.

The main factors influencing foreign direct investment frequently: certainly enter the market, the ability to participate in the privatization process and the political and economic stability.

Various literature says that mostly is investing in countries, who all together act in these groups of factors:

- specific property (property rights and real estate) advantages (Ownership Specific Advantages). This factor mainly includes company size, entry and access to resources, opportunity, business opportunity for complementary activities (such as the production and distribution), to take advantage of the differences between the parties.
- internalization advantages granted (internalization incentive advantage). They occur when foreign markets are not fully used, it is a niche there is a free activity.
- specific advantages of the country situation (Location Specific Advantage) includes the country's natural resources, transportation costs, macro-economic stability, cultural factors and regulatory differences. Earlier it was better to invest in countries that have had a lot of natural resources, but did not have enough capital or technological know - how needed to get natural resources, process and sell to other countries.

Labor factor affecting investments when multinational companies are located in countries with expensive labor force. Then, the company set up or acquire subsidiaries in countries with lower labor costs in those industries that are labor - intensive production of intermediate or final products. In order to attract such investment, often creating free-trade zone.

Another very important factor affecting FDI, the so - called market factors such as market size (in general, as well as in relation to income level) and market growth. For businesses new markets are an opportunity to remain competitive, grow, increase volume and achieve economies of scale. For greater effectiveness through FDI helps to rationally allocate resources, and the pursuit of the market - to invest in such a way so as to derive maximum benefit from geographically dispersed operations.

Evaluating differences between countries, investing countries choose the most favorable countries for investment, and focused by the production of these countries to meet the needs of the markets in many countries. In addition, investments could be done in the country which has stable macroeconomic and political situation, and an open and developed foreign markets.

In economic literature presented five most distinguished groups of factors of foreign investment in the country (Xiaolun, 2002).

2 table. Factors promoting foreign direct investment in the country (prepared by author)

Group of factors	**Causes of promoting**
Market factors	Often companies invest abroad to acquire additional market segments. The new market, its size, potential growth rates help to ensure a profit levels and activities
Factors of barriers to trade	FDI leads to eliminate trading barriers and give the right to act as local company, without being influenced by various trade restrictions
Cost factors	FDI help firms to take the horizontal and vertical diversification. By investing abroad, they attract cheaper raw materials and labor, lower capital costs, use financial and non-financial incentives of the government, the price level
General factors	Foreign investors are more interested in companies that have specific advantages against other companies operating in the country or region. Corporate benefits occur intangible assets that form, it can be the image of the company
Investment climate factors	The membership of international organizations, union, a well - developed infrastructure, a large domestic market, skilled labor force, a positive attitude towards FDI in the country, small investors restrictions, political and legal stability, low ownership restrictions, exchange rate adjustment factor in favor of the tax system, the stability of international trade, economic growth

1.3. Positive impact of foreign direct investment for country economic growth

A positive attitude towards foreign direct investment on developing countries are largely dependent on J. H. Dunning theory. It states that foreign direct investment as a driver of economic development due to the increasing productivity can accelerate industrial development. For example, increasing the amount of resources and the improvement of the quality of scientific and technological innovation increases the productive capacity of society, resulting in the country's agricultural productivity: selling and providing service quality and increase the quantity as well as economic growth, which is reflected in the gross domestic product.

Other foreign direct investment theory explains the positive impact that the local economy earned income, dependent on foreign capital inflows core size, cost elasticities, experience and knowledge drain scale. Such knowledge outflows from advanced foreign companies in several ways leads to productivity growth. First of all, the local firm can increase its productivity by copying the technology. Second, it can more efficiently use existing technologies or due to increased competition in the market to look for new technologies. Third, foreign investors can train local workers, who then hired local firms. Another significant way during the opening spread knowledge of customers and suppliers close co - operation (refer to joint multinational companies and local enterprises to economic activity) (Verslas: teorija ir praktika, 2003).

Foreign direct investments have been identified as one of the most effective means to develop economic growth, which is particularly important for countries in transition. In front capital resources and limited the quantity of foreign direct investment promotes:

1. Production and export development. Usually, foreign capital investment in domestic firms is accompanied by new technologies and product mix upgrade, improving the quality of output and ground into new foreign markets. Taking a favorable geographical position, it can be concluded that a large part of foreign direct investment in the manufacturing sector will be allocated for export development, which would help to reduce the current high increase in the foreign trade deficit;
2. Creation of new jobs and existing jobs in an efficient exploitation of society together and raise living standards;
3. Advanced market economies adopt management and marketing methods, which inevitably accompanied with a capital "bring" foreign investors installation.

Considering these advantages of foreign direct investment, it can be concluded that the above - mentioned factors as a whole provide good prospects for companies to successfully compete in the market, ensuring their long - term economic viability of growing competition. However, it should be noted that only a large amount of investment does not guarantee rapid

economic development. Strongly influenced by the nature and structure of the investment, human capital and technological expertise, which fall outside the quantitative expression level of investment, seen as a key factor in ensuring the stability of economic activity. Therefore, attracting foreign investment, it is important to make full use of their advantages and try to avoid negative impact on the national economy.

Foreign Direct Investment importance to the national economy is based on the following considerations (Samuolis, 2002):

- the creation of new jobs. Often, foreign - owned enterprises in start - up phase by reducing the number of employees, but later expanding activities, create new jobs, improve working conditions;
- foreign investors regularly invest and allocate more money for employee training and new job skills formation;
- introduction of new and advanced management ideas that are changing the old, deeply rooted in local businesses. This is most true of those economic activities that are traditionally considered to be strategic, and from ancient times the property of the State;
- private enterprise is almost always more productive than public. Higher productivity means that the company will provide a better and wider range of services, often at lower prices. Lithuania felt the lack of capital, and foreign capital attraction allows transformation of large companies;
- on foreign direct investment, introduced modern technology, and business success often is defined "progress pace and ability to adapt in a changing market;
- in today's market, most businesses valued at the available industrial plant or personnel qualifications, but because of the available technology and corporate communications. Companies that have strong international connections, are more likely to absorb new technologies and introduce them to the factory;
- foreign investment is important for the development of foreign markets as multinational corporations have a good network of business contacts in many countries, this leads to an increase in exports;
- foreign investors with foreign capital transfer and business relations with international financial institutions.
- if a country does not attract foreign capital, it risks being left unnoticed in the global market. To reduce the gap between developed countries and to ensure sufficient high

growth rates, much higher foreign direct investment growth rate than in developed countries.

- Other countries, knowing that in a rapidly growing direct investment more readily supports the economically developing country's independence and membership in international organizations. Foreign investors interested in investing in the country to ensure the government of the country in which the investment is security.

Foreign direct investment can play an important and positive role in the economic life of the country. Considering these advantages of foreign direct investment, it can be concluded that the above mentioned factors as a whole provide good prospects for companies to successfully compete in the market, ensuring their long - term economic viability of growing competition. However, it should be noted that only a large amount of investment does not guarantee rapid economic development, foreign direct investment has a negative side.

1.4. Negative impact of foreign direct investment for country economic growth

The negative attitude towards foreign direct investment to national development would be based on the following logic. Foreign capital companies often operate in particularly high concentration of rich sectors of the economy, with a high entry barriers. A large concentration of foreign direct investment may even increase. This would allow foreign - owned companies to "pick up" economic rent and the giving away of the local capital of the country, which in turn lead to the development of the country's economic slowdown. Instead of bridging the gap between investment and foreign exchange reduction in foreign direct investment can out of the market with local residents and replace them with foreign suppliers or manufacturers. In contrast, here you can see oligarchic support for local companies to use more efficient technologies concentrated in the capital, but also reducing staff availability.

However, it should be noted that countries lacking the financial resources often ignores foreign direct investment influence factors and negative sides, encouraging foreign direct investment. In the development of its economic policies they often underestimate the foreign direct investment coming into the country's economy is determined by many different factors. Foreign direct investment flows affect not only state policy, but also the country's geographical location, its structural characteristics. The most important factor leading to investor's decisions to invest abroad, named Dunning, Shatr and Vanables.

Derived from the theoretical analysis of foreign direct investment, it can be said that foreign capital transfer from one country to another at the same time the controversy affect the

country's economic growth: some economic sectors or industries, foreign direct investment can contribute to economic growth and development, to complement and intensify local business operations and performance, but in others, under certain circumstances, and disrupt.

Dunning says that foreign investors are more interested in businesses that are profitable and have specific advantages over other country or region of the companies providing certain markets. According to H. Shatr and A. J. Vanables, global economic integration is beneficial for minimizing production costs in respect of avoiding trade tariffs and the reduction in the production of the required materials and cheap labor.

1.5. Scientific literature review and results of factors affecting foreign direct investment

In different literature sources are mentioned different factors affecting foreign direct investment. In assessing a country's investment environment takes into account many factors: the political environment, economic environment, the country's legal framework, the analysis of various global institutions calculated indices of economic freedom, global competitiveness, investor protection, tax and business environment. It also determines the attractiveness of the investment environment, not only in the global space provided ratings, but also national economic growth. In this thesis there are analysed 15 different opinions of authors in different sources of literature, such as K. W. Jun ir H. Singh (1995) [1], B. A. Czapor (2000) [2], Capital Markets Consultative Group (2003) [3], A. Bevan, S. Estrin, K. Meyer (2004) [4], K. C. Fung, A. Garcia- Herrero, H. Iizaka, A. Siu (2005) [5],] L. Artige, R. Necolini (2005) [6], G. Agiomirgianakis, D. Asterijon, K. Papthoma (2006) [7],] A. Benassy-Quere, M. Cuopet, T. Mayer (2007) [8],] F. N. Campos, Y. Kinoshita (2008) [9], D. Rupulienė., K. Montvilaitė, Ž. Grigaliūnienė (2008) [10], S. Adams (2009) [11], N. C. Leitão (2010) [12], S. K. Kahai (2011) [13], P. Egger, D. M. Radulescu (2011) [14], J. C. Anyanwu (2012) [15] and the results of analysis is shown in the table below. In the table No. 3 are shown factors and how often they are mentioned of different authors.

As it is shown in table No. 3, there are a lot of different opinions of authors in different literature of identifying factors affecting foreign direct investment. But there are some of the factors, which are repeating in different sources of literature. The most repeating factors in 15 analysed sources of literature are market size, labor costs, trade regime, economic growth, infrastructure, human capital, tax system, legal system, market development, GDP (which could be connected to economic growth), inflation, political environment, economic openess, institutational

development. Some of the factors have the smaller factors inside, which could be linked with each other.

3 table. Factors affecting foreign direct investment in scientific literature (designed by author)

Factors \ Authors	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	Total
Market size	×	×	×		×	×	×		×		×	×	×	×	×	13
Labour costs	×	×	×	×	×	×	×		×	×	×	×				11
Trade regime		×	×			×	×		×			×		×		7
Economic growth		×	×				×	×			×		×		×	7
Infrastructure		×	×		×		×							×	×	6
Human capital		×	×		×		×								×	5
Tax system			×		×	×					×	×				5
Legal system									×		×		×	×	×	5
Market development		×	×				×	×								4
GDP per capita				×				×							×	3
Inflation									×			×			×	3
Political environment											×		×	×		3
Institutional development				×				×	×							3
Economic openness				×					×						×	3
Privatization				×					×							2
Export	×												×			2
Inter-regional differences	×		×													2
Financial development				×											×	2
Currency fluactuations	×															1
Geographical location		×														1
Liberalization				×												1
Transport costs							×									1
Business and investment climate							×									1
Language barriers								×								1
Banks efficiency									×							1
Household income for one member										×						1
Natural recources											×					1
Corruption level															×	1
Competitive environment													×			1
Production prices														×		1

So, most authors mention the following foreign direct investment into the country factors:

market size, labor costs, trade regime, economic growth, infrastructure, human capital, tax system, legal system, market development, GDP and ect.

Research highlighted one of the key factors - the size of the market - characterized by each country's population. Large populations provide a large market for products and services offered by multinational enterprises, have a large labor force and a vast skill base. Admission to institutions of higher learning in these countries is highly competitive and only those with a high potential are admitted. Apart from the quality of human resources, the number of graduates in these countries is also astounding. When the demand for highly trained professionals is far greater than the supply, the cost of these professionals for a multinational corporation is much lower than employing home country nationals, but scarcity is contributing to a rapid increase in the cost of technical and managerial personnel. So as hypothesis could be mentioned that investors prefer to invest in countries with larger population (Aziz, Makkawi, 2012).

Another component for attracting FDI involves the availability of low - cost employees. The literature on labor market effects on FDI inflows has mostly focused on the impact of labor cost as part of the firm’s production cost. In the literature frequently use average wage rate and unit labor costs as measures of labor costs (Parcon, 2008). Important component for attracting FDI involves also skilled employees who possess the necessary attitudes, experience and proficiencies to create, manufacture, and provide goods and services that can compete in global markets. For this component evaluation could be used enrolment rate (%). Enrolment rate - of a certain age pupils and students in the same age population ratio, expressed as a percentage (Lithuanian statistics department).

FDI also depends on the size of the tax burden, which is calculated as a percentage of GDP from the production and import taxes. For foreign investors is applied a lower tax burden as an incentive to invest in the country. As for the tax burden rate, it was agreed that this is the amount that can be measured both in absolute amount and relative terms. In Tax Help tax burden is defined as all tax payers pay taxes - both in the national budget, and a range of funds. The tax burden can be calculated as the relative ratio of tax revenue to gross domestic product, showing how gross domestic product and taxes are distributed. This value can be compared to the time scale of one country's tax level and between different countries (Balčiūnaitė A.).

FDI also depends on economic growth and economic openness which consists of a lot of evaluation parametres. Such as GDP, GDP per capita, economic openness index. The openess index is an economic metric calculated as the ratio of country's total trade, the sum of exports plus imports, to the country's gross domestic product. The interpretation of the openness index is the higher the index, the larger the influence of trade on domestic activities. Gross domestic product

(GDP) is the market value of all officially recognized final goods and services produced within a country in a given period of time. GDP per capita is often considered an indicator of a country's standard of living (Lithuanian Statistics department).

In the table No. 4 there are selected criteria of evaluating factors influencing an attracting FDI to the country mentioned by authors in different literature sources. Also in this table near the factors is the serial number according to frequency mentioned in literature. Factors by frequency is chosen these because they are qantatative factors could be evaluated by quantatative criteria, some of the mentioned factors are more qualitative and could not be evaluated by formulas and numbers.

4 table. Factors having impact for foreign direct investment attracting and evaluation criteria for the factors (designed by author)

Factor	**Evaluation criteria**
Market size (1)	Population (mill.)
Labor cost (2)	Average wage (EUR);
Tax system (7)	Tax burden (%)
Human capital (6)	Enrolment rate (%)
Economic growth (4)	GDP, GDP per capita (EUR);
Economic openness (14)	Economic openness index (%);
Purchasing power (26)	Average disposable income per household member per month (EUR)

1.6. The introduction to the Gravity model

The gravity model is the most common formulation of the spatial interaction method. It is named as such because it uses a similar formulation than Newton's formulation of gravity. Accordingly, the attraction between two objects is proportional to their mass and inversely proportional to their respective distance (Rodrigue, 2012).

Originally, gravity models were used to explain bilateral trade flows between countries in analogy of Newton's law of gravitation. Basically, gravitation comes about by the attraction of two masses with distance reducing this effect. Applied to bilateral trade flows, the pull

forces are represented by the size of the economies concerned, measured by GDP or population, while distance is proxied either by kilometers, transportation costs or, more generally, transaction costs. In its simplest form, the gravity equation states that the volume of trade between any two countries is positively correlated with the economic size of these countries and negatively correlated with the geographic distance between them (Gopinath , Echeverria, 2004).

In 1687, Newton proposed the "Law of Universal Gravitation." It is held that the attractive force between two objects *i* and *j* is given by where notation is defined as follows.

$$F_{ij} = G \frac{MiMj}{D^2 ij} \quad (1)$$

- *Fij* is the attractive force;
- *Mi* and *Mj* are the masses;
- *Dij* is the distance between the two objects;
- *G* is a gravitational constant depending on the units of measurement;

1.7. An economic approach of Gravity model

After being introduced by Tinbergen (1962), the gravity model was considered to be a useful physical analogy with fortunate empirical validity. Subsequently, however, connections have been made to key elements of trade theory. The standard assumption of the Heckscher - Ohlin model that prices of traded goods are the same in each country has proved to be faulty due to the presence of what trade economists call "border effects." Properly accounting for these border effects requires prices of traded goods to differ among the countries of the world. Gravity models have been interpreted in these terms.

Anderson (1979) was the first to do this, employing the product differentiation by country of origin assumption, commonly known as the "Armington assumption" (Armington, 1969). By specifying demand in these terms, Anderson helped to explain the presence of income variables in the gravity model, as well as their multiplicative (or log linear) form. This approach was also adopted by Bergstrand (1985) who more thoroughly specified the supply side of economies. The result was the insight that prices in the form of GDP deflators might be an important additional variable to include in the gravity equations described above. Price effects have also been captured using real exchange rates.

The monopolistic competition model of new trade theory has been another approach to providing theoretical foundations to the gravity model (Helpman, 1987 and Bergstrand, 1989). Here, the product differentiation by country of origin approach is replaced by product

differentiation among producing firms, and the empirical success of the gravity model is considered to be supportive of the monopolistic competition explanation of intra-industry trade (Reinert).

Alternatively, there are other approaches to gravity - based explanations of bilateral trade that do not depend on compete specialization. As emphasized by Haveman and Hummels (2004), this involves accounting for trade frictions in the form of distance - based shipping costs or other trade costs, as well as policy - based trade barriers. Distance costs can also be augmented to account for infrastructure, oil price, and trade composition as in Brun et al. (2005). The two approaches (complete vs. incomplete specialization) can be empirically distinguished by category of good, namely differentiated vs. homogeneous, as in Feenstra, Markusen and Rose (2001).

In 1962 Jan Tinbergen proposed that roughly the same functional form could be applied to international trade flows. However, it has since been applied to a whole range of what we might call "social interactions" including migration, tourism, and foreign direct investment. This general gravity law for social interaction may be expressed in roughly the same notation:

$$F_{ij}=G\frac{M_i^{\alpha}M_j^{\beta}}{D_{ij}^{\theta}} \qquad (2)$$

where notation is defined as follows:

- F_{ij} is the"flow" from origin i to destination j, or, in some cases, it represents total volume of interactions between i and j (i.e. the sum of the flows in both directions);
- M_i and M_j are the relevant economic sizes of the two locations;
  - If F is measured as a monetary flow (e.g. export values), then M is usually
- the gross domestic product (GDP) of each location;
  - For flows of people, it is more natural to measure M with the populations.
- D_{ij} is the distance between the locations (usually measured center to center);

Note that we return to Newton's Law (equation 1) if $\propto= \beta = 1 \; and \; \theta = 2$.

We must think of gravity as a kind of short - hand representation of supply and demand forces. If country i is the origin, then M_i represents the amount it is willing to supply. Meanwhile M_j represents the amount destination j demands. Finally distance acts as a sort of tax "wedge", imposing trade costs, and resulting in lower equilibrium trade flows.

The multiplicative nature of the gravity equation means that we can take natural logs and obtain a linear relationship between log trade flows and the logged economy sizes and distances:

$$\ln Fij = \alpha \ln Mi + \beta \ln Mj \; \epsilon - \theta \ln Dij + \rho \ln Rj \; + \; \bullet \varepsilon ij \qquad (3)$$

The inclusion of the error term $\bullet_{ij}$ delivers an equation that can be estimated by ordinary least squares regression. If our derivations in the earlier section are correct, we would expect to estimate $\alpha = \beta = \rho = 1$ (K. Head, 2000).

The gravity equation characterises were applied in many trade models including both intraindustry trade models and standard trade theories (Deardorff, 1995; Kumar and Zajc, 2003). The Gravity Model has been used widely since the late 1980s to evaluate the trade effects in regions. It contributed to econometric techniques to test the efficiency of the empirical models not only in trade but also in FDI.

So the Gravity Model can be used in trade and FDI studies. Earlier researchers used the Gravity Model to test the factors of trade between two countries. It is a model that proved to be applicable and empirically successful in explaining bilateral trade flows. Since the growth of FDI in recent decades shares some features with the evolution of trade, having become more intense between countries with similar and relatively high income levels, and having grown faster than income, the Gravity Model may also be useful in modelling the regional pattern of FDI (Brenton et al., 1999). More recently, the Gravity Model has been one of the most influential methods to analyse countries' attractiveness as a location for FDI using aggregate - level data or identifying the determinants of FDI across countries.

1.8. Using Gravity model for evaluating foreign direct investment

More and more frequently mentioned in the literature gravity model, which is used to evaluate foreign direct investment influencing factors and to identify them. Different authors present an overview of several different approaches to the gravity model, and the use of foreign direct investment, finding of the best evaluation criteria, their impact for foreign direct investment, identification, forecast. From different authors can be seen insights of gravity model applications for foreign direct investment applicability and their evolution.

In the last years, the Gravity Model has become very popular in explaining FDI, including the flow of FDI (Stone and Jeon, 1999), the effects of distance over FDI (Egger and Pfaffermayr, 2004), and the relationship between FDI and trade in a bilateral context (Gopinath and Echeverria, 2004).

The Gravity Model can capture the relative market sizes of two economies and their distance from each other. Distance can be viewed as a measure of the transaction cost in undertaking foreign activities, for instance, costs of transportation and communications, costs of dealing with cultural and language differences, costs of sending personnel overseas, and the

informational costs of institutional and legal factors, for example, property rights, regulations and tax systems (Thanyakhan, 2008).

Stone and Jeon (1999) explored how the Gravity Model specification can be used to estimate the bilateral flows of FDI. The log - linear FDI equation which specifies FDI flows from home country i to country j can be explained by supply conditions of the home country, by demand conditions of host country, and by other economic forces either assisting or resisting the flows. The authors applied the general form of the gravity equation from Anderson (1979), and then specified the gravity - type equation for the FDI study as follows:

$$FDI_{ij} = \beta_1 GDP_i + \beta_2 Pop_i + \beta_3 GDP_j + \beta_4 Pop_j + \beta_5 Distance_{ij} + \beta_6 Trade_{ij} + \beta_7 APEC + \beta_8 ASEAN + \beta_9 DAE + \varepsilon_{ij} \quad (4)$$

where FDI_{ij} and $Trade_{ij}$ represent total bilateral FDI and trade flows between two countries, and subscripts i and j identify the home country and the host country, respectively. GDP is the gross domestic product, Pop is the population, and Distance is the geographical distance between the two countries i and j.

The study (Stone and Jeon, 1999) showed that FDI flows in the region were driven more by market size and income in the home country than factors in the host country. It was also evident that the geographic location factor was not a significant resistance or assistance factor for FDI flows.

Buch et al. (2003) used data to examine the patterns of FDI in two regions on the periphery of Europe (Central – East Europe) and the countries of Southern Europe. The findings showed that the most important determinant of FDI is the purchasing power (market size) of the host country market, rather than low labour costs. Bilateral trade and GDP per capita had positive effects on FDI. Overall, bilateral trade and GDP per capita showed the positive effects of the FDI stocks. The FDI forecasting was investigated with the following equation (Buch et al., 2003):

$$lnX_{ij} = \alpha + \beta_1 \ln(GDP)_j + \beta_2 ln(GDP\ per\ capita)_j + \beta_3 ln(Distance)_{ij} + \beta_4 (FDI\ restriction)_j + \beta_5 EU + \beta_6 (Common\ language)_{ij} + \beta_7 (Common\ legal\ system)_{ij} + \varepsilon_{ij} \quad (5)$$

where xij is the logarithm of total FDI stock held in given reporting in country i and in recipient country j, (FDI restriction) j is the index for restrictions and controls of the recipient country for FDI, and ε_{ij} is the error term.

The findings in equation No. 5 showed GDP, GDP per capita, common language, and common legal system positively impact FDI stocks. However, FDI restrictions in the host country

and further distances between both the countries brought less FDI. As independent variables an author chose GDP, population, distance, adjacency dummy, trade, common language, common legal system, relationship between countries (EU).

Bevan and Estrin (2004) derived the empirical model for gravity and FDI in the following form:

$$FDI_{ij}^{t} = f(GDP_{i}^{t}, GDP_{j}^{t}, dist_{ij}, trade_{j}^{t}, ULC_{j}^{t}, r_{ij}^{t}, risk_{j}^{t}) \quad (6)$$

where t is year, i is the source country, j is the host country, $GDP^{t}_{i(j)}$ represents the size of the source (host) country, ULC^{t}_{j} is the unit labor costs in host country, r^{t}_{ij} measures the interest rate differential between the source and host countries, $dist_{ij}$ represents the distance between the source and the host country, $_{j}$ trade measures the openness of the host economy, and $_{j}$ risk captures a vector of institutional, legal, and political factors in the host country. The results showed the most important influences on FDI were unit labor costs (negatively), distance (negatively), and market size (GDP) (positively). As an independent variables an author chose GDP, risk rate, trade, distance, unit labor cost, bond yield rate, dependant – FDI.

Egger and Pfaffermayr (2004) analysed the effects of distance as a common determinant of exports and FDI in a three - factor trade model: physical capital, human capital, and labor endowment; assuming that distance affected both pure trade costs and plant set - up costs. The results were similar to Bevan and Estrin (2004) findings. There were significant negative interactions between distance and the difference in physical capital to labor ratio on outward FDI.

Gopinath and Echeverria (2004) examined the relationship between FDI and trade in a bilateral context using a Gravity Model approach. The relative demand (import/ FDI, produced goods) was negatively affected by tariffs and transportation cost and positively affected by institutional distance. The results suggest that, as distance between the two economies increases, the home country's bilateral exports (host country's bilateral imports) fall relative to FDI - based production. Hence, the authors reported geographical distance caused countries to switch from nominal trade to FDI, which has not been evidenced in previous studies before (Thanyakhan, 2008).

The Gravity Model has also been used to examine cross border equity flows (Portes and Rey, 2005). The results showed that distance was a significantly negative factor. Telephone calls and financial market sophistication had a positive influence on transaction flows. The cross border equity flows and trading costs relied on market size in the source and destination countries. The authors suggested that the model may capture some determinants of asset flows but not all.

Also there were some more opinions of using gravity models, such as Kumar and Zajc (2003). Authors used gravity equation in evaluation FDI in Slovenia. As independant variables they

used inward FDI, outward FDI, distance, GNP per capita, free trade agreement (FTA), secondary school enrolment rate. There was a weak complementary relationship between bilateral trade flows and FDI. Population, GNP per capita, and distance were highly significant factors on FDI flows. Outward FDI positively affected the level of export of investment products. The effects of bilateral FDI were the strongest for bilateral trade flows with investment and intermediate products.

1.8.1. Gravity model of FDI variables

According to various theoretical approaches to explain FDI and more specifically, the regional distribution of FDI, empirical studies based upon a gravity - type approach should include three sets of variables:

- **Market-related variables:**

1. GDP of host country as an indicator of market volume;
2. development level, representing the degree of demand differentiation;
3. population of host country as indicator of country size;
4. GDP of neighboring countries as an indicator of the market potential beyond the host country, especially in integration areas.

- **Distance-related variables:**

1. geographical distance between capitals or economic centers in kilometers;
2. factors affecting the economic distance between the countries concerned, such as trade preferences, openness for imports, common language, economic and political risk in host country, common border, etc.

- **Endowment-related variables**

1. skill variables of employees in host country;
2. wages in host country;
3. GDP per head as an indicator of technological and general development level agglomeration forces.

The two first-mentioned groups can be regarded as elements of a modified traditional gravity approach, while the third group is derived from “new” theories of FDI.

So gravity model, which is used in the analysis of foreign direct investment usually has the form of dependency, which is expressed in the bilateral relationship between foreign direct investment flows from one country (i) to another country (j) and some factors. Using gravity models in the analysis of regional FDI distribution presumes that country size (markets) and distance can be considered important FDI determinants. Prevailing theoretical approaches to explain FDI gravity model could be said that an author can choose the variables by his own opinion and it depends on

the evaluating country, because the different authors and different literature reviews say different variables of FDI, different formulas evaluating FDI by gravity approach.

So, in the theoretical part of this thesis variables in the FDI and portfolio investment models include GDP, GDP per capita, GDP Growth Rate, Distance, Trade, Exchange Rate, Wage Rate, Inflation Rate, regional integration dummy variables (APEC and ASEM), and the Asian Financial Crisis dummy variables. Also in this part of work we found a lot of opinions of different authors of distinguishing different variables which could impact and influence FDI: enrolment rate, tax burden, average wages, ect. All these variables and their usage in gravity approach models we saw in theoretical part but first of all these variables should be checked by the regression analysis because regression results support the claim that the extended Gravity Model specification can be used to determine the inflows of FDI. Graphical analysis of FDI using Baltic States example and regression analysis using variables found in the theoretical part of thesis and also Baltic States example are done and analysed in the sedond part of this master thesis.

2. GRAPHICAL ANALYSIS OF FOREIGN DIRECT INVESTMENT IN BALTIC REGION

The Baltic countries abroad are often still considered as a unit. However, Lithuania, Latvia and Estonia participate in the fierce race on economic success. The countries in their historical and economic experience, mentality and objectives are very similar. However, despite being similar in many aspects, the neighboring countries have different economic structure and the same goals seek by using different economic levers and sometimes become competitors. But the most important thing is that all three Baltic countries in the region are aware that they have a very strong focus on attracting foreign direct investment not only in their country but also to the region, because they realize that each individual country is too small to compete in the large european market, so easier to focus on the region for foreign direct investments.

Small countries normally attract only small amounts of FDI in nominal terms unless they function as international headquarters. The experience of the three Baltic countries fits this image. Because the percent of Baltic States FDI to FDI in all European Union is only 2-3%. However, amounts that seem insignificant in an international comparison can be very important for a small recipient country where FDI usually finances a large part of the current account deficit, is equivalent to some 20 - 40 percent of gross fixed capital formation, and helps access new technology and new markets.

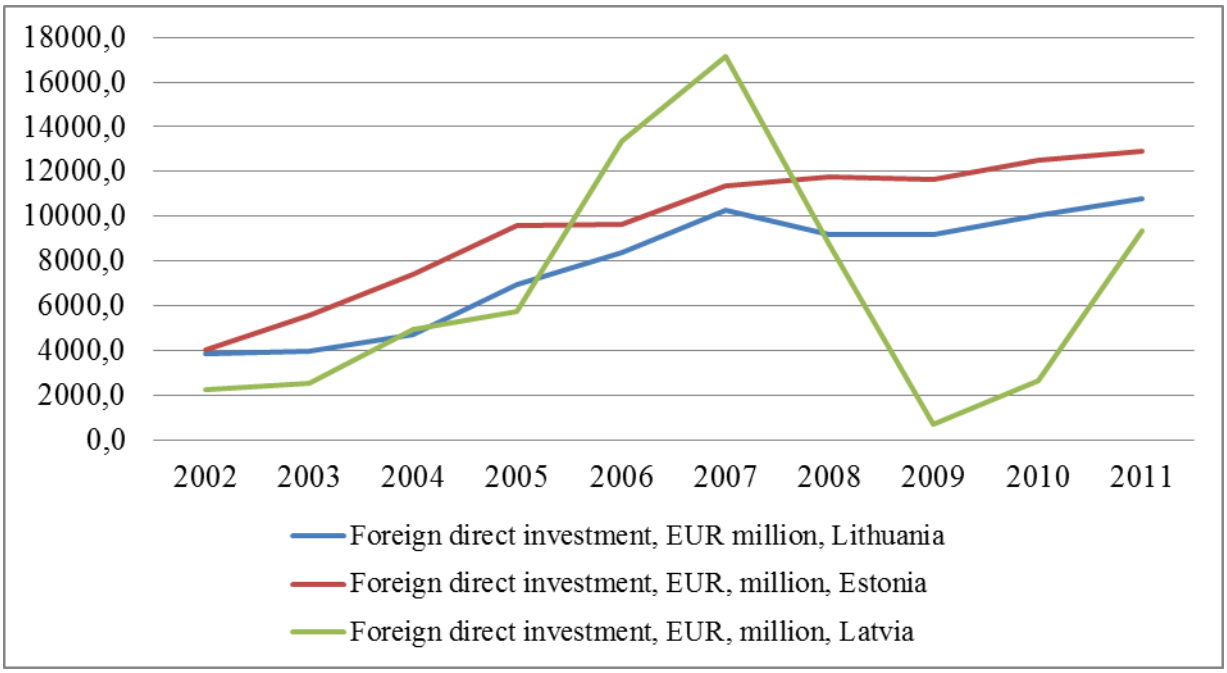
In 2008 in all the Baltic countries, is visible an impact of the global financial crisis, and since 2010 FDI trends in all countries are improving and increasing the attractiveness for foreign investment. Most of the annual investment attracts Estonia, the second - Lithuania, the third - Latvia. The financial crisis on foreign direct investment is the most affected Lithuania, after that the crisis felt in Estonia and Latvia (The Vienna Institute for International Economic Studies, 2012).

Before the FDI research in Baltic States I did an analysis for each country: Lithuania, Latvia and Estonia. But the conclusions in all the countries was the same, that we can not see any trends and links between the countries and between the independent variables, that is why we decided to analyse a region as a unit and try to find links and trends there. In the Baltic countries, foreign direct investment is valued at as one of the factors of economic development, has been considered important productivity and thus economic growth stimulating condition. This approach to FDI was dictated by the Baltic countries economic policies of foreign capital in respect of: parties to fully promote and encourage international capital coming. He enjoyed by both tax relief and specific strategic investor rights privatization important state objects. However, individual cases

cast doubt on whether FDI is always the same to ensure productivity growth of goods sold and services provided quality and quantity increase.

Because of the large FDI exposed economic indicators of the quantity and vivid assessment methods differences in assessment was based only on the following main measurable indicators, such as GDP per capita, exports, average wages, the country's market share, economic openness, the tax burden. Before evaluating all indicators by gravity model all indicators should be analysed by correlation analysis and found dependence between indicators. In this part of work I am presenting a graphical analysis for all three Baltic States by all the factors mentioned in theoretical part.

FDI trends in the Baltic countries analyzed and differentiated into separate investment flows, to determine the distribution of FDI among the Baltic holdings under the influence of different economic policies of foreign capital.



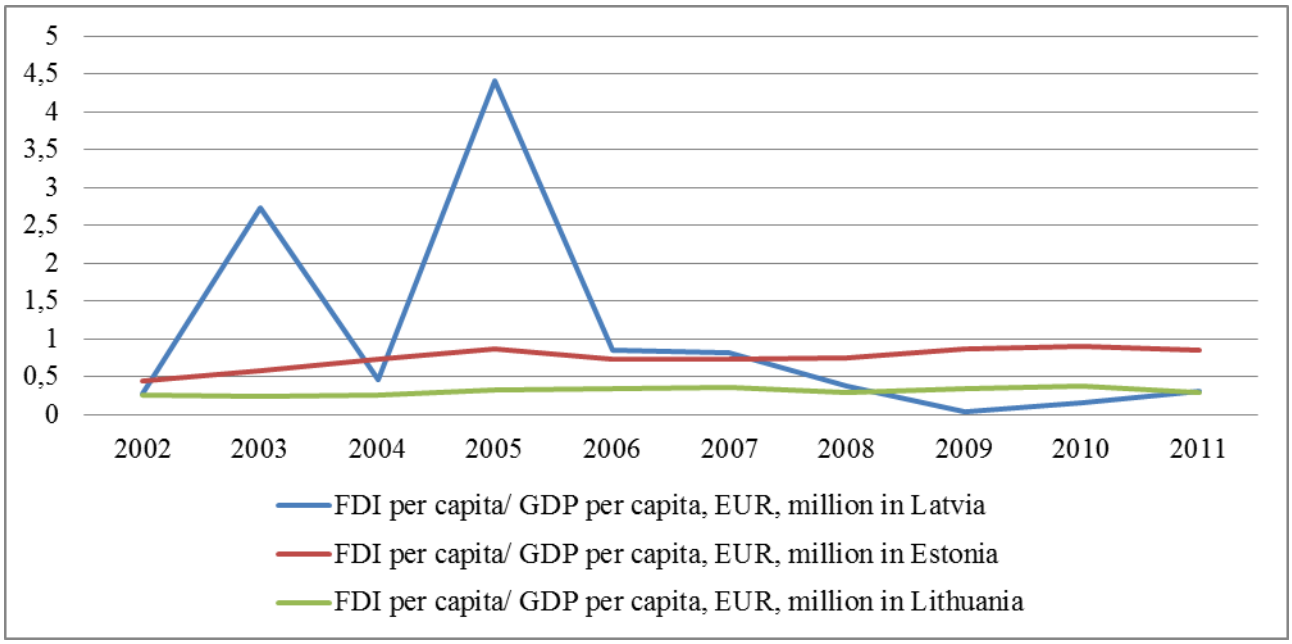
2 picture. Annual foreign direct investment in three Baltic countries 2002 – 2011

Annual foreign direct investment (mil. EUR) in each of the Baltic countries in the region differently, most like during the period analyzed, the other in Estonia and Lithuania. Over the past 10 years, foreign direct investment in the Baltic region has gradually increased. Reached peak in all three Baltic countries were in 2007 – 2008. Very similar to foreign investors invested in Estonia and Lithuania and big distractions in the last decade was not. However, the drastic situation in Latvia, when came the global economic crisis, foreign direct investment in the country has fallen to the lowest level in the last ten years.

The following FDI analysis will be held by using the factors which is got by theoretical analysis in the first part of the thesis. In the first part of this thesis I have analysed the different opinions of authors about variables which are important for investors to evaluate before decide in which country to direct the investment and authors often refer to these (could be evaluate quantative) factors: market size, labor costs, tax system, human capital, economic growth, economic openess and purchasing power. So it is very important to analyse the situation of Baltic States regarding these factors which will be using in the practical part to evaluate the importance of them for investors to decide where to invest and which country is more attractive to direct investment.

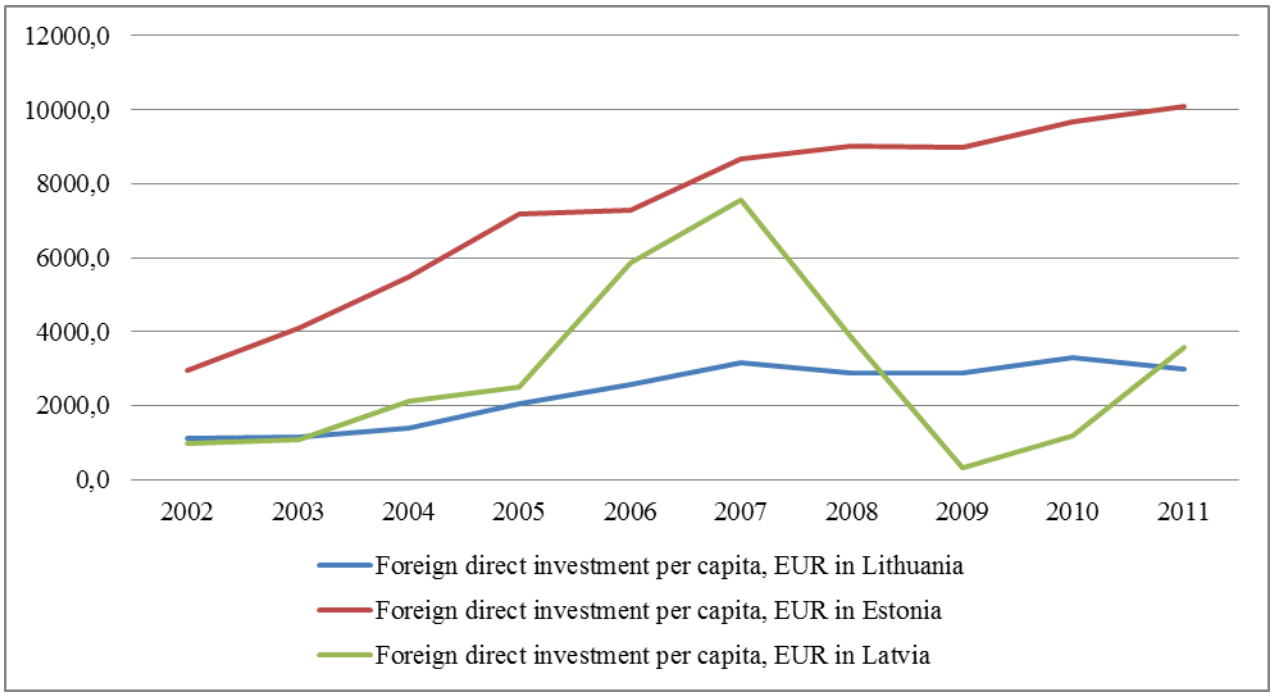
2.1. GDP as a factor determining FDI analysis in Baltic States

FDI trends in Lithuania, Estonia and Latvia mostly evaluating by comparing foreign direct investments flows in each country by calculating FDI per capita and comparing FDI flows with GDP.



3 picture. FDI per capita (EUR, mill.) comparing with GDP per capita (EUR, mill.) in Baltic States 2002 – 2011

Perhaps the most interesting trends again observed in Latvia, 2004 years change is not so great as it seems in the graph is associated with the integration of Latvia into the European Union. Foreign direct investment in the country has not a big change, but suddenly jumped GDP per capita (EUR mill.). More similar trends observed in Estonia and Lithuania. According to the aggregate of all years of data from foreign direct investment in the country's economy is leading Estonia. This is confirmed by the Statistics Department of the calculated flow through the year in all the Baltic countries, compared to GDP and FDI per capita (Picture No. 3).



4 picture. Foreign direct investment per capita, EUR in all Baltic States 2002 – 2011

FDI per capita comparison between the Baltic countries, both in relation to GDP in each country, Estonia is the most attractive to foreign investors, followed by Latvia and Lithuania. Market size and growth of the natural attractiveness aspect of Estonia can be described as the strongest market and its growth in the country, while in Lithuania and Latvia, the country still possess economic growth and in particular Latvia strongly dependent on changes in the market economy. Also evaluating the data of foreign direct investment per capita in all Baltic states, it is seen that in 2007 – 2009 Latvia`s FDI was strongy dependent on World economy crisis, banks crisis, talking about country`s bankupcy. Investors sensitivly reacts to these facts of the country.

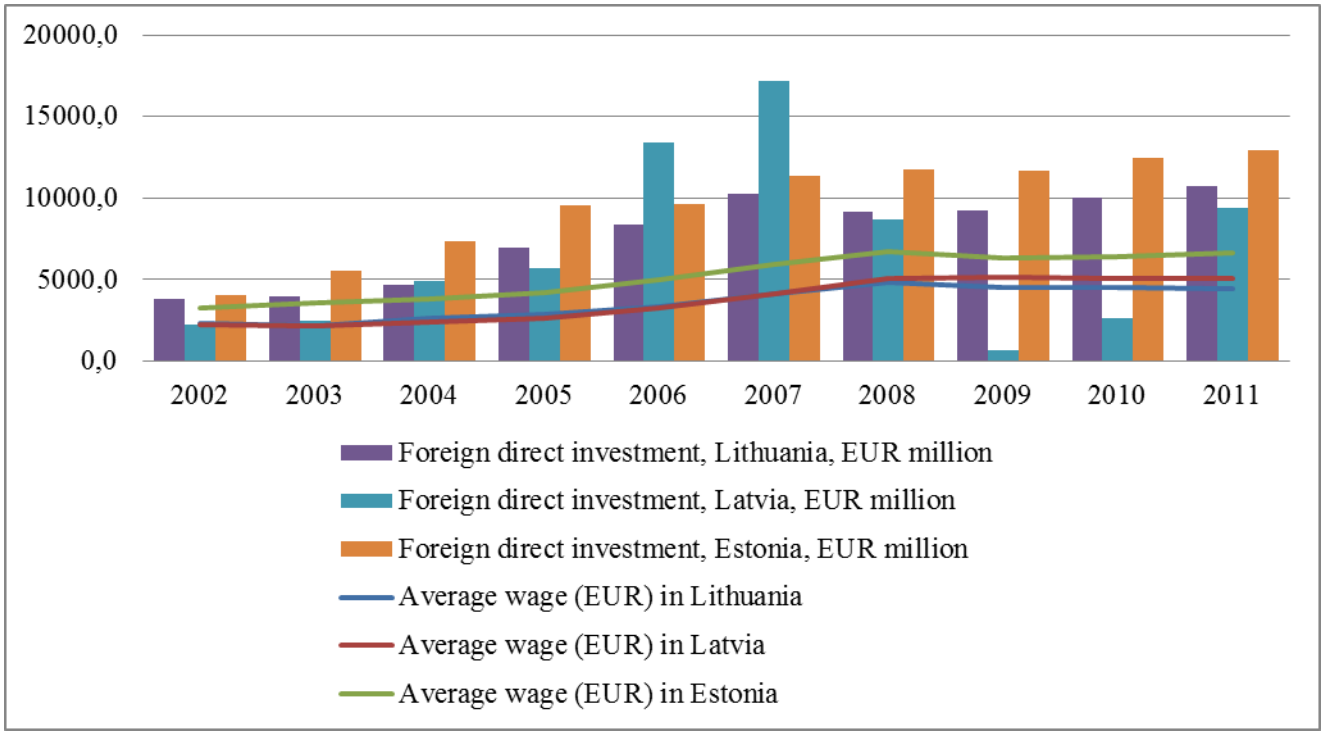
Estonia regarded as the most advanced country and the best managed in the region. Its progress towards a market economy is a huge and very well appreciated by foreign investors, helping it to grab the largest foreign investment in all three Baltic states. Foreign investors do not see any significant barriers to investment in the country. Therefore, the Estonian economic policy, foreign capital, can be considered as purposive in order to attract more foreign investment but it should be noted that the Estonian foreign investment activity resulted in a close Estonian and Scandinavian ties conducive to the Estonian legal system and created a positive and rapid reforms performing image of the country.

2.2. Average wage as a factor determining FDI analysis in Baltic States

According to all three Baltic countries statistical department data, the lowest average salary (EUR) rates are in Lithuania, Latvia is not far behind, but after the crisis, the country's

average wage level is not dropped, as in Lithuania. Estonia's average salary over the last decade has remained the highest of all three countries.

In all Baltic countries in the region by 2008 average wage grew. However, in 2008 started the global economic crisis has had an impact on this indicator, which also has an impact on the country's attractiveness for foreign investment. In all countries, the average wage in times of crisis 2008 - 2009 first half decreased, the smallest change is seen in Latvia. Seen from this perspective, Lithuania should be the most attractive to foreign investors with relatively low average wage rate.



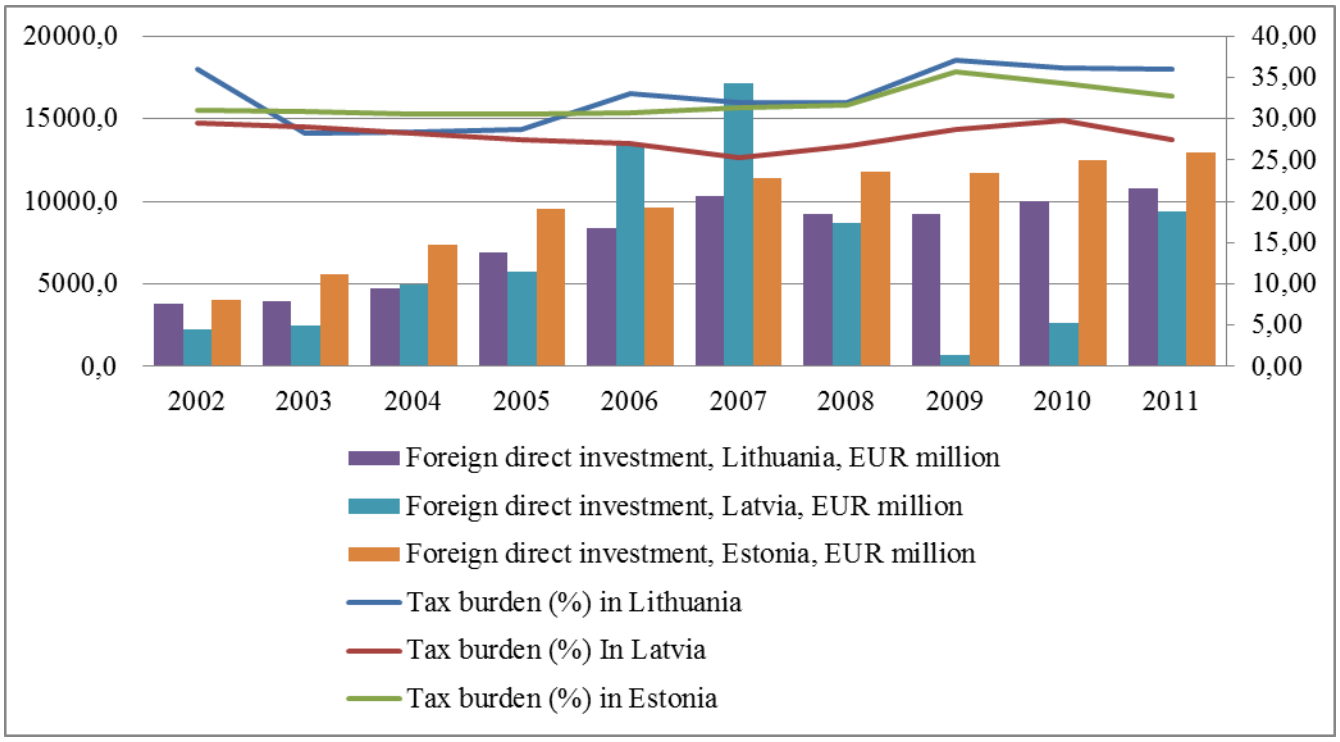
5 picture. FDI (EUR. mill.) comparing with average wage (EUR) in all Baltic region countries 2002 - 2011

From this diagram No. 5 we see that till 2007 in all the countries it is almost perfect correlation between average wage and FDI. But the changes began together with World economic crisis: the weakest link between FDI and the average wage in Latvia, this is concerned with actions during the crisis, we find that the average salary in Latvia in 2008 did not start to decrease as in Estonia and Lithuania, and maintained the same level of investment but withdrew due to other factors. In Lithuania and Estonia, where wages have decreased investment retreated at a lower rate, so it means that investors the average wage in the Baltic countries was rated as one of the important criteria and according to decided which direction to direct more investment.

2.3. Tax burden (%) as a factor determining FDI analysis in Baltic States

Tax burden - one of the criteria in choosing the location for multinational organizations to develop and expand. A lower tax burden - one of the conditions which should attract more foreign investors to the country.

Lithuania is one of the lowest tax burden countries in the European Union. Total taxes, including social, levels are among the six lowest in the EU. According to the statistics, the fees in Lithuania is 32,74% of gross domestic product, while the EU average, they seek to 38,4 %. Compared with the other Baltic countries, Lithuania is a leader because in Latvia tax burden seeks 27,9 % in average and Estonia 31,94 %. So looking from tax burden (%) in average perspective Latvia should be the most attractive country from all Baltic region for foreign investors.

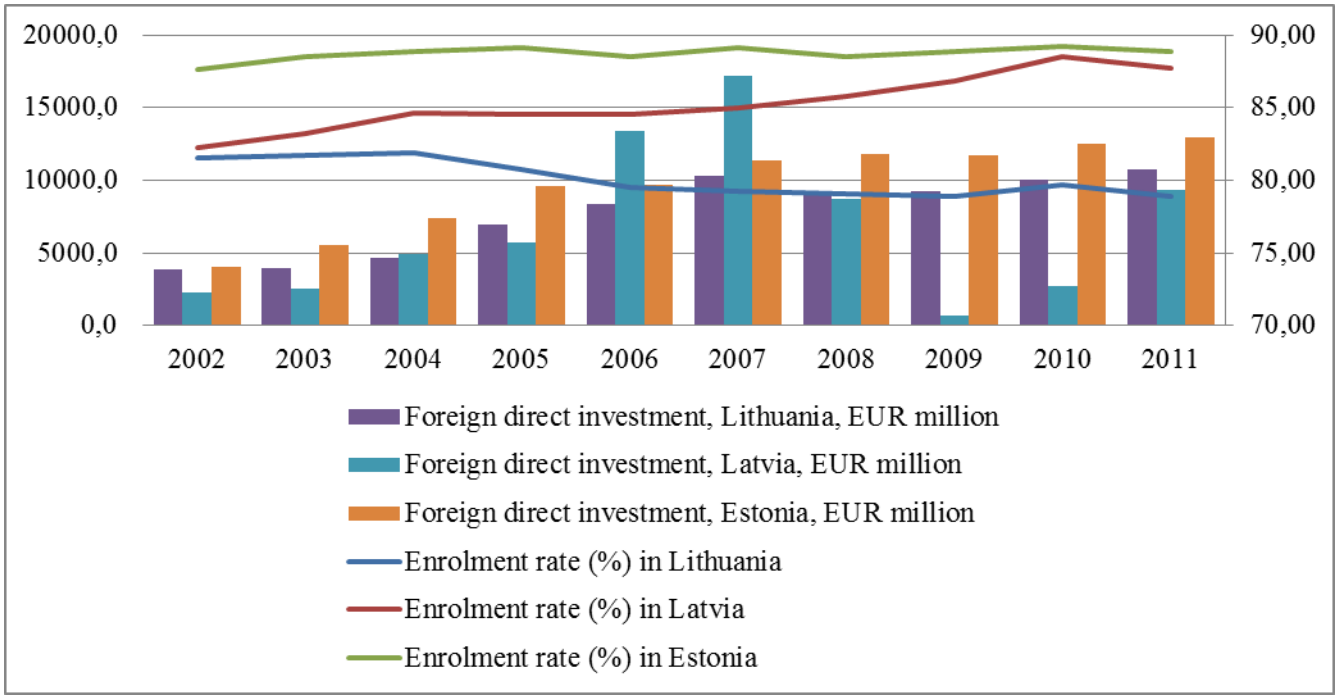


6 picture. FDI (EUR.mill) comparing with tax burden (%) in all Baltic region countries 2002 - 2011

From the picture No. 6 it is seen that 2010 – 2011 years when tax burden in Latvia decreasing, FDI strongly increases, also in Estonia interdependence between tax burden and FDI very strong, because tax burden in this country decreases from 2009 till 2011 and FDI curve behaves contrary. Only in Lithuania tax burden is not very strongly correlating with FDI, , when the tax burden is stable, FDI increases and it could be said that tax burden in Lithuania is not very significant parameter to evaluate factors wich are important to analyse before choosing country where to invest.

2.4. Enrolment rate (%) as a facor determining FDI analysis in Baltic States

If we see a trend of all the countries (picture No. 7), it is seen the quite good correlation. In each country the trend shows the enrolment rate (%) in the country, it is seen that the highest enrolment rate (%) is in Estonia, it is close to 90% and it is really high if we evaluate it in Europe or all over the World trend. The biggest enrolment rate (%) changes are seen in latvian region, where enrolment rate (%) from 2002 till 2011 changed close to 6%. The lowest level of enrolment rate (%) is in Lithuania and it was only 78,9% in 2011 and the trend is decreasing. An average of this variable in all Baltic States countries 84, 7%, so the rate in Estonia and Latvia is up to average of all three countries but the rate in Lithuania is lower than an average. The trend of enrolment rate (%) in all Baltic States is strongly correlating with emigration level, the higher emigration level in the country, the lower enrolment rate (%) because of emigrating people in work – age.



7 picture. FDI (EUR.mill) comparing with enrollment rate (%) in all Baltic region countries 2002 - 2011

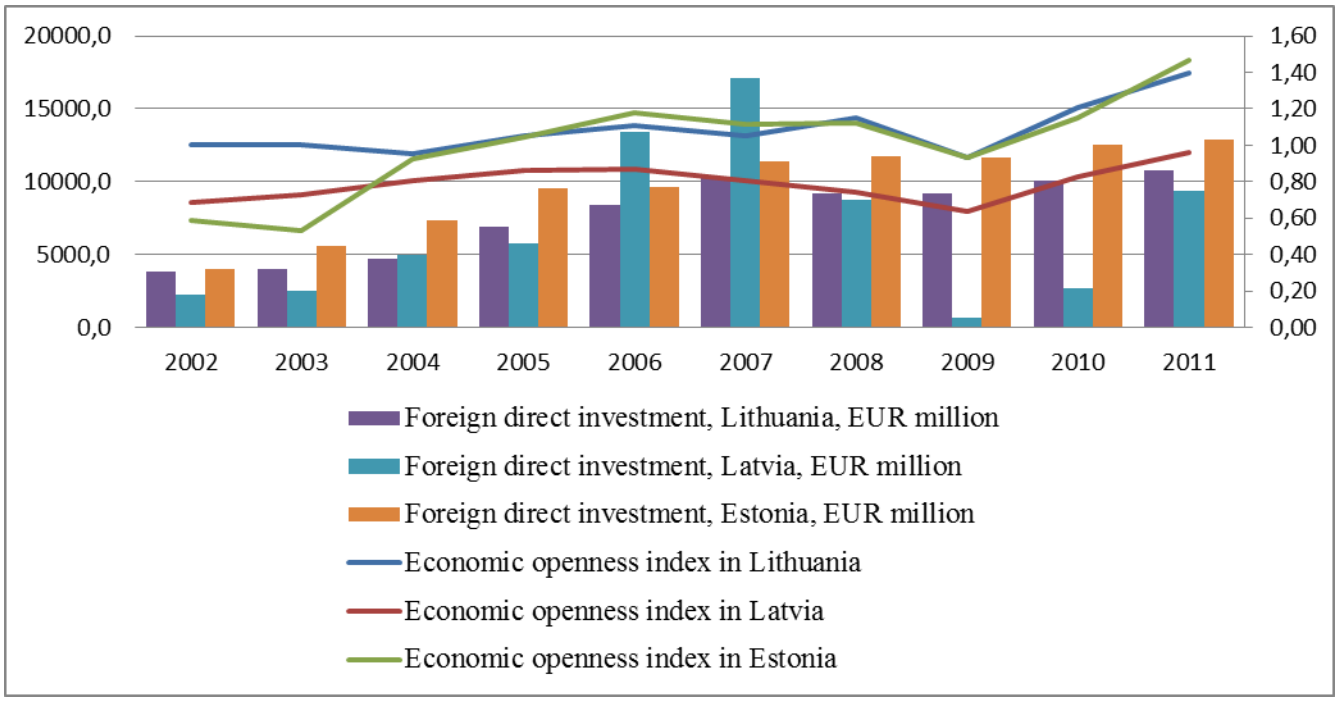
If we evaluating enrolment rate (%) and foreign direct investment in each country we see that dependence between these variables are different in each country. The strongest negative correlation between FDI and enrolment rate (%) is in Lithuania, from the Picture No. 7 it is seen that the lower enrolment rate (%) is, the higher rate of foreign direct investment is attracting to the country. This link is not very normal but could be explained as the type of investment: if an investor want to invest and he needs unskilled labor, so he do not see to this indicator or chooses a country in which unskilled labor rate is bigger. Latvian trend and link betwwen FDI and enrolment rate (%) shows a quite good dependence till 2007 but from 2008 like other indicators depended on World

Economic crisis which affected also the all other indicators in this country as it was seen before in this thesis. In Estonia, the correlation between FDI and enrolment rate (%) is not very strong, but it can be explained, since 2007 foreign direct investment in Estonia unlike any other country in the Baltic States were maintained and grown as the level of enrolment (%) when the population decreased.

2.5. Economic openness index as a factor determining FDI analysis in Baltic States

Country's economy can not grow detached from the world economy, not maintaining a relationship with other countries, but in some countries the economy is more open than the other. Countries openness is an important indicator for the foreign investor searching which country to choose as a partner.

The country's economy is more open, the more developed foreign trade, which is very important to the domestic economy. The higher degree of economic openness, the higher income level, and it is characterized by both small and large countries, both developed and developing countries (Corden, 1997).



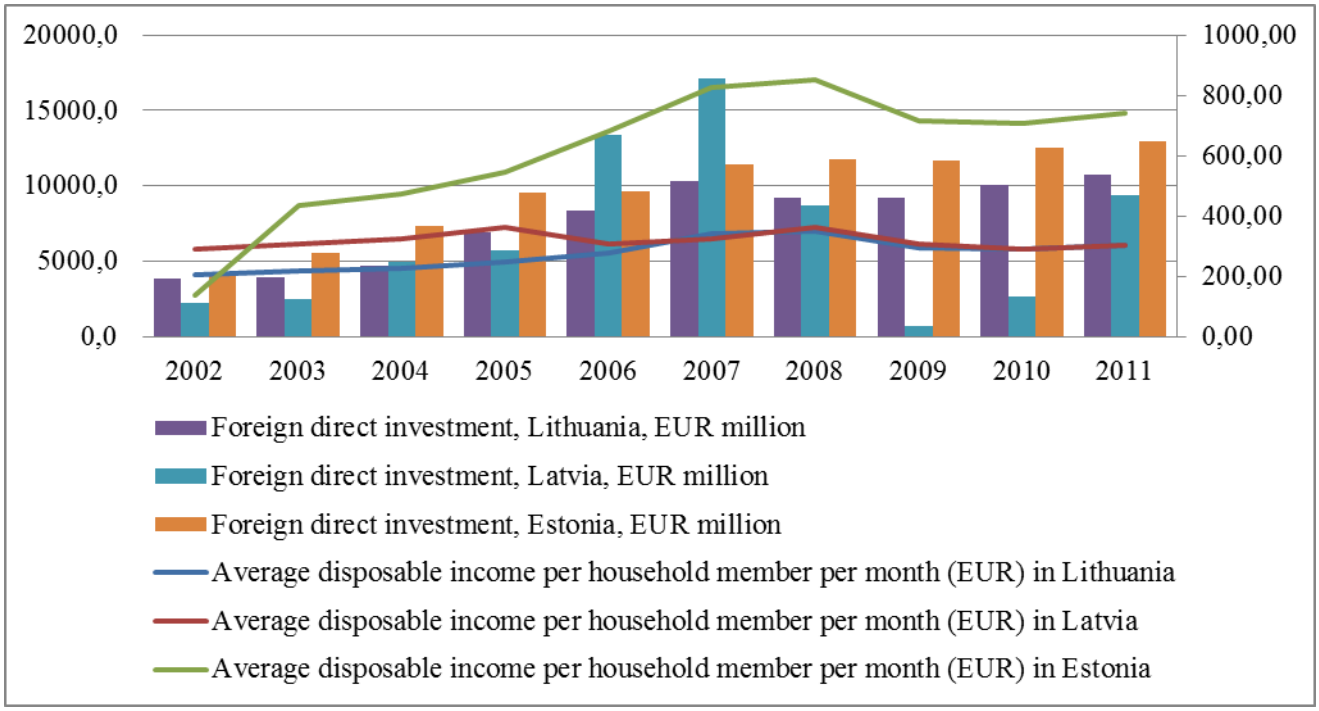
8 picture. FDI (EUR.mill) comparing with economis openess index in all Baltic region countries 2002 – 2011

Economic openness index of long - term trend over the past decade has been increasing. Except for the period 2008 - 2009 it means that Baltic countries affected the global economic crisis. If we monitor a link between economic openness index and foreign direct investment, we see that bright enough correlation between this variable and foreign direct investment in Estonia felt that

foreign direct investment continued adherence to growth trends, only the economic openness index in 2009 dropped. In Lithuania and Latvia the relationship between these two indicators are medium, but in the after - crisis period in all countries growing economic openness index and also increasing foreign direct investment, if the same trend continues can be argued that this index is very important in making decision which country choose to invest.

2.6. Average disposable income per household member (EUR) as a factor determining FDI analysis in Baltic States 2002 – 2011

If it is analysing the average disposable income per household member (EUR) in all the Baltic countries, it is seen that the trend and values of this indicator are different in all countries but the most similar trend is in Lithuania and Latvia. The highest value of this indicator has Estonia and it seeked 739,84 EUR per member in 2011 while in Lithuania it was 304,8 EUR, in Latvia – 304,62 EUR.



9 picture. FDI (EUR.mill) comparing with average disposable income per household member (EUR) in all Baltic region countries 2002 – 2011

A correlation of average disposable income per household member (EUR) in all the countries is quite good, the peak in all the states was in 2008 and it could be explained because of the economic, banks, lowns, purchasing power situation in Baltic States. When became World Economic crisis the income became lower and it could be also explained by analysis changes in unemployment rate in all the countries, because in all the countries increased unemployment rate in this year.

If we are analysing a situation between FDI and average disposable income per household member (EUR) in the countries we see a quite good and srong correlation between variables in Lithuania and Estonia and it means that the higher investment in the country, the higher average disposable income per household member (EUR) is. The more different situation is in Latvia where the average disposable household income per member (EUR) decreasing but foreign direct investment in the country increasing in these year, so correlation coefficient is not high and could not be explained as strong.

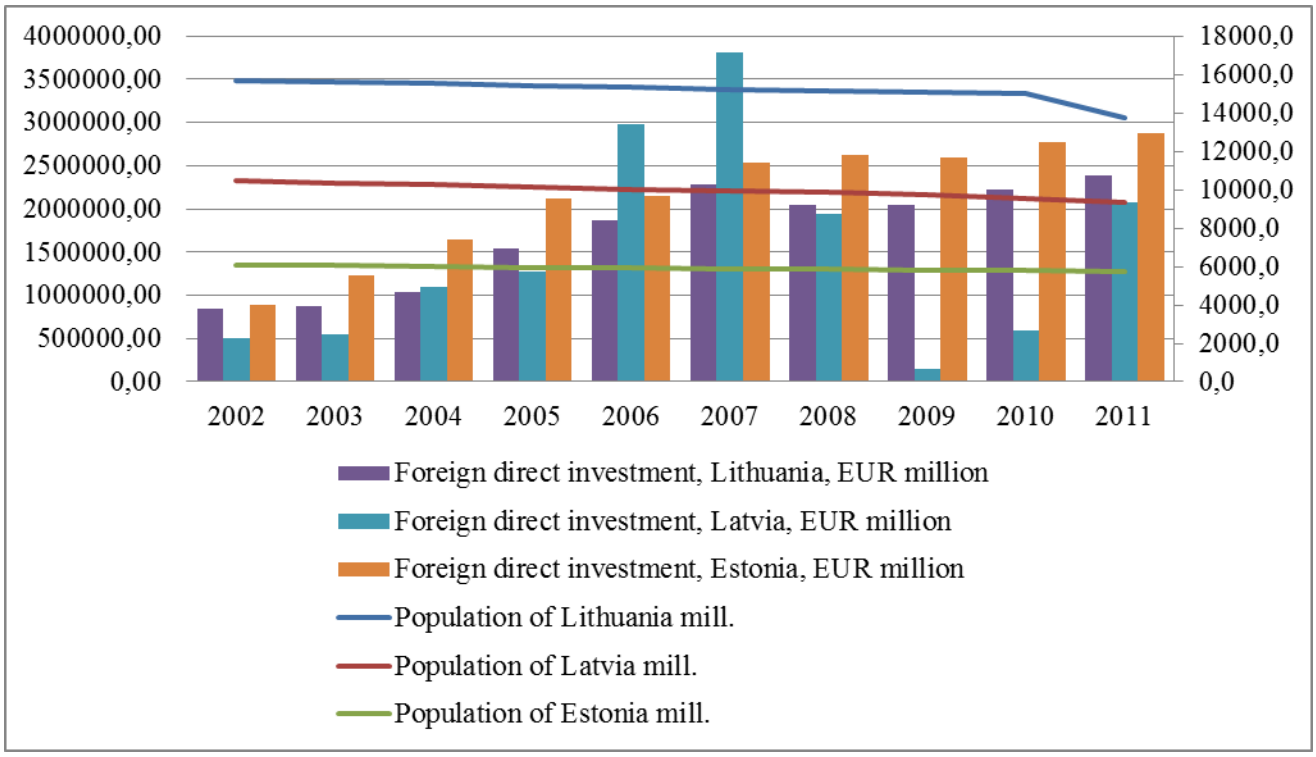
2.7. Population as a factor determining FDI analysis in Baltic States 2002 – 2011

One of the economic literature secreted factor that promotes foreign direct investment in the country, there are market factors. Often companies invest abroad in order to acquire additional market segments. A new market, its size, potential growth rates help to ensure a level of profit and business development (Dunning, Narula, 1996).

In picture No.10 there is the data on the three Baltic market size (number of inhabitants in the country, expressed in millions of inhabitants) development in 2002-2011. In these countries, throughout the period of the local market decreased. One of the main reasons for this trend - remarkably increased emigration from the Baltic states level.

Picture No. 10 shows that there is a very strong link between foreign direct investment (EUR) and market size (population mill.) in Lithuania and Latvia, and Estonia - the connection is weak. Relationship is inverse, as foreign direct investment in the countries examined have increased and the number of people trend was decreasing, however, such a connection is not correct and can not say that the connection exists because the investor is interested in investing in the country, where could realize the production, provide services, i.e. there is a sufficient market size of the population.

However, the Baltic countries, one might assume that part of the investment can be referred to as the transit investment, when investing in neighbor countries of the Baltic region, but need to make additional investment into Baltic countries (e.g. investments in storage, transportation).



10 picture. FDI (EUR.mill) comparing with population (mill.) in all Baltic region countries 2002 – 2011

From the graphical analysis could be seen a lot of trends, correlations, links between different variables, links between dependent and independent variables. But for creating a gravity model to evaluate foreign direct investment we need to make regression analysis. By making regression analysis we can find a regression equation, find links between variables in numbers, to evaluate interdependence or non - dependence between variables, to choose and check significance of variables and also find a gravity equation which in the future could be used to evaluate foreign direct investment in other countries. In the third part of this master thesis will be shown regression analysis results and their usage in the practical situation in example of Baltic States.

3. FOREIGN DIRECT INVESTMENT IN BALTIC STATES REGRESSION ANALYSIS AND GRAVITY MODEL APPROACH

In many practical problems, where the processes used in the quantitative indicators, it is important how they affect each other. The relationships between variables may exist in reality, or only suspected. This connection can be a simple functional relationship where each independent variable value can be uniquely specify the dependent variable (function) value. However, in many physical and economic processes but rather the exception. In most cases these relations are very complex, and resut rates depend on many factors simultaneously and difficult to say what the most.

In the practical part I will use correlation and regression analysis to evaluate dependence between dependent and undependent variables. Correlation and regression analysis - is a communication between the variable dependence. Correlation and regression analysis is used to complex economic and natural phenomena studies.

Correlation analysis - a statistical method for testing random variables with normal distribution, the relationship between the General population. Correlation analysis method reveal links between the causes of the values - it only makes it possible to quantify the strength of those ties. Regression analysis - a statistical method used to determine dependencies between random variables, in mathematical terms (regression equation) and analysis of its parameters.

Because we want to investigate the dependent variable - foreign direct investment dependence with several independent variables, and multiple correlation and regression analysis fits well with work goals and objectives. For research we use a related factor - foreign direct investment, and several independent variables. Independent factors is used as on the theoretical part of the thesis analyzed by different authors to distinguish elements in literature.

In the first part of the analysis selected 7 independent factors and one dependent factor. As the independent variables in the analysis is used: $\frac{Population\ of\ Baltic\ Sates\ (millions)}{Population\ of\ EU\ (millions)}$ (x_1), $\frac{Average\ wage\ (EUR)\ in\ Baltic\ states}{Average\ wage\ (EUR)\ in\ EU}$ (x_2), tax burden (%) (x_3), enrolment rate (%) (x_4), $\frac{GDP\ per\ capita\ (EUR)\ in\ Baltic\ States}{GDP\ per\ capita\ (EUR)\ in\ EU}$ (x_5), economic openness index (x_6), $\frac{Average\ disposable\ income\ per\ household\ member\ (EUR)\ in\ Baltic\ States}{Average\ disposable\ income\ per\ household\ member\ (EUR)\ in\ EU}$ (x_7). Due to the Baltic States market size comparing with the other bigger market sizes in all over the World, some parametres is calculates as ratios $\frac{X_i(Baltic\ States)}{X_j(European\ Union)}$ for comparing the ratio to of Baltic States with the all European Union countries (number of the countries depends on the year).

The main goals of this part of thesis are:

1. Set of foreign direct investment in the Baltic countries, mostly dependent on various authors referred determinants;
2. Select the largest factors affecting the determinants of foreign direct investment and to find their form and analytical expressions;
3. Perform paired regression analysis;
4. Perform multiple regression correlation analysis;
5. To make conclusions of dependence of independent varianbles and foreign direct investment in Baltic States.
6. Using the results of analysis make a gravity model on it and check an adequacy of it.

In the analysis is used data of three Baltic States in 2002 – 2011 years. Data is shown in table No. 5.

5 table. Baseline data for the following analysis of Baltic States 2002 – 2011 years

	Foreign direct investment, Baltic States, EUR million	Population of Baltic States/Population EU (million)	Average wage EUR in Baltic States/ Average wage EUR in EU	Tax burden (%)	Enrolment rate (%)	GDP per capita EUR in Baltic States/ GDP per capita EUR in EU	Economic openness index	Average income per household member EUR in Baltic States/ Average income per household member EUR in EU
2002	10102,60800	0,01579	0,01231	32,13333	83,76667	0,00005	0,75867	0,01254
2003	12020,50448	0,01460	0,01411	29,33333	84,46667	0,00005	0,75396	0,01900
2004	17005,90511	0,01443	0,01401	29,06667	85,13333	0,00005	0,89446	0,01960
2005	22214,67264	0,01425	0,01626	28,93333	84,76667	0,00006	0,98533	0,02220
2006	31411,49179	0,01409	0,01792	30,23333	84,16667	0,00007	1,05268	0,02255
2007	38810,55138	0,01394	0,01974	29,56667	84,43333	0,00008	0,99027	0,02548
2008	29678,17793	0,01378	0,02328	30,10000	84,46667	0,00008	1,00587	0,02556
2009	21560,21368	0,01362	0,02285	33,80000	84,86667	0,00008	0,83346	0,02143
2010	25191,26496	0,01343	0,02193	33,36667	85,80000	0,00007	1,06108	0,02079
2011	33060,15962	0,01274	0,02199	32,06667	85,16667	0,00008	1,27508	0,00217

The analysis also will be made by the same data of three Baltic States in 2002 – 2011 years expressed in logarithms (data is presented in the table No. 6 below).

6 table. Baseline data expressed by logatithms for the following analysis of Baltic States 2002 – 2011

	ln(Foreign direct investment, Baltic States, EUR million)) y	ln(Population of Baltic States/ Population EU (million)) x_1	ln(Average wage Baltic States/ Average wage EU (EUR)) x_2	ln(Tax burden (%)) x_3	ln(Enrolment rate (%)) x_4	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)) x_5	ln(Economic openness index)) x_6	ln(Average income per household member in Baltic States/ Average income per household member in EU (EUR)) x_7
2002	9,220548887	-4,148404734	-4,397514557	3,469893913	4,428035156	-9,978493	-0,27619343	-4,378944497
2003	9,394369177	-4,226904948	-4,261050439	3,378724526	4,436356979	-9,961464	-0,28242055	-3,963129048
2004	9,741315922	-4,238142142	-4,267671698	3,369592042	4,444218655	-9,846217	-0,11153376	-3,932350301
2005	10,00850828	-4,250998782	-4,119196343	3,364994333	4,439902384	-9,696808	-0,01477922	-3,80781845
2006	10,35492909	-4,262577287	-4,021770579	3,408945068	4,43279896	-9,589808	0,051340183	-3,79210683
2007	10,56644743	-4,273256862	-3,925163512	3,386647601	4,435962268	-9,451185	-0,00977986	-3,669969982
2008	10,29816731	-4,28445491	-3,760178529	3,404525172	4,436356979	-9,373982	0,005852488	-3,666597818
2009	9,978604936	-4,296475962	-3,778687541	3,520460802	4,441081397	-9,495077	-0,18216994	-3,842838298
2010	10,13425259	-4,309902035	-3,820124453	3,507557398	4,452019006	-9,504576	0,059286032	-3,873216469
2011	10,4060842	-4,363104827	-3,817164655	3,467817069	4,444610121	-9,384765	0,243012585	-6,133530462

3.1. Paired correlation analysis

Correlation analysis allows to determine whether there is a correlation between the factors, expressed as quantitative indicators. For example, we want to determine whether there is a link between foreign direct investment and the size of the market and also learn how market size affects foreign direct investment into the country.

Correlation analysis aims - to stochastic correlation between factors X and Y exist. This is done based on available statistical data to calculate the correlation coefficient and assessing its significance. If the correlation coefficient is significant in size, this conclusion about the existence of stochastic communication. The correlation coefficient may acquisition cry from -1 to 1. When the correlation coefficient is positive, it means that, with increasing values of the factor X increases and Y values. If negative - meaning the inverse relationship and shows that with increasing values of factor X, Y stagnates and behaving contrary. The values of correlation coefficient significance is shown in table No. 7.

7 table. Values of correlation coefficient significance (Pabedinskaitė, 2007)

Very Strong	**Strong**	**Average**	**Weak**	**Very weak**	**No connection**	**Very weak**	**Weak**	**Average**	**Strong**	**Very Strong**
-1	from -1 till -0,7	from -0,7 till -0,5	from -0,5 till -0,2	from -0,2 till 0	0	from 0 till 0,2	from 0,2 till 0,5	from 0,5 till 0,7	from 0,7 till 1	1

After calculating of the correlation coefficient between y - foreign direct investment and the variables $x_{1, 2 \dots 7}$, we obtain the following values.

8 table. Correlation coefficient between FDI and $x_{1, 2 \dots 7}$

	Foreign direct investment, Baltic States, EUR million	Population of Baltic States/Population EU (million)	Average wage EUR in Baltic States/ Average wage EUR in EU	Tax burden (%)	Enrolment rate (%)	GDP per capita EUR in Baltic States/ GDP per capita EUR in EU	Economic openness index	Average income per household member EUR in Baltic States/ Average income per household member EUR in EU
Correlation coefficient		-0,71	0,70	-0,03	0,18	0,86	0,78	0,14

Evaluating the results of correlation coefficient between dependent variable y and independent variables $x_{1,2,\dots7}$, we see that two of coefficients are negative. The negative ones are between foreign direct investment and the ratio of population (millions) (x_1) and tax burden (%) (x_3). It means that increasing values of independent variable, dependent variable values decreasing. So, if the ratio of population (millions) (x_1) and tax buden (%) (x_3) in Baltic States increases, foreign direct investment in Baltic States decreases. So in the simple words it means that foreign investor evaluates tax burden (%) and population of the country and if these parametres have an increasing trend, he wants to invest in the Baltic States less. Sure, the correlation coefficient of tax burden (%) very weak. If we are evaluating a value of correlation coefficient, we see that four of them have strong and average strong connection and it means that exists a connection between the dependent and independent variables.

9 table. Correlation coefficient between FDI and $x_{1, 2 \dots 7 \text{ in}}$ expressed by logarithms

	ln(Foreign direct investment, Baltic States, EUR million)) y	ln(Population of Baltic States/ Population EU (million)) x_1	ln(Average wage Baltic States/ Average wage EU (EUR)) x_2	ln(Tax burden (%)) x_3	ln(Enrolment rate (%)) x_4	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)) x_5	ln(Economic openness index)) x_6	ln(Average income per household member in Baltic States/ Average income per household member in EU (EUR)) x_7
ln (Correlation coefficient)		-0,77656652	0,796567134	-0,0023449	0,298373503	0,910516782	0,83846192	-0,076217881

The results of correlation coeficient expressed by logarithms are very similar with the results of correlation coefficient in the table No. 8. The more significant are correlations between dependent variable (y) ln (ratio of foreign direct investment (mill. EUR)) and ln (ratio of population (mill.) (x_1)), ln (ratio of average wage (EUR)) (x_2), ln (ratio of GDP per capita (EUR)) (x_5) and ln (economic openness index) (x_6).

However, just by the size of the correlation coefficient can not be judged on the stochastic connection existence, because you need to take into account the statistical sample volume. In order to evaluate the correlation coefficients and statistical sample volume needed to calculate the statistics t ($t_{calculated}$) and compared with $t_{critical}$ (t_{cr}). $t_{critical}$ (t_{cr}) counted with MS EXCEL function TINV with the probability of $\alpha = 0{,}05$ and degrees of freedom equal to (n - 2, 10-2).

$t_{calculated}$ is counting using formula:

$$t_{calculated} = r\sqrt{\frac{n-2}{1-r^2}} \quad (7)$$

where, r – correlation coefficient, n – number of observations, k = n-2 – degree of freedom.

10 table. Statistics t and critical t values

	Foreign direct investment, Baltic States, EUR million	Population of Baltic States/Population EU (million)	Average wage EUR in Baltic States/ Average wage EUR in EU	Tax burden (%)	Enrolment rate (%)	GDP per capita EUR in Baltic States/ GDP per capita EUR in EU	Economic openness index	Average income per household member EUR in Baltic States/ Average income per household member EUR in EU
t_{cr}	2,306004135							
$t_{calculated}$		-2,85863311	2,77224196	-0,088562	0,5058461	4,846523253	3,5197279	0,402230997

In table No.8 and No. 9 in grey color marked $t_{calculated}$ values which are higher than $t_{critical}$ values. If $|t_{calculated}| > t_{cr}$, then it can be assumed that between y and x there is a stochastic relationship. Comparing the t_{cr} with $t_{calculated}$ from the table we can see that such a link exists between foreign direct investment (y) and ln (foreign direct investment) (ln(y)) and ratio of population (millions) (x_1) and ln (ratio of population (millions) ($\ln(x_1)$), ratio of average wage (EUR) (x_2) and ln(ratio of average wages (EUR)) ($\ln(x_2)$), ratio of GDP per capita (EUR) (x_5), and ln(ratio of GDP per capita (mill. EUR)) ($\ln(x_5)$), economic openess index (x_6) and ln(economic openness index) ($\ln(x_6)$), but the stochastic relationship is non - existent or very weak between foreign direct investment (y) and ln (foreign direct investment) (ln(y)) and tax burden (%) (x_3), and ln(tax burden (%)) ($\ln x_3$)) , enrolment rate (%) (x_4) and ln(enrolment rate (%)) ($\ln(x_4)$), ratio of average income per household member (EUR) (x_7) and ln(average income per household member (EUR)) ($\ln(x_7)$) . These do not always mean that a stochastic relationship does not exist at all, perhaps, need to collect more data to explore this phenomenon further.

11 table. Statistics t and critical t values expressed by logarithms

	ln(Foreign direct investment, Baltic States, EUR million)) y	ln(Population of Baltic States/ Population EU (million)) x_1	ln(Average wage Baltic States/ Average wage EU (EUR)) x_2	ln(Tax burden (%)) x_3	ln(Enrolment rate (%)) x_4	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)) x_5	ln(Economic openness index)) x_6	ln(Average income per household member in Baltic States/ Average income per household member in EU (EUR)) x_7
$t_{cr.}$	2,306004135							
$t_{calculated}$		-3,48625216	3,726791478	-0,0066324	0,884203914	6,228546683	4,35174618	-0,216205623

Therefore, for further analysis we select only those factors which has $|t_{calculated}| > t_{cr}$: ratio of population (millions) (x_1), ratio of average wage (EUR) (x_2), ratio of GDP per capita (EUR) (x_5), economic openess index (x_6) and the same expressed by logarithms (table No. 9).

3.2. Paired regression analysis with 4 selected independent variables

Paired regression analysis aim - evaluate stochastic relationship between x and y form and analytical expression. This is done by selecting the curve that best describes the statistical points together, and to assess the adequacy of the actual position of the curve (Pabedinskaitė, 2007).

So, stochastic dependency - it is a relationship where there is no unambiguous compliance with the independent and dependent variable values, but it can be said that the change of the independent variable x, changing the dependent variable y probability distribution. For the examination of these forms of dependencies is using regression analysis.

In the paragraph before is found that stochastic connections exists between y and x_1, x_2, x_5, x_6 and $\ln(x_1)$, $\ln(x_2)$, $\ln(x_5)$, $\ln(x_6)$ that is why it could be made different linear regression equations for each pair of variables. Suppose that we are searching the relationship between x and y, so there is a regression curve $\hat{y} = f(x)$ looks like this:

$$\hat{y}=a_0 + a_1x \quad (8)$$

If we suppose that we are looking for the relationship between ln(y) and ln(x), so there is a regression curve $\ln(\hat{y}) = \ln(f(x))$ looks like this:

$$\ln(\hat{y}) = a_0 + a_1\ln(x) \quad (9)$$

12 table. Four selected variables for further analysis with calculated coefficients a_0 and a_1

Baltic states	Foreign direct investment, Baltic States, EUR million	**Population of Baltic States/Population EU (million) (x_1)**	**Average wage Baltic States/ Average wage EU (EUR) (x_2)**	**GDP per capita EUR in Baltic States/ GDP per capita EUR in EU (x5)**	**Economic openness index (x6)**
2002	10102,61	0,01579	0,01231	0,00005	0,75867
2003	12020,50	0,01460	0,01411	0,00005	0,75396
2004	17005,91	0,01443	0,01401	0,00005	0,89446
2005	22214,67	0,01425	0,01626	0,00006	0,98533
2006	31411,49	0,01409	0,01792	0,00007	1,05268
2007	38810,55	0,01394	0,01974	0,00008	0,99027
2008	29678,18	0,01378	0,02328	0,00008	1,00587
2009	21560,21	0,01362	0,02285	0,00008	0,83346
2010	25191,26	0,01343	0,02193	0,00007	1,06108
2011	33060,16	0,01274	0,02199	0,00008	1,27508
a_0		2055,80	-5383,01	-13145,11	-20131,55
a_1		-3505,09	1599208,02	552971012,35	46028,27

13 table. Four selected variables expressed by logarithms for further analysis with calculated coefficients a_0 and a_1

	ln(Foreign direct investment, Baltic States, EUR million)	ln(Population of Baltic States/Population EU (million))	ln(Average wage Baltic States/ Average wage EU (EUR))	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)	ln(Economic openness index)
2002	9,220548887	-4,148404734	-4,397514557	-9,978493325	-0,276193433
2003	9,394369177	-4,226904948	-4,261050439	-9,961463636	-0,282420547
2004	9,741315922	-4,238142142	-4,267671698	-9,846217156	-0,111533763
2005	10,00850828	-4,250998782	-4,119196343	-9,696808254	-0,01477922
2006	10,35492909	-4,262577287	-4,021770579	-9,589808044	0,051340183
2007	10,56644743	-4,273256862	-3,925163512	-9,451184915	-0,009779862
2008	10,29816731	-4,28445491	-3,760178529	-9,373982298	0,005852488
2009	9,978604936	-4,296475962	-3,778687541	-9,495076543	-0,182169942
2010	10,13425259	-4,309902035	-3,820124453	-9,504576091	0,059286032
2011	10,4060842	-4,363104827	-3,817164655	-9,384765255	0,243012585
a_0		1792,386933	16,08868415	26,86981521	10,12766677
a_1		-50,19739069	1,51321508	1,75104658	2,268018562

a_0 – y value when x = 0. This is the distance from the beginning of the coordinate system to the point where the regression line crosses the y axis. a_0 – regression line y section. a_1 - the slope of the line is called the regression coefficient. a_0 is calculating using MS EXCEL function INTERCEPT, a_1 - function SLOPE. And the values are calculated in table No. 9.

Put the values into the general form of regression equation, we obtain the following mathematical expressions and pictures No. 11,12,13,14,15,16,17,18 below:

$\hat{y}_1 = 2055{,}80 – 3505{,}09x_1$;

$\hat{y}_2 = -5383{,}01 + 1599208{,}02x_2$;

$\hat{y}_5 = -13145{,}11 + 552971012{,}35x_5$;

$\hat{y}_6 = -20131{,}55 + 46028{,}27x_6$;

Also mathematical expressions expressed by logarithms:

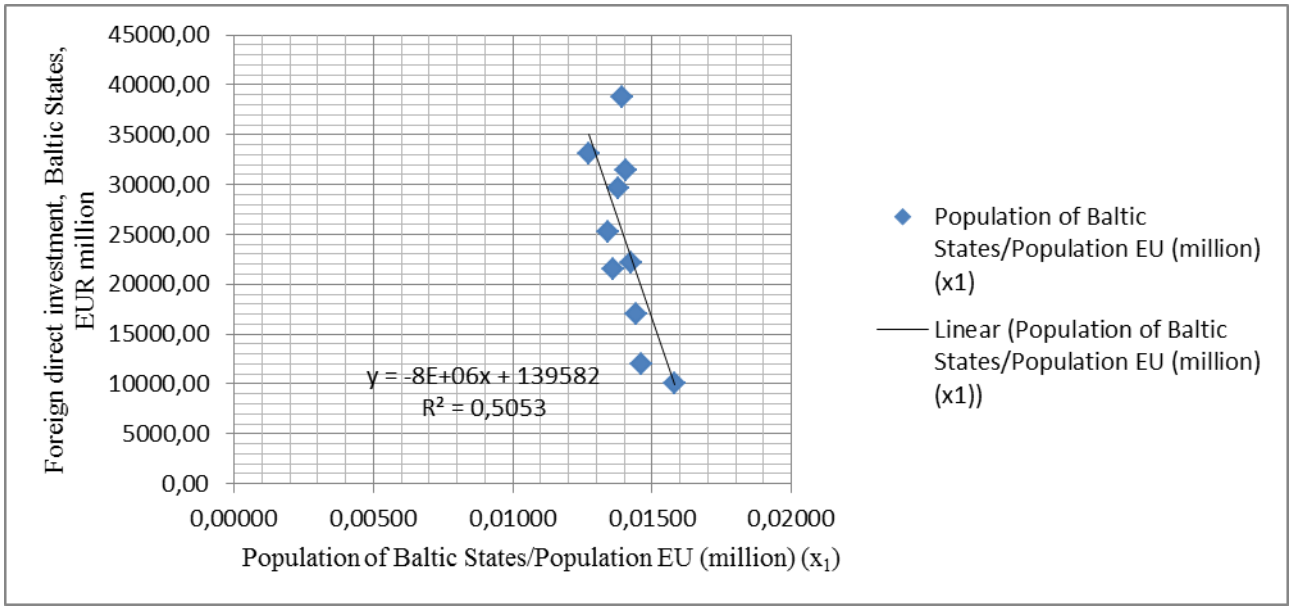
$\ln(\hat{y}_{1)} = 1972{,}39 – 50{,}20\ln(x_1)$;

$\ln(\hat{y}_{2)} = 16{,}09 + 1{,}51\ln(x_2)$;

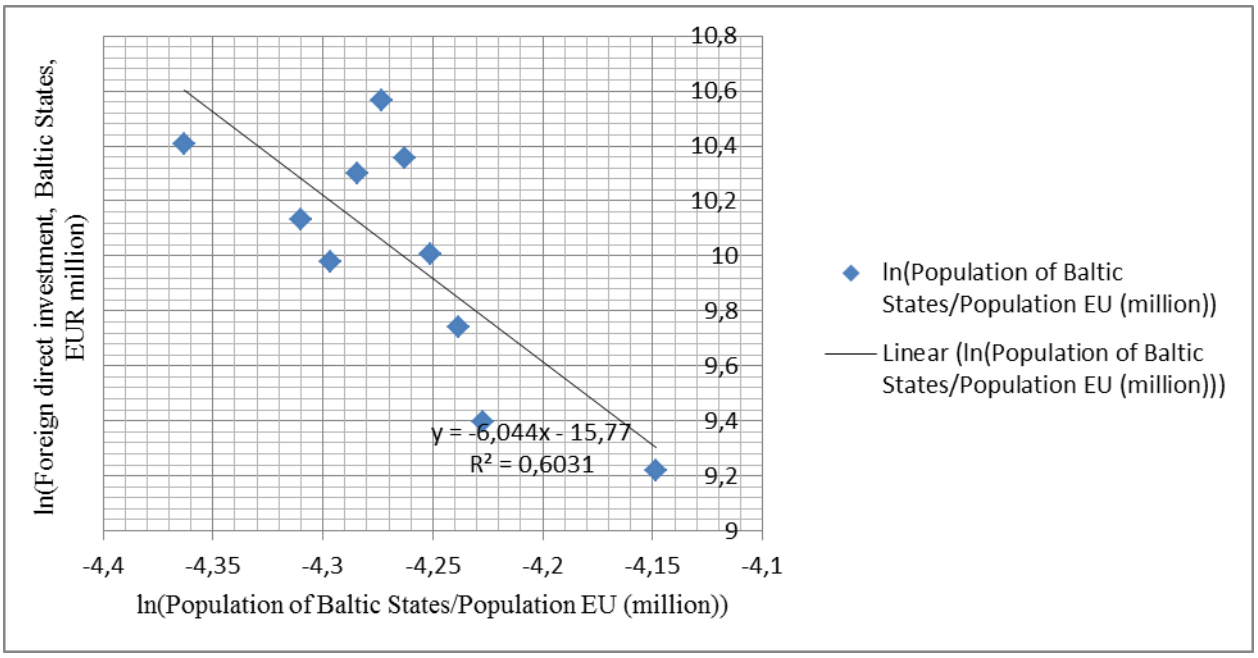
$\ln(\hat{y}_{5)} = 26{,}87 + 1{,}75\ln(x_{5)})$;

$\ln(\hat{y}_{6)} = 10{,}13 + 2{,}69\ln(x_6)$;

With the relationship between foreign direct investment and the variables x_1, x_2, x_5, x_6 and $\ln(x_1)$,$\ln(x_2)$,$\ln(x_5)$, $\ln(x_6)$ mathematical expression we can calculate what the average value of foreign direct investment where in the country is selected corresponding parameter $x_{1,\ 2,5,6,}$ $\ln(x_{1,\ 2,5,6})$ size.



11 picture. Foreign direct investment in Baltic States (mill. Eur) (y) and ratio of population (mill.) ($_{x1}$) correlation field

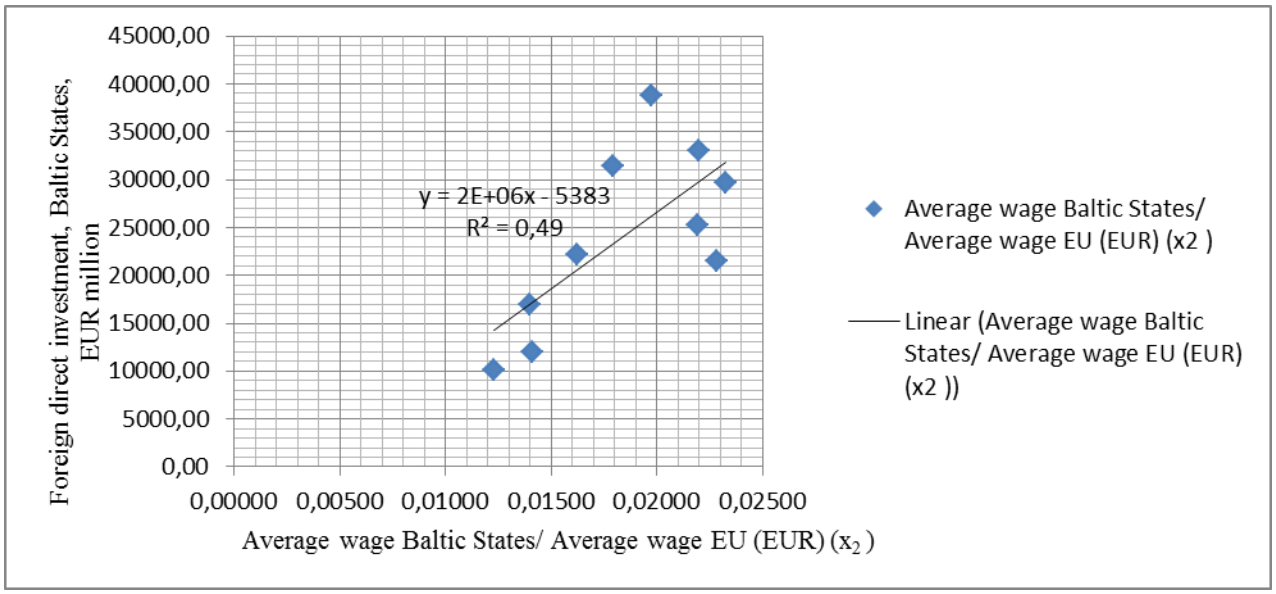


12 picture. ln(Foreign direct investment in Baltic States (mill. Eur)) (ln(y)) and ln(ratio of population (mill.)) ($\ln(x_1)$) correlation field

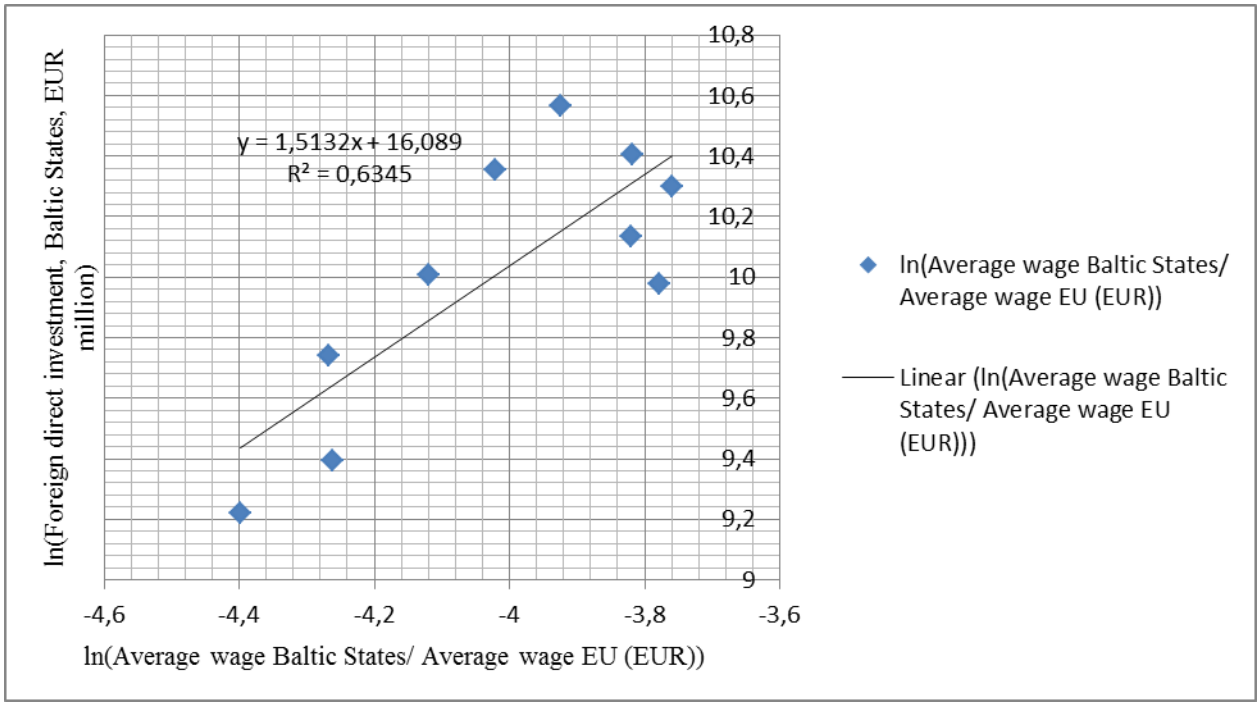
From picture No. 11, 12 we see that between ratio of population (mill.) (x_1) and ln(ratio of population (mill.)) ($\ln(x_1)$) and foreign direct investment (EUR mill.) (y) and ln(foreign direct investment (EUR mill.) (ln(y)) exists negative linear correlation (t statistic values and correlation coefficient is presented in table No. 8, 9, 10, 11. It means that if popullation ratio (x_1) or ln(popullation ratio) ($\ln(x_1)$) decreases, foreign direct investment (y) or ln(foreign direct investment) (ln(y)) increases. This expression is not very fair because logically investor wants to invest in the country with bigger market size, where also is bigger labor market, purchasing power and ect. So it could be that in the further analysis this factor will be rejected and considered as negligible.

In Picture No. 13,14 is presented a correlation field between FDI in Baltic States (y), ln(FDI in Baltic States) (ln(y)) and ratio of average wage (EUR) (x_2), ln(ratio of average wage (EUR)) ($\ln(x_2)$) and it seems that between them exists a positive linear correlation (t statistics and correlation coefficient are presented in tables No. 8, 9, 10, 11). It means that if average wages in Baltic States are increasing, the foreign direct investment in Baltic region also increases. But it is also not very fair conclusion because in all press and television nowadays is talking about a risk of increasing a minimum wage size and the impact for foreign direct investment. But this risk could be seen only from one side when an investor think about labor cost. But talking about the other side of this parameter, an investor must think about purchasing power and domestic consumption. If an average wage will increse, people in the region should spend more and the domestic consumption will be bigger and the products or services will be more popular and much more increases a

realization. But it says that this parameter also could be rejected and considered as negligible in the further analysis.



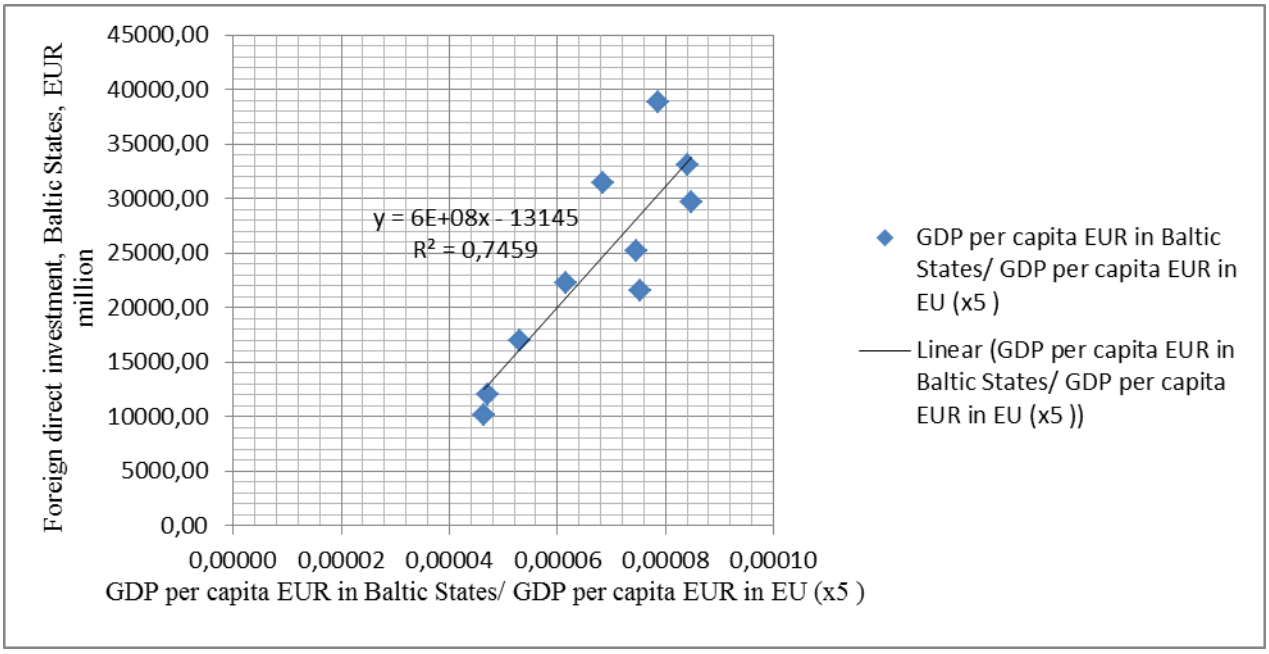
13 picture. Foreign direct investment in Baltic States (mill. Eur) (y) and the ratio of average wage (EUR) (x_2) correlation field



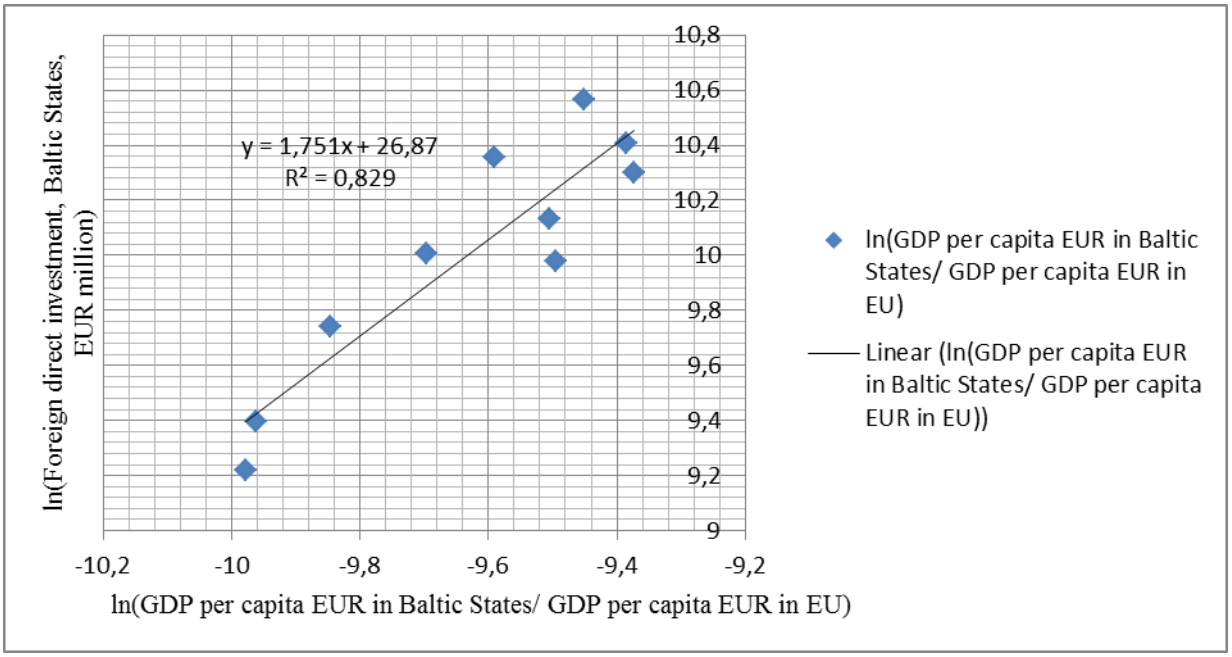
14 picture. ln(Foreign direct investment in Baltic States (mill. Eur)) (ln(y)) and ln(ratio of average wage (EUR)) (ln(x_2)) correlation field

In Picture No. 15, 16 we see that between foreign direct investment in Baltic States (mill. EUR) (y) or ln(foreign direct investment in Baltic States (mill. EUR)) (ln(y)) and the ratio of GDP per capita of Baltic States (EUR) (x_5) or ln(ratio of GDP per capita of Baltic States (EUR)) (ln(x_5)) exists a positive linear correlation (t statistics and correlation coefficient are presented in

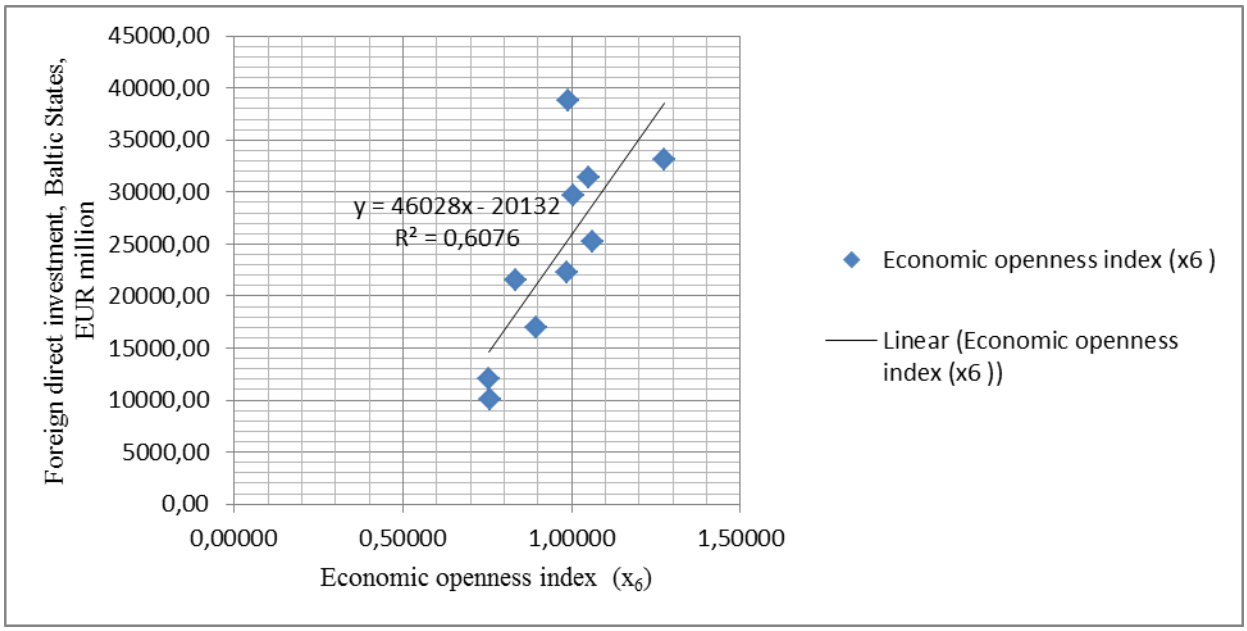
tables No. 8,9,10,11). It means that if GDP per capita (EUR) in Baltic States (x_5) increases, the foreign direct investment in Baltic States (mill. EUR) (y) also will be increasing. This is logical conclusion that investors from foreign countries evaluates a GDP per capita parameter to know what economic growth and countries economic stability are in the partner country. It is also shown in theoretical part, in different authors opinions analysis.



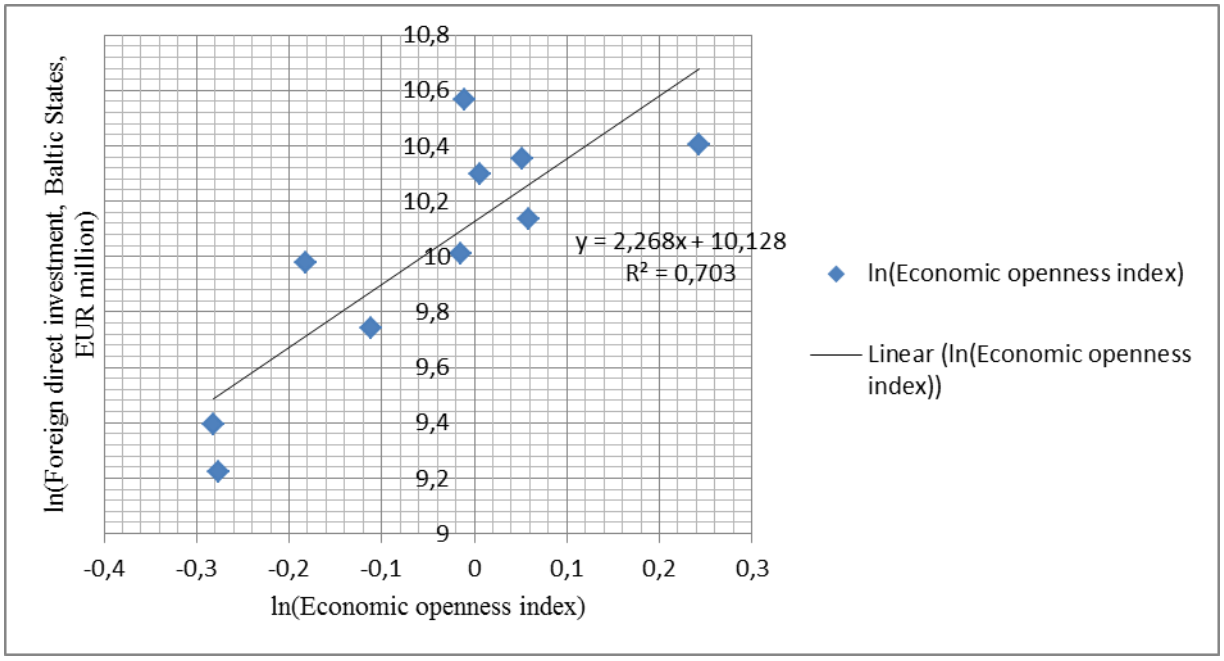
15 picture. Foreign direct investment in Baltic States (mill. Eur) (y) and the ratio of GDP per capita of Baltic States (EUR) (x_5) correlation field



16 picture. ln(Foreign direct investment in Baltic States (mill. Eur)) (ln((y)) and ln(ratio of GDP per capita of Baltic States (EUR)) (ln(x_5)) correlation field



17 picture. Foreign direct investment in Baltic States (mill. Eur) (y) and economic openness index in Baltic States (x_6) correlation field



18 picture. ln(Foreign direct investment in Baltic States (mill. Eur)) (ln(y)) and ln(economic openness index in Baltic States) (ln(x_6)) correlation field

In the Picture No. 17,18 we see that between foreign direct investment or ln(foreign direct investment) (ln(y) in Baltic States (mill. Eur) and economic openness index in Baltic States (x_6) or ln(economic openness index in Baltic States) (ln(x_6)) exists a linear positive correlation (t statistics and correlation coefficient is presented in tables No. 8, 9, 10, 11). It means that a foreign investor evaluates economic openness index in Baltic States and should it understand as if it grows up, the countries become more attractive and he will think about an investment in this region.

Curve adequacy of the available statistical data (or the real situation) assessed by comparing the regression equation $\hat{y}_x$, the scattering of the values of the average $\check{y}$ (regression variance $S_{\hat{y}}^2$) the statistical dispersion of the values y_x of the regression relation (residual variance $S^2_{Residual}$). If the variance of the regression line is significantly lower, which means that the curve is fairly well reflected in the statistics.

Thus, to assess the adequacy of the regression we calculate regression variance ($S_{\hat{y}}^2$) (formula No. 11) (m - the number of factors) and and residual variance ($S^2_{Residual}$) (formula No 12):

$$S_{\hat{y}}^2 = \frac{\Sigma(\hat{y}_i - \overline{y})^2}{m} \quad (11)$$

$$S^2_{Residual} = \frac{\Sigma(\hat{y}_i - y_i)^2}{n-2} \quad (12)$$

14 table. Results of regression variance $S_{\hat{y}}^2$ and residual regression variance $S^2_{Residual}$

	$\hat{y}_1$	$\hat{y}_2$	$\hat{y}_5$	$\hat{y}_6$
Regression variance $S^2\hat{y}$	4883682373	384440404,4	585281716	476753108,9
Residual regression variance $S^2_{residual}$	610460296,62	48055050,55	73160214,50	59594138,62

15 table. Results of regression variance $S_{\hat{y}}^2$ and residual regression variance $S^2_{Residual}$ expressed by logarithms

	$\hat{y}_1$	$\hat{y}_2$	$\hat{y}_5$	$\hat{y}_6$
Regression variance $S^2\hat{y}$	39859783,5	1,116362894	1,45860109	1,236879
Residual regression variance $S^2_{residual}$	4982470,95	0,080377632	0,03759786	0,065313

It is also necessary to calculate the variances ratio by the formula (formula no.13):

$$F = \frac{S_{\hat{y}}^2}{S_{Residual}^2} \quad (13)$$

Calculated variances ratio we compare with the critical (table) value. Statistics F distributed according to Fisher's law of distribution with degrees of freedom v_1= m and v_2 = n-2. If the variance ratio calculated in accordance with inequalities $F \geq F_{\alpha,v_1,v_2}$ this we conclude that the regression equation is adequate for the actual situation, and it can be used in planning, practical calculations.

16 table. Variance ratio (F) and ln(Variance ratio (F)) in comparison with Fisher`s distribution law $F_{critical}$ results

	ŷ1	ŷ2	ŷ3	ŷ4
(Variance ratio (F))	6,893030518	7,685325472	23,48878764	12,388485
ln(Variance ratio (F))	8,000003184	13,88897472	38,79479378	18,937695
Fisher`s distribution law Fcritical	5,317655072			

As it is seen all the values of variance ratio (F), also ratio expressed by logarithms in analysis are bigger than Fisher`s distribution law value $F_{critical}$ (it is correct by inequality $F \geq F_{critical}$). So we conclude that the regression equations $\hat{y}_1$, $\hat{y}_2$, $\hat{y}_5$, $\hat{y}_6$ are adequate for the actual situation, and it can be used in planning and continuing practical calculations.

If the equations are adequate we can use them for evaluating the changes of dependent variable y if the independent variables ($x_{1,2...4}$) will be changing.

3.3. Multiple regression analysis with 4 selected independent variables

When we analysing dependent factor (y) connection with several independent factors x_1, x_2, ..., x_n, we will use with multiple correlation regression analysis. Based on multiple regression analysis sought statistical relationship between the form factor of the dependent variable y and independent factors x_1, x_2, ..., x_m.

Since the regression model we included four independent and one dependent variables, the total of multiple linear regression model is as follows:

$$\hat{y} = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4 \quad (14)$$

Also the regression model expressed by logarithms with four independent variables and one dependent:

$$\ln(\hat{y}) = a_0 + a_1 \ln(x_1) + a_2 \ln(x_2) + a3\ln(x_3) + a_4 \ln(x_4) \quad (15)$$

Because the shape of regression equation is linear (formula No. 14, 15), in this case we use a statistical MS EXCEL function LINEST.

17 table. Statistical function LINEST results

a_4	a_3	a_2	a_1	a_0
-12455,7881	1494630770	-3838967,334	-3875564,247	60695,618
20374,99443	429903959,4	1579365,101	4510812,218	85080,98
0,914145151	3670,519713	#N/A	#N/A	#N/A
13,30945715	5	#N/A	#N/A	#N/A
717258090	67363574,83	#N/A	#N/A	#N/A

18 table. Statistical function LINEST results expressed by logarithms

a_4	a_3	a_2	a_1	a_0
0,037156386	3,444382696	-2,097875644	-1,543208862	28,166286
1,024228395	1,540545447	1,575950725	3,280820221	13,001051
0,916576331	0,171332579	#N/A	#N/A	#N/A
13,73375726	5	#N/A	#N/A	#N/A
1,612609684	0,146774263	#N/A	#N/A	#N/A

In the first row of the table are regression coefficients (from the right): a_0, a_1, a_2, a_3, a_4. The second line is a factor of the average standard deviations of each parameter. In the third row of the first column is the coefficient of determination (D), in this case, it is equal to 0,9141, which means that the regression equation explains 91,41% statistical dispersion of points, which of course refers to the reliability of the equation. In case with data expressed by logarithms determination coefficient is equal 0,9165 and it means that the regression equation explains 91,65% statistical dispersion of points, which of course also refers to the reliability of the equation. In the fourth line variance ratio F. The last row contains the sum of squares needed for calculation of the regression and residual variances: the first column of the regression sum of squares, and the second - the residual sum of squares variance. Over the residual variance of the sum of squares (that is, the fourth row, second column) is the variance of degrees of freedom. Critical statistical F value, which must be compared with the dispersion relation, we find with the MS EXCEL function FINV.

$F_{critical}$	5,192167773
F	13,30945715
F expressed by logarithms	13,73375726

A dispersion ratio F in our analysis is equal 13,30945715 and in case with data expressed by logarithms 13,73375726 and in comparison with the statistical F value gives us inequality which is correct and satisfy inequality $F \geq F_{critical}$ and it means that regression equation is adequate for the actual situation, and it can be applied for planning.

So we got these regression coefficients:

a_0 = 60695,618; a_1= -3875564,247; a_2 = -2,097875644; a_3 =3,444382696; a_4 =0,037156386;

So we got these regression coefficients in analysis with logarithms:

a_0 = 28,166286; a_1=-1,543208862; a_2 = - 3838967,332; a_3 = 1494630770; a_4 = -12455,7881;

So,it is got a linear regression equation of four factors:

$$\hat{y}_x = 60695,618 - 3875564,247x_1 - 3838967,334x_2 + 1494630770x_3 - 12455,7881x_4 \quad (16)$$

So, it is got a linear regression equation of four factors expressed by logarithms:

$$\ln(\hat{y}_x) = 60695,618 - 3875564,247\ln(x_1) - 3838967,334\ln(x_2) + 1494630770\ln(x_3) - 12455,7881\ln(x_4) \quad (17)$$

Also we can compare the results with the not linear regression equation, namely the exponential growth curve. MS EXCEL function LOGEST results presented in the table No. 19, meaning the values are the same as in table 18.

19 table. Statistical function LOGEST results

b_4	b_3	b_2	b_1	b_0
0,68926615	4,658034766	2,1643E-61	1,051E-95	194755
1,01872667	21494,7115	78,9664679	225,53551	4,253953
0,90428393	0,183521832	#N/A	#N/A	#N/A
11,8094582	5	#N/A	#N/A	#N/A
1,59098263	0,168401314	#N/A	#N/A	#N/A

The determination coefficient of the calculations by MS EXCEL function LOGEST is equal to 0,9042. But less than determination coefficient by calculating by funcion LINEST. Thus, a linear relationship reflects well the relationship between the foreign direct investment consideration and the four selected factors. Because we do not use the exponential expression of regression equation, these data would not be calculated as logarithmic expression.

Another form of non - linear dependencies can be chosen changing the algebraic expression of the linear dependence (by factors) and using the MS EXCEL statistical function LINEST. Assessing the adequacy of the equations of statistical data and comparing the obtained coefficients of determination values can be selected the best regression equation. It should be noted that in practice quite often used for planning is not necessarily the best, but the simpler interpretation of the equation (Pabedinskaitė, 2007).

So in our case, we will choose the linear regression model for interpreting the equation and the following using these coefficients and equation for creating a gravity model.

As it was wrote on the section No. 3.1. of this thesis the independent variable ratio of population (mill.) (x1) has a negative correlation with dependent variable foreign direct investment in Baltic States (mill. EUR) (y) and it`s meaning is not logical and correct on the foreign investor`s attitude. As it was written, could be two different sides of interpreting this parameter. Also the not logical result could be got because of the research object – Baltic States, in this thesis as an example I used Baltic States, may be the different result will be with other countries or regions. Also it could be related due to too small number of observations. To avoid not logical final result and to get the most efficient and correct result as gravity model equation, I am suggesting to reject this factor from the regression equation and continue analysis without it despite the significance of variable and correlation with dependent variable. The analysis will be continuing by the same procedure as in the sections of thesis No. 3.2. and 3.3.

3.4. Paired regression analysis with 3 selected independent variables

We are continuing analysis with 3 selected independent variables as the ratio of average wage (EUR) (x_2), ratio of GDP per capita (mill. EUR) (x_5) and economic openness index of Baltic States (x6) and also the same variables expressed by logarithms.

20 table. Three selected variables for further analysis with calculated coefficients a_0 and a_1

	Foreign direct investment, Baltic States, EUR million	**Average wage Baltic States/ Average wage EU (EUR) (x_2)**	**GDP per capita EUR in Baltic States/ GDP per capita EUR in EU (x5)**	**Economic openness index (x6)**
2002	10102,61	0,01231	0,00005	0,75867
2003	12020,50	0,01411	0,00005	0,75396
2004	17005,91	0,01401	0,00005	0,89446

Continuation of table No.20. Three selected variables for further analysis with calculated coefficients a_0 and a_1

2005	22214,67	0,01626	0,00006	0,98533
2006	31411,49	0,01792	0,00007	1,05268
2007	38810,55	0,01974	0,00008	0,99027
2008	29678,18	0,02328	0,00008	1,00587
2009	21560,21	0,02285	0,00008	0,83346
2010	25191,26	0,02193	0,00007	1,06108
2011	33060,16	0,02199	0,00008	1,27508
a_0		-5383,01	-13145,11	-20131,55
a_1		1599208,02	552971012,35	46028,27

21 table. Three selected variables for further analysis with calculated coefficients a_0 and a_1, expressed by logarithms

	ln(Foreign direct investment, Baltic States, EUR million)	ln(Average wage Baltic States/ Average wage EU (EUR))	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)	ln(Economic openness index)
2002	9,220548887	-4,39751456	-9,978493325	-0,276193433
2003	9,394369177	-4,26105044	-9,961463636	-0,282420547
2004	9,741315922	-4,2676717	-9,846217156	-0,111533763
2005	10,00850828	-4,11919634	-9,696808254	-0,01477922
2006	10,35492909	-4,02177058	-9,589808044	0,051340183
2007	10,56644743	-3,92516351	-9,451184915	-0,009779862
2008	10,29816731	-3,76017853	-9,373982298	0,005852488
2009	9,978604936	-3,77868754	-9,495076543	-0,182169942
2010	10,13425259	-3,82012445	-9,504576091	0,059286032
2011	10,4060842	-3,81716465	-9,384765255	0,243012585
a_0		16,08868415	26,86981521	10,12766677
a_1		1,51321508	1,75104658	2,268018562

Put the values into the general form of regression equation, we obtain the following mathematical expressions and pictures No. 13,14, 15, 16, 17, 18 above:

$\hat{y}_2 = -5383,01 + 1599208,02x_2$;

$\hat{y}_5 = -13145,11 + 552971012,35x_5$;

$\hat{y}_6 = -20131,55 + 46028,27x_6$;

Also expressed by logarithms:

$\ln(\hat{y}_2) = 16,09 + 1,51\ln(x_2)$;

$\ln(\hat{y}_5) = 26{,}87 + 1{,}75(x_5)$;

$\ln(\hat{y}_6) = 10{,}13 + 2{,}27\ln(x_6)$;

Thus, to assess the adequacy of the regression we calculate regression variance ($S^2_{\hat{y}}$) (formula No. 11) (m - the number of factors) and and residual variance ($S^2_{Residual}$) (formula No 12):

22 table. Results of regression variance $S^2_{\hat{y}}$ and residual regression variance $S^2_{Residual}$

	ŷ2	ŷ3	ŷ4
Regression variance $S^2\hat{y}$	384440404,36	585281715,99	476753108,94
Residual regression variance $S^2_{residual}$	50022657,56	24917493,61	38483569,49

23 table. Results of regression variance $S^2_{\hat{y}}$ and residual regression variance $S^2_{Residual}$, data expressed by logarithms

	$\hat{y}_2$	$\hat{y}_5$	$\hat{y}_6$
Regression variance $S^2\hat{y}$	1,116362894	1,458601094	1,2368793
Residual regression variance $S_{2residual}$	0,080377632	0,037597857	0,0653131

Calculated variances ratio we compare with the critical (table) value. Statistics F distributed according to Fisher's law of distribution with degrees of freedom v1= m and v2 = n-2. If the variance ratio calculated in accordance with inequalities F ≥ F_(∝,v_1,v_2) this we conclude that the regression equation is adequate for the actual situation, and it can be used in planning, practical calculations.

24 table. Variance ratio (F) and F expressed by logarithms in comparison with Fisher`s distribution law $F_{critical}$ results

	$\hat{y}_2$	$\hat{y}_5$	$\hat{y}_6$
Variance ratio (F)	13,89	38,79	18,94
ln(Variance ratio (F))	13,88897472	38,79479378	18,93769478
Fisher`s distribution law Fcritical	5,317655072		

So we conclude that the regression equations $\hat{y}_2$, $\hat{y}_5$, $\hat{y}_6$ and also equations expressed by logarithms are adequate for the actual situation, and it can be used in planning and continuing practical calculations.

If the equations are adequate we can use them for evaluating the changes of dependent variable y if the independent variables ($x_{2,5,6}$) will be changing.

3.5. Multiple regression analysis with 3 independent variables

Since the regression model we included three independent and one dependent variables, the total of multiple linear regression model is as follows:

$$\hat{y} = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 \quad (17)$$

Multiple regression model with three independent variables with data expressed by logarithms:

$$\ln(\hat{y}) = a_0 + a_1 \ln(x_1) + a_2 \ln(x_2) + a_3 \ln(x_3) \quad (18)$$

Because the shape of regression equation is linear (formula No. 17, 18), in this case we use a statistical MS EXCEL function LINEST.

25 table. Statistical function LINEST results

a_3	a_2	a_1	a_0
724,2641093	1317557500	-2889972,656	-12057,65155
13113,57116	368957781,6	1103976,185	8085,146978
0,901469939	3589,540832	#N/A	#N/A
18,29837376	6	#N/A	#N/A
707312844,6	77308820,3	#N/A	#N/A

In this case, determination coefficient ($D = R^2$) it is equal to 0,9015, which means that the regression equation explains 90,15% statistical dispersion of points, which of course refers to the reliability of the equation.

26 table. Statistical function LINEST results with data expressed by logarithms

a_3	a_2	a_1	a_0
0,412482454	3,019269965	-1,536920479	32,92833003
0,599022153	1,163808093	0,961054458	7,609013384
0,912884823	0,159827534	#N/A	#N/A
20,95811218	6	#N/A	#N/A
1,606114904	0,153269044	#N/A	#N/A

In this case, determination coefficient ($D = R^2$) it is equal to 0,9129, which means that the regression equation explains 91,29% statistical dispersion of points, which of also course refers to the reliability of the equation. Critical statistical F value, which must be compared with the dispersion relation, we find with the MS EXCEL function FINV and it is:

$F_{critical}$	4,757062663
F	18,29837376
F expressed by logarithms	20,95811218

A dispersion ratio F in our analysis is equal 18,29837376 and F expressed by logarithms is equal 20,95811218 in comparison with the statistical F value gives us inequality

which is correct and satisfy inequality $F \geq F_{critical}$ and it means that regression equation is adequate for the actual situation, and it can be applied for planning.

So we got these regression coefficients:

$a_0 = -12057,65155$; $a_1 = -2889972,656$; $a_2 = 1317557500$; $a_3 = 724,2641093$;

So,it is got a linear regression equation of three factors:

$$\hat{y}_x = -12057,65155 - 2889972,656x_1 + 1317557500x_2 + 724,2641093x_3 \quad (19)$$

Also we got regression coefficient, calculated using data expressed by logarithms:

$a_0 = 32,92833003$; $a_1 = -1,536920479$; $a_2 = 3,019269965$; $a_3 = 0,412482454$;

The linear regression equation of three factors, data expressed by logarithms is as following:

$$\ln(\hat{y}_x) = 32,92833003 - 1,536920479\ln(x_1) + 3,019269965\ln(x_2) + 0,412482454\ln(x_3) \quad (20)$$

As it was wrote on the section No. 3.1. of this thesis the independent variable ratio of average wages (EUR) could be rejected from the continuing analysis. As we see the coefficient a_1 in the linear regression equation is negative -2889972,656 when the correlation coefficient was caltucating between dependent variable (y) and the ratio of average wages (x_2), the result was positive, so it is not a correct result. Calculating correlation coefficient using logarithmic data we get negative value and in the linear regression equation of three parameters we get negative value (-1,535620479). Such a discrepancy may result from the not enough number of observations or of the research object – Baltic States.

Also we can check the correlation between the other parametres in equation, such as ratio of GDP per capita (mill. EUR) (x_5) because participating in the analysis, independent factors $x_{1,2,3...n}$ can be strongly correlated with each other. If between two factors there is a strong correlation is logical to combine the regression equation, with only one of them. Unfortunately the examination of economic factors is difficult to distinguish between truly independent, since most of the factors are more or less dependent (Pabedinskaitė, 2007).

Between the independent variables ratio of average wage (EUR) (x_2) and ratio of GDP per capita (EUR) (x_5) exists a strong connection, because correlation coefficient is 0,951257731. Also if we check the coefficients a_1 of ratio of average wages (EUR) and a_2 of ratio of GDP per capita (mill. EUR) and use them as exponents, we get, that (in calculation of logarithms) and use coefficients a_1 and a_2 as exponents :

$$\left(\frac{GDP\ per\ capita\ in\ Baltic\ states\ (EUR)\ 2}{GDP\ per\ capita\ in\ EU\ (EUR)}\right)^3 + \left(\frac{Average\ wages\ in\ Baltic\ States\ (EUR)}{Average\ wages\ in\ EU\ (EUR)}\right)^{-1,5} \sim$$

$$\sim \left(\frac{GDP\ per\ capita\ in\ Baltic\ states\ (EUR)}{GDP\ per\ capita\ in\ EU\ (EUR)}\right)^{1,5} \quad (21)$$

It shows that exponents of the ratio of average wages (EUR) (x_2) and ratio of GDP per capita (mill.EUR) (x_5) cancel and it is normal to use only one of the factors, I choose the bigger one ratio of GDP per capita (mill. EUR) (x_5) and reject a variable ratio of average wages (EUR) (x_2). Logically in the simple words a foreign investor think about the economic growth and if the economic in the country or region is growing up, so normally average wages also growing up. So if he evaluates one of the parameters, there is no need to evaluate the other one.

3.6. Paired regression analysis with two selected independent variables

So our analysis we continuing with only two independent factors, such as ratio of GDP per capita (mill. EUR) (x_5) and economic openness index (x_6).

27 table. Two selected variables for further analysis with calculated coefficients a_0 and a_1

	Foreign direct investment, Baltic States, EUR million	GDP per capita EUR in Baltic States/ GDP per capita EUR in EU (x5)	Economic openness index (x6)
2002	10102,61	0,00005	0,75867
2003	12020,50	0,00005	0,75396
2004	17005,91	0,00005	0,89446
2005	22214,67	0,00006	0,98533
2006	31411,49	0,00007	1,05268
2007	38810,55	0,00008	0,99027
2008	29678,18	0,00008	1,00587
2009	21560,21	0,00008	0,83346
2010	25191,26	0,00007	1,06108
2011	33060,16	0,00008	1,27508
a_0		-13145,11	-20131,55
a_1		552971012,35	46028,27

Put the values into the general form of regression equation, we obtain the following mathematical expressions and pictures No. 15, 17 above in the thesis:

$\hat{y}_5 = -13145{,}11 + 552971012{,}35x_5$;

$\hat{y}_6 = -20131{,}55 + 46028{,}27x_6$;

28 table. Two selected variables for further analysis with calculated coefficients a_0 and a_1, expressed in logarithms

	ln(Foreign direct investment, Baltic States, EUR million)	ln(GDP per capita EUR in Baltic States/ GDP per capita EUR in EU)	ln(Economic openness index)
2002	9,220548887	-9,978493325	-0,276193433
2003	9,394369177	-9,961463636	-0,282420547
2004	9,741315922	-9,846217156	-0,111533763
2005	10,00850828	-9,696808254	-0,01477922
2006	10,35492909	-9,589808044	0,051340183
2007	10,56644743	-9,451184915	-0,009779862
2008	10,29816731	-9,373982298	0,005852488
2009	9,978604936	-9,495076543	-0,182169942
2010	10,13425259	-9,504576091	0,059286032
2011	10,4060842	-9,384765255	0,243012585
a0		26,86981521	10,12766677
a1		1,75104658	2,268018562

As we use data in the logarithms form, we get these linear regression equations and pictures No. 16, 17.

$\ln(\hat{y}_5) = 26{,}86981521 + 1{,}75104658\ln(x_5)$;

$\ln(\hat{y}_6) = 10{,}12766677 + 2{,}268018562\ln(x_6)$;

Thus, to assess the adequacy of the regression we calculate regression variance ($S^2_{\hat{y}}$) (formula No. 11) (m - the number of factors) and and residual variance ($S^2_{Residual}$) (formula No 12):

29 table. Results of regression variance $S^2_{\hat{y}}$ and residual regression variance $S^2_{Residual}$

	$\hat{y}_5$	$\hat{y}_6$
Regression variance $S^2\hat{y}$	585281715,99	476753108,94
Residual regression variance $S^2_{residual}$	24917493,61	38483569,49

30 table. Results of regression variance $S^2_{\hat{y}}$ and residual regression variance $S^2_{Residual}$ expressed by logarithms

	$\hat{y}_5$	$\hat{y}_6$
Regression variance $S_{2\hat{y}}$	1,458601094	1,236879268
Residual regression variance $S^2_{residual}$	0,037597857	0,065313085

Calculated variances ratio we compare with the critical (table) value. Statistics F distributed according to Fisher's law of distribution with degrees of freedom v1= m and v2 = n-2. If the variance ratio calculated in accordance with inequalities $F \geq F_{(\propto,v\_1,v\_2}$) this we conclude that the regression equation is adequate for the actual situation, and it can be used in planning, practical calculations.

31 table. Variance ratio (F) in comparison with Fisher`s distribution law $F_{critical}$ results

	$\hat{y}5$	$\hat{y}6$
Variance ratio (F)	38,79	18,94
Variance ratio (F) expressed by logarithms	38,79479378	18,93769478
Fisher`s distribution law Fcritical	5,317655072	

As it is seen all the values of variance ratio (F) in analysis are bigger than Fisher`s distribution law value $F_{critical}$ (it is correct by inequality $F \geq F_{critical}$). So we conclude that the regression equations $\hat{y}_5, \hat{y}_6$ are adequate for the actual situation, and it can be used in planning and continuing practical calculations.

If the equations are adequate we can use them for evaluating the changes of dependent variable y if the independent variables ($x_{5,6}$) will be changing.

3.7. Multiple regression analysis with two selected independent variables

Since the regression model we included two independent and one dependent variables, the total of multiple linear regression model is as follows:

$$\hat{y} = a_0 + a_1 x_1 + a_2 x_2 \quad (22)$$

Logarithmic regression model with two independent variables and one dependent variable is as follows:

$$\ln(\hat{y}) = a_0 + a_1 \ln(x_{1)} + a_2 \ln(x_{2)} \quad (23)$$

Because the shape of regression equation is linear (formula No. 22,23), in this case we use a statistical MS EXCEL function LINEST.

32 table. Statistical function LINEST results

a_2	a_1	a_0
18246,36692	406283461,9	-20799,88327
15280,24383	165680840,8	9977,40399
0,788935472	4863,946091	#N/A
13,08260647	7	#N/A
619015863,9	165605801	#N/A

33 table. Statistical function LINEST resuls, expressed by logarithms

a_2	a_1	a_0
0,914851489	1,250755877	22,10023057
0,563937686	0,400938351	3,838339322
0,875752735	0,176715527	#N/A
24,66963422	7	#N/A
1,540785304	0,218598643	#N/A

In this case, determination coefficient ($D = R^2$) it is equal to 0,7889, which means that the regression equation explains 78,89% statistical dispersion of points, which refers the quite good reliability of the equation. In expression by logarithms determination coefficient ($D = R^2$) is equal 0,8758, it means that logaritmic regression equation explains 87,58% statistical dispersion of point, which shows a good reliability of equation. Determination coefficient in logarithmic expression is higher, that is why we use it for the final regression model.

Critical statistical F value, which must be compared with the dispersion relation, we find with the MS EXCEL function FINV and it is:

$F_{critical}$	4,737414128
F expressed by logarithms	24,66963422
F	13,08260647

A dispersion ratio F in our analysis is equal 13,08260647, ratio F expressed by logarithms is equal 24,66963422 and in comparison with the statistical F value gives us inequality which is correct and satisfy inequality $F \geq F_{critical}$ and it means that regression equation is adequate for the actual situation, and it can be applied for planning.

So we got these regression coefficients for linear regression equation,

$a_0 = -20799,88327$; $a_1 = 406283461,9$; $a_2 = 18246,36692$;

and regression coefficients for logarithmic regression equation:

$a_0 = 22,10023057$; $a_1 = 1,250755877$; $a_2 = 0,914851489$;

So,it is got a linear regression equation of three factors:

$$\hat{y}_x = 22,10023057 + 1,250755877x_5 + 0,914851489x_6; \quad (24)$$

The regression equation expressed by logarithms:

$$\ln(\hat{y}_x) = 22,10023057 + 1,250755877\ln(x_5) + 0,914851489\ln(x_6); \quad (25)$$

The linear regression equation (formula No. 24) and logarithmic regression equation (formula No. 25) now mathematically are correct and from the logical side it looks also correct. For the foreign investor is important to know and evaluate the economic growth of the country or region and the economic openess index, which shows trade volumes. Due to the determination coefficient

of logarithmic regression equation is more significant, for the forecast and calculation of an error we will use it.

To show the model`s adequacy we have to calculate an average relative error of the model each year and average.

33 table. Average relative error of the model each year and average 2002 - 2011

	Relative error of calculations for each year 2002 - 2011	**Relative error of calculations for each year 2002 - 2011 (%)**
2002	-0,166452724	-17%
2003	0,004251527	0%
2004	0,049600894	5%
2005	0,041918537	4%
2006	0,17718741	18%
2007	0,251108028	25%
2008	-0,094085271	-9%
2009	-0,08998801	-9%
2010	-0,149648335	-15%
2011	-0,203707003	-20%
Average relative error	0,062127494	**6%**

From the table No. 33 it is seen that created model is quite adequate and could be used for the following calculations and forecasting because average relative error (%) is only 6%. Each year a relative error of a model ranging from 0% error till maximum 25%.

So our main gravity model equation which will be used for forecasting FDI flows in Baltic region is as following:

$$\ln(FDI in\ Baltic\ States) = 22{,}10023057 + 1{,}250755877 \ln\left(\frac{GDP\ per\ capita\ in\ Baltic\ States}{GDP\ per\ capita\ in\ EU}\right) +$$

$$+ 0{,}914851489 \ln(Economic\ openess\ index) \quad (26)$$

3.8. Forecast using moving average method

Moving average method consists in the time series average of the last n values calculation. The average is used as a forecast for the new ordinary period. Moving average is calculated as follows:

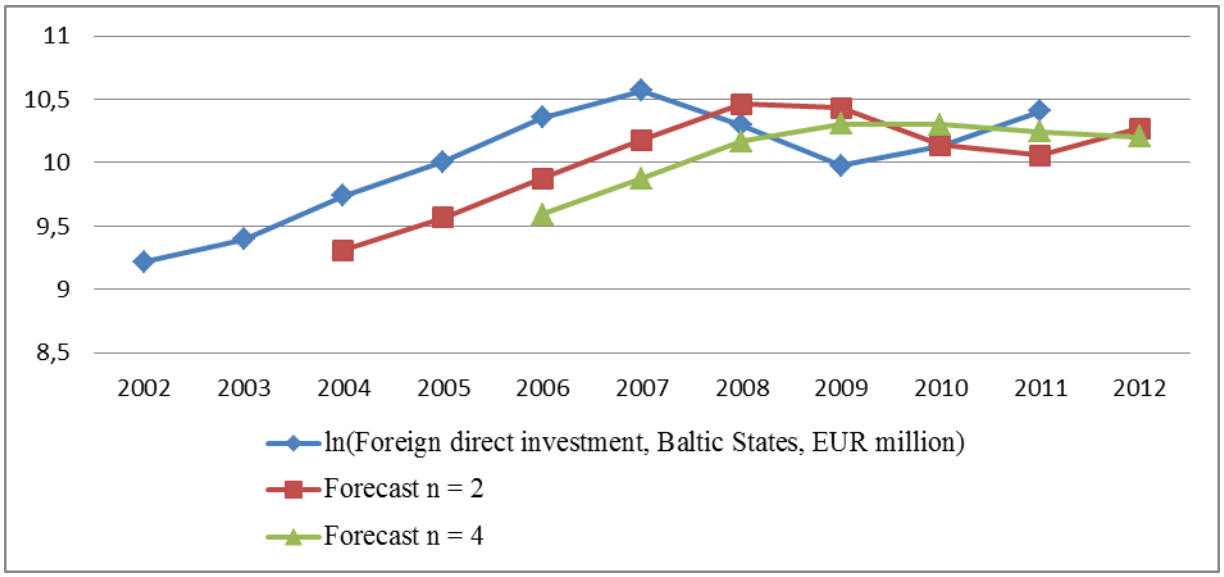
$$Moving\ average = \frac{Sum\ of\ last\ values\ (n)}{n} \quad (27)$$

Moving average method is based on to find a new time series value, it replaces the oldest value in the formula (formula No. 27) and calculated a new average. Thus, the average changes, moves, when it becomes aware of new observational values.

In the table No. 34 is presented errors when n = 2 and when n = 4, also the square errors with n = 2 and n = 4. An error shows an accurate of forecast. However, to know, that forecast is accurate, it is necessary to calculate average squared error (mean squared error) (MSE).

34 table. Summary of forecasts and errors calculation

	ln(Foreign direct investment, Baltic States, EUR million)	Forecast n = 2	Error $\varepsilon_1 = 2$	Forecast n = 4	Error $\varepsilon_2 = 4$	Square errors, when n = 2	Square errors, when n = 4
2002	9,220548887						
2003	9,394369177						
2004	9,741315922	9,31	0,43			0,19	
2005	10,00850828	9,57	0,44			0,19	
2006	10,35492909	9,87	0,48	9,59	0,76	0,23	0,58
2007	10,56644743	10,18	0,38	9,87	0,69	0,15	0,48
2008	10,29816731	10,46	-0,16	10,17	0,13	0,03	0,02
2009	9,978604936	10,43	-0,45	10,31	-0,33	0,21	0,11
2010	10,13425259	10,14	0,00	10,30	-0,17	0,00	0,03
2011	10,4060842	10,06	0,35	10,24	0,16	0,12	0,03
2012		**10,27**		**10,20**			
Sum			**1,47**		**1,25**	**2,16**	**1,57**



19 picture. Forecast using moving average method 2002 - 2012

We are calculating MSE by the formula:

$MSE = \frac{\sum a}{n}$, when a – square error (28)

MSE when n = 2 is equal **0,56**, MSE = **0,31** when n = 4.

Comparing results of MSE (n = 2) and MSE (n = 4) mean that forecast calculating by 4 values is more accurate thancalculating by 2 values and MSE is lower.

So the forecast for ln(Foreign direct investment in Baltic States) (ln(y)) for 2012 10,20, calculated by moving average method. The graphic is presented in the picture No. 18. By the forecast (n = 4) we see that trend of ln (foreign direct investment in Baltic States) is decreasing in 2012.

The same forecast is laso forecasting by created gravity model equation. Foreign direct investment in Baltic countries will decrease in 2012, 2013.

CONCLUSIONS

1. In theoretical part it is analysed 15 different authors opinions of factors influencing foreign direct investment in the countries. It was found 30 different factors inluencing foreign direct investment. Some factors could be analysed only by qualitative analysis so we chose 7 frequently mentioned factors that be analysed by quantatatively. There is great diversity in the sets of parameters chosen by different authors while describing the behaviour of FDI.

2. In theoretical part of gravity model is seen that different authors have different opinions of using gravity equations in evaluating foreign direct investment and there are no united opinion how to adapt this model for evaluating FDI. So the form for adapting this model for FDI factors which have impact depends on every author opinion.

3. It is difficult to apply any mathematical model for single small country like Lithuania, Latvia, Estonia because each single investment can change FDI figures dramatically. So we looked for larger region – Baltic States - while describing FDI behaviour.

4. FDI flows in Baltic States in all the countries are similar. The biggest FDI flows in 2002 – 2011 got Estonia, the second by the FDi flows was Lithuania and the third – Latvia. The biggest impact of financial economic crisis in 2007 – 2009 felt Latvia, in 2007 it had the largest foreign direct investment growth rate, and in 2008 had the largest decline. But the global financial crisis has had a negative impact on foreign direct investment flows in all Baltic region countries.

5. In the third part of thesis it is found that not all of the selected 7 factors, which at the first glance would be important, are significant and in the following analysis can be used only 4 of them: ratio of population (millions), ratio of average wages (EUR), GDP per capita (EUR) and economic openness index.

6. Also in the third part is found that not all of selected 4 variables are logically significant for using them in gravity equation model. Only GDP per capita (EUR) and economic openess index appeared to stay being relevant. The ratio of population was rejected as illogical. Also it appears that average wages do not influence the FDI flow from EU to Baltic States, so our results conflict with the opinion that increment of wages is dangerous for FDI flow.

7. Statistical checking proves that gravity model describes the best as compares to other models the FDI flow from EU to Baltic States in the time interval 2002 – 2011.

8. So after the multiple correlation – regression analysis we found that the most significant variables for evaluating foreign direct investment success from EU as total to the Baltic States are ratio of GDP per capita (EUR) and economic openness index and this equation could be used as gravity model equation for Baltic States.

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