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# Driving Growth and Innovation: Exploring Foreign Direct Investment in the Manufacturing Sector (The Case of Lithuania)

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## Abstract

Recent geo-economic transformations have led to new challenges for countries in their economic development. The evolving global landscape has emphasized regional competitiveness and attractiveness in terms of capital, labor force, and information. Scholars widely agree that countries receiving foreign direct investment (FDI) gain new knowledge, management skills, and advanced production techniques, leading to increased competitiveness and economic growth (Bayar, et. al., 2020). Changing conditions have also influenced investors' behavior. Globalization and digitalization have shaped international economic relations, focusing not only on resource acquisition, but also on leveraging human capital, knowledge, institutional structures, and networking for firm efficiency. This shift is reflected in changing investors' preferences: the importance of natural resources, cheap labor, and the size of the national market has decreased, with greater attention given to service- and technology intensive manufacturing markets (Sadedghi, et. al., 2020). The aim of this study is to identify the factors that determine the attraction of foreign direct investment in the Lithuanian manufacturing sector and assess their impact. To accomplish this objective, several main tasks were formulated: 1) Highlight the necessity for assessing FDI attraction in the manufacturing sector. 2) Identify the factors that influence the attraction of foreign direct investment in the manufacturing sector. 3) Provide empirical evidence of the impact of these factors. The article is structured as follows: Firstly, a review of the scientific literature was conducted to address the research problem, which is the lack of literature on foreign direct investment at the sectoral level. Based on this literature analysis, the factors influencing investment attractiveness at the regional and sectoral levels were identified and compared. Additionally, the factors that determine the attractiveness of the manufacturing sector for investment were also identified. In the second part of the study, a research methodology was developed to assess the impact of these factors on foreign direct investment in the Lithuanian manufacturing sector. The results of the third part of the study indicated that although the Granger causality test did not reveal any causal relationship between FDI in Lithuanian manufacturing and variables such as exports, imports, gross domestic product, the number of educated individuals, government gross debt, government R&D expenditure in manufacturing, the number of FDI enterprises in manufacturing, the wage index, and labor productivity, the correlation analysis demonstrated that exports, gross domestic product, and labor productivity have a significant influence on attracting FDI to the industrial sector. These macroeconomic indicators were statistically significant both in the short term and in the long run. Empirical findings indicated that labor productivity has the greatest impact on the attractiveness of foreign direct investment in the Lithuanian manufacturing sector, both in the short and long term. To maintain the viability and promote the development of the manufacturing industry, Lithuania should focus on the factors that affect labor productivity in this sector.

**KEYWORDS:** investment attractiveness, foreign direct investment, manufacturing sector, sectoral determinants of investment.



The Fourth Industrial Revolution, new decarbonization requirements, and economic shocks such as the 2008 financial crisis, Brexit, the coronavirus pandemic, or the war in Ukraine have altered countries' competitive attitudes and presented new challenges for economic development (Bruneckiene, *et. al.*, 2023). According to the authors, the smart approach has recently been adopted in the economic development strategies of several countries, with the aim of enhancing the competitiveness of European countries and regions. Bruneckiene, *et. al.* (2023) argue that this strategy focuses on priority areas of specialization, leveraging existing strengths and assets as the foundation for fostering innovation. Digitalization, skills such as entrepreneurship, knowledge and innovation, managerial discretion, clusters, and networking contribute to a large extent to competitiveness. Scholars agree that foreign investment is a driver of technological development and innovation and that a country's attractiveness for investment can also be related to its resilience to economic shocks and geopolitical uncertainties. There is a large body of scientific literature describing the benefits of foreign direct investment (FDI) on a country's economy, productivity, and other important indicators (Svedin & Stage, 2016; Baranwal, 2019; Stundziene & Saboniene, 2019). While there is abundant literature on the factors influencing foreign capital inflow, only a few studies have examined sector-specific determinants of foreign direct investment (Padhi, 2022; Abdul Hadi, *et.al.*, 2018; Lee, *et. al.*, 2016; Polat, 2015). There is a lack of sectoral analysis that would help identify the factors that can attract foreign direct investment into the manufacturing sector. Conducting research on the factors influencing the attraction of foreign direct investment and the importance of the manufacturing industry to the country reveals a problem: there is an insufficient amount of research on investment attraction in the manufacturing sector. It can be argued that the attractiveness of foreign direct investment in this sector requires a holistic approach. Investment attractiveness depends on the chosen sector, the competitive environment, and current trends in the economy. The evolving manufacturing sector and investor expectations require the search for ways to maintain and enhance the attractiveness of the country in the global market.

Lithuania is seen as a bridge between East and West, allowing easy access to new markets. The country is one of the world's leading countries in terms of attractiveness to manufacturing companies. Businesses see Lithuania as an open and dynamic market. Lithuania is considered an industrialized country that is successfully integrated into the value chains of the European Union. Industry contributes up to 20% of Lithuania's GDP and industrial goods account for more than 80% of Lithuania's exports of goods and services. The manufacturing sector is one of the strategic areas of Lithuania and its situation is constantly changing. Investments in the manufacturing sector are particularly important as they bring innovation, new technologies, and knowledge. Foreign capital, know-how, and knowledge enable the sector to develop further, ensure progress, and can contribute to the sector's vitality.

After the pandemic, Lithuania's foreign direct investment (FDI) curve, while not reaching its pre-pandemic level, has started to rise again. The optimism of investors for 2022 has been considerably shattered by the outbreak of war in Ukraine. Geopolitical developments have led to a drop from 8 out of 10 investors planning to choose Europe for their investments to 4 out of 10 (Ernst & Young, 2022). According to the study, Lithuania ranked 21st on the map of foreign direct investment, which is 2 positions lower than in 2020. In terms of jobs created by investment per 1 million inhabitants, Lithuania ranked 6th among European countries. Lithuania leads the way in financial technology year after year, both in terms of the volume of investment and the number of investment companies. However, in other sectors (including manufacturing), investment flows are lower. There is a trend that while the total volume of FDI is increasing, the number of investing enterprises in the manufacturing sector is significantly decreasing. In addition, the number

of new projects and new jobs created in this sector is decreasing. This may be a sign that the Lithuanian market is not very attractive for this sector and that it is therefore crucial to improve the Lithuanian investment climate.

**Relevance.** Lithuania has been very successful in attracting more and more foreign direct investment into the financial technology sector in recent years, making it one of the country's priority development areas. However, attracting investment in other sectors is also important if the country is to continue its successful economic growth, job creation, and development in various areas. The manufacturing sector is important as it has been identified as one of the most attractive industrial sectors that can contribute to the stable growth of the national economy. Research confirms that foreign investment is a driver of technological development and innovation, and attracting it to the manufacturing sector under analysis would ensure the sector's viability and sustainable development.

**Research problem.** Scholars have extensively analyzed FDI from a regional perspective, but there is a lack of sectoral analysis. There is a lack of research that analyzes the determinants of the attraction of FDI in the manufacturing sector, which is why it is important to carry out a comprehensive assessment of this sector.

**Research object** - foreign direct investment in the Lithuanian manufacturing sector.

The purpose of the paper is to identify the factors influencing the attraction of foreign direct investment to the Lithuanian manufacturing sector and to assess their impact.

To achieve the purpose of this paper, three tasks have been formulated:

- 1 to disclose the need for the valuation of FDI attraction to the manufacturing sector;
- 2 to distinguish the factors that determine the attraction of foreign direct investment to the manufacturing sector;
- 3 to provide empirical evidence of their impact.

**Research methods:** systematization and logical analysis of scientific literature, analysis of official statistical data, causality test, correlation and regression analysis, and econometric evaluation.

**Key results:** empirical results show that investment is significantly influenced by a country's gross domestic product, export volumes, and the productivity of manufacturing workers. The econometric estimation showed that in the long- and short-term, labor productivity has the greatest impact on the attractiveness of foreign direct investment in the Lithuanian manufacturing sector. To maintain the viability of the manufacturing industry and ensure its development, Lithuania must focus on the factors that affect labor productivity in this sector.

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## Literature review

Accelerating economic globalization forces countries to compete with each other for corporate investment capital. This competition is best described by analyzing foreign direct investment statistics (Reurink & Garcia-Bernardo, 2021). The targeted and timely use and absorption of the region's investments promotes job creation and growth and ensures the country's social and economic development. Over the past decades, the analysis of multinational enterprises and foreign direct investment flows has been widely studied by business, economics, and academics. Reviews range from macro-level studies on outward FDI to micro-level studies that analyze the sample, motives, characteristics and performance of FDI (Paul & Feliciano-Cestero, 2021). It has been observed that there is a significant body of research that examines overall trends and factors related to foreign direct investment, including its benefits for the host country's economy and the conditions of investment attractiveness. However, there is a dearth of studies that specifi-

cally address the sectoral challenges associated with foreign direct investment. Limited research exists that enables us to assess the significance of factors that exert a substantial influence on foreign direct investment in the manufacturing industry.

Foreign direct investment is considered one of the key elements of globalization. It can be described as a set of managerial, entrepreneurial and technological skills that enable investors to produce goods and services in another country (Sadeghi, *et. al.*, 2020). These investments can narrow the gap between developing and developed countries by providing capital for outstanding domestic investment projects. According to the authors, attracting FDI is a key issue for many developing countries, and experts and policy makers are continuously examining the key factors that determine the level of attractiveness of FDI. FDI has also been described as an important vehicle for technology transfer, contributing relatively more to growth than domestic investment. Bayar, *et. al.* (2020) view FDI as secular progress through the transfer of know-how and the dissemination of technology, thereby also enhancing a country's competitiveness.

In the scientific literature, when analyzing investment attraction to a certain country or industry, the concept of investment attractiveness is used. According to Karlova, *et. al.* (2021) - the investment climate is a generalized set of socio-economic, organizational, socio-cultural and other factors that influence the successful development of regions. Similarly, investment climate is described by Garba (2019), who states that the investment climate can be understood as a set of local factors that shape the incentives and opportunities for companies to invest, grow, and create jobs, and it is the result of various government institutions in the country. Investment attractiveness aims to create a solid foundation that will determine the priorities and the most favorable ways to help the business management structure achieve the set goals while balancing social, economic and environmental needs. Investment attractiveness is inseparable from a country's competitive advantage over other countries. This is a necessary condition for competitiveness. For the country to become competitive, it must become attractive for investments. When planning a business strategy, in order to attract as many foreign investments as possible, the state must evaluate the factors that are its advantage in relation to other countries. As stated by Zykiene, *et. al.* (2021) the attractiveness of an area for business development is the ability to act intelligently and efficiently through its environment, attracting and creating business in such a way that the region can become competitive against other areas.

Authors studying investment attractiveness emphasize its importance in attracting foreign direct investment to the country. The attractiveness for investments is formed under the influence of many indicators. To define and properly implement strategies and policy measures to improve competitiveness and the economy and its growth, it is important to reveal the determinants of foreign direct investment (Bayar, *et. al.*, 2020). Scholars highlight the importance of political factors, natural resources and raw materials, key market indicators, and infrastructure. To evaluate the factors that determine foreign direct investment, it is important to consider the aforementioned factors that determine the country's investment attractiveness.

Many scientific sources emphasize that the attraction of direct foreign investments is determined by the country's valuable resources and opportunities. However, Sadeghi, *et. al.* (2020) note that, conventionally, a country's ability to attract FDI is assessed by emphasizing demand factors, such as: market size, country's GDP, and non-market factors, such as resource abundance, etc. However, the changing market forces us to take into account other factors that determine economic capacity, such as human capital, knowledge, and institutions.

Wang, *et. al.* (2022) claim that the attraction of investments is determined by economic factors (labor costs, infrastructure or exchange rate), other researchers also study the influence of in-

stitutions on the attractiveness of foreign direct investments. Many authors in their publications highlight the factors that make the investment climate attractive. Garba (2019) assesses this phenomenon by distinguishing costs, risks and competitive forces in the economy. The investment climate can be characterized by factors such as climate, natural resources, distance from important objects, as well as the state of the country's infrastructure, economic and social policy, and the stability of various institutions and authorities (Garba, 2019). However, recent trends show that due to global climate change problems, many countries are implementing environmental regulatory policies and scholars are increasingly focusing on the impact of environmental regulation on foreign direct investment (Wang, *et. al.*, 2022).

Bruneckiene, *et. al.* (2019) revealed a new approach to the assessment of investment attractiveness, including "soft" and smart criteria such as: creativity, sustainability, social responsibility, digitization, curiosity and new knowledge competencies. The rapidly changing environment leads to increasing competition among companies, and in order to remain competitive, companies are looking for smart ways to compete nationally and internationally in the long term. Direct foreign investments increase the competitiveness of the company and the well-being of the entire country (Bruneckiene, *et. al.*, 2019). Zykiene and others (2021) distinguished in their research paper tangible macro-environmental factors and "soft" capabilities that determine a country's attractiveness for investment. Also, the authors note that the countries themselves, by increasing their investment attractiveness, significantly contribute to the increase in the competition of companies and the attraction of knowledge, technology, and innovation. The formation of investment attractiveness can be justified by the positive impact of foreign direct investment.

Researchers (Haraguchi, *et. al.*, 2017; Naudé & Szirmai, 2012; Behun, *et. al.*, 2018) concur that the manufacturing sector plays a significant role in national economies and contributes to sustainable economic growth. Manufacturing holds a crucial position in the economies of developing countries, and according to Haraguchi, *et. al.* (2017), countries have increased opportunities to participate in manufacturing activities as they progress along the path of modern industrialization. Naudé & Szirmai (2012) argue that the global market for manufacturing firms faces numerous challenges, such as the impact of China's rise, changes in geopolitics affecting global supply chains, and the demand for more sustainable manufacturing solutions due to climate change policies. The authors also emphasize the need to adapt industrial policies to recent developments that involve learning, experimentation, and research. Scholars unanimously agree that entrepreneurial efforts, innovation, and knowledge play a pivotal role in the industrial sector. Consequently, policy solutions should prioritize the creation of a conducive learning environment that promotes the development and enhancement of new and advanced skills. Research in the manufacturing sector underscores the importance of multinational enterprises, as these organizations facilitate the transfer of knowledge, technology, and innovation.

Scientific works on investments in the production sector mainly focus on factors related to indicators such as labor productivity (Stundziene & Saboniene, 2019; Stundžiene & Baliute, 2022; Abdul Hadi, *et.al.*, 2018), trade openness (Polat, 2015; Paul & Jadhav, 2019; Padhi, 2022) and employee qualifications (Ye, *et. al.*, 2019; Baranwal, 2019; Kishor, *et. al.*, 2020). Baranwal (2019), who studied the Indian manufacturing industry, found that the labor market has a significant impact on the inflow of foreign direct investment into the country. In the literature on the labor market, attention is mainly paid to the demand for direct foreign investments, and the problem of wages is solved. However, the supply of foreign direct investment can enrich the skilled labor force of the host country by providing various training or on-the-job learning. The author comes to the conclusion that employees who want to work for companies that are established with the

support of foreign capital must be sufficiently qualified, so it can be said that foreign companies choose to invest only in those markets where they can get enough qualified employees.

Stundziene and Baliute (2022) found that in the European market, wage growth increases labor productivity, but productivity does not affect wage increases. The authors also distinguish investments in material assets, which include investments in equipment, vehicles, and inventory, claiming that in Lithuania this type of resource increases work productivity. However, in less productive countries, a negative relationship is recorded between investment in material assets and labor productivity. This phenomenon is explained by the fact that investment funds are used inefficiently. Stundziene and Baliute (2022) also concluded that changes in apparent labor productivity led to changes in investments in tangible assets, but not the other way around. The authors claim that investments in material assets depend on the number of people working in manufacturing. It can be said that labor productivity and efficiency make the region more competitive for investors. Labor productivity can be directly related to economic growth, which is also classified as one of the factors that can make the market more attractive to foreign investment.

Many theoretical and empirical studies on productivity focus on labor productivity, which is the result of intangible investments in human resources, knowledge and staff training, which increase the skills and motivation of workers to be more productive.

Ye, *et al.* (2019) study results revealed that while high labor costs are generally believed to discourage foreign direct investment, capital-intensive foreign firms and high-performance foreign firms in the case of China were more concentrated in areas with higher labor costs. The aspiration of foreign companies to achieve the highest possible efficiency of work. It was established that investing companies generally have a higher demand for highly qualified and educated employees, so they are ready to pay higher wages.

Paul and Jadhav (2019) note that different types of FDI are determined by different factors. For these reasons, they distinguished the factors for different sectors of the country. To ensure the development of the manufacturing industry, they emphasized that government efficiency, regulatory quality, exchange rate, GDP, market size, labor costs, trade openness, and R&D-friendly foreign direct investment policies are important factors for FDI. In addition, the authors, Paul and Jadhav (2019), distinguished the differences between developed and developing countries. They argue that for developed countries, market size, trade openness, and freedom index are among the key determinants of FDI. Developing countries that want to attract more FDI in manufacturing need to consider gross fixed capital formation, trade openness and efficiency variables.

Summarizing the analyzed works of scientists who study and distinguish factors that can influence the flow of foreign direct investments into the manufacturing sector of the country, it can be concluded that it is important to study the dynamics and importance of these indicators. Most authors note the importance of elements related to labor force indicators. Such different indicators as labor productivity, labor market flexibility, labor costs, and qualifications are distinguished. Equally important are economic factors such as market size, country's GDP indicators, interest rates, economic stability, and company performance. Due to changing conditions and trends, direct foreign investments in the production sector can also be affected by political and institutional factors, the number of clusters, the indicator of the country's investment in R&D activities, which is considered extremely important. The factors identified by the researchers are presented in [Table 1](#).

**Table 1**

Factors determining foreign direct investment in the manufacturing sector

Factors	Authors
Qualified labor force	Ye, <i>et. al.</i> , 2019; Baranwal, 2019; Kishor, <i>et. al.</i> , 2020
Productivity	Stundziene & Saboniene, 2019; Stundziene & Baliute, 2022; Abdul Hadi, <i>et.al.</i> , 2018
Market size	Polat, 2015; Paul & Jadhav, 2019
Political stability	Polat, 2015; Liu, 2012
Economic stability	Polat, 2015
Flexibility of the labor market	Polat, 2015
Labor costs	Polat, 2015; Paul & Jadhav, 2019; Sing, 2019; Demirbarg ir kt., 2008
Clusters	Polat, 2015
Trade openness: export, import	Polat 2015; Paul & Jadhav, 2019; Mora & Singh, 2013; Padhi 2022
Institutions	Polat 2015; Paul & Jadhav, 2019; Liu 2012
GDP	Paul & Jadhav, 2019; Mora & Singh, 2013; Abdul Hadi, <i>et.al.</i> , 2018
Country interest rate	Abdul Hadi, <i>et.al.</i> , 2018
Investment to research and experimental development (R&D)	Abdul Hadi, <i>et.al.</i> , 2018; Liu 2012; Kishor, <i>et. al.</i> , 2020
Results of companies operating in the market	Lee, <i>et. al.</i> , 2016

Source: Authors

The factors identified by researchers can be grouped into four different groups of indicators, which reveal the reasons investors can make a decision on where to invest. This grouping confirms the fact that the study of the determining factors of foreign direct investment in the manufacturing sector requires a holistic approach, since foreign entrepreneurs make the decision to expand their activities by taking into account and evaluating not one, but a whole group of factors. Groups of indicators can be divided into:

- » Labor market indicators: qualified workforce, labor productivity, productivity, labor market flexibility, labor costs;
- » Indicators of companies operating in the market: clusters, results of companies operating in the market;
- » Economic indicators of the country: market size, economic stability, openness to trade, import and export indicators, indicators of the country's GDP, the country's interest rate, the country's investments in R&D;
- » Political factors: regulation, political stability.

The development of the manufacturing sector and foreign investments in this sector are an important object of research by scientists, since the manufacturing industry makes a significant contribution to the country's economy. A large part of scientific works describes the development strategies, the benefits of foreign capital for the country's manufacturing industry, and the importance of the main indicators of the economy. It has been noticed that there is a large amount of work that studies the general trends and factors of direct foreign investments, their benefits for the country's economy, and conditions of investment attractiveness. However, in the course of scientific analysis, there is a lack of research that would explain the sectoral problems of direct foreign investment. There is a small amount of work that would allow us to assess the importance of factors that have a significant impact on direct foreign investment in the manufacturing industry. The literature analyzed during the empirical study allowed us to identify the following factors. Based on the information analyzed, it can be concluded that these factors can be applied in assessing the factors that determine the attractiveness of the Lithuanian manufacturing sector for foreign investments.

Empirical research was conducted to look for factors that, according to the researchers, have a direct impact on attracting foreign investment to Lithuanian manufacturing. The analysis of the literature also revealed that the factors identified by the authors of the scientific literature can be grouped into several essential groups according to their nature. Therefore, when examining the impact of factors on FDI in the Lithuanian manufacturing sector, it can be argued that a comprehensive approach is needed to assess these inflows. The aim of this study is to examine the impact of factors selected from the literature on FDI in the Lithuanian manufacturing sector and to assess the possible expansion or contraction of the sector in light of changes in these indicators. The selected data are interpreted and applied to the factors selected from the scientific literature analysis (see [Table 2](#)):

Dependent variable	Units of measurement
End-of-period foreign direct investment in manufacturing	mIn. EUR
Independent variables	Units of measurement
Export	ths. EUR
Import	ths. EUR
GDP	mIn. EUR
Population with tertiary, post-secondary, secondary education with professional qualifications	ths.
General government debt	mIn. EUR
Public funding for research and experimental development (R&D) in manufacturing and technology	mIn. EUR
Direct investment enterprises in the manufacturing sector	unit
Wage index (monthly) vs. previous period	p.c.
Labor productivity, value added per person employed, at current prices in manufacturing	ths. EUR per person employed

Source: Authors

## Data and Methodology

**Table 2**

Factors and Units of Measurement in an Econometric Study



- » Openness to trade, import, and export performance in terms of exports and imports in thousands of euros;
- » Country GDP figures in terms of GDP at current prices in million euros;
- » Skilled labor force, expressed in terms of data that provide information on the population with tertiary, post-secondary, secondary, and vocational qualifications;
- » Economic stability is expressed in terms of the general government gross debt;
- » National investment in R&D is defined as public funding for research and experimental development (R&D) in production and technology;
- » Market size and performance of firms operating in the market are proxied by the number of direct investments in manufacturing by firms at the end of the period;
- » Labor costs are expressed as a wage index;
- » Labor productivity and productivity are given as labor productivity in terms of value added per person employed at current prices in manufacturing.

The empirical study included the following steps:

- 1 Assessment of the statistical characteristics of the sampled data.
- 2 Assessment of causality using the Granger test.
- 3 Correlation analysis to determine linear relationships.
- 4 Development of econometric models (ECM and PTR) to assess the impact in the short and long term.
- 5 Estimation of model parameters and residual errors.
- 6 Estimation of the effect of indicators on the independent variable.

The annual data evaluated are eighteen observations: from 2004 to 2021. Analysis of the observations shows that the data follow a normal distribution (see [Table 3](#)). Stationarity analysis of time series shows that exports, imports, gross domestic product, number of people with tertiary

**Table 3**

Statistical characteristics of the variables analyzed

	Minimum value	Maximum value	Standard deviation	Jarque – Bera Criteria	Stationarity
FDI in Manufacturing	2060,41	3938,66	573,04	0,6140	I(1)
Export	7477745,1	34474875,9	7848342	0,629	I(1)
Import	9958192,30	37690668,4	6101192	0,820	I(1)
GDP	18219,7	56179,1	10332,52	0,751	I(1)
High-education population	1377,4	1613,5	75,1708	0,456	I(1)
General government debt	5,108	19,107	3,7901	0,537	I(1)
Public funding for R&D	3404,5	24535,5	6483,814	0,732	I(2)
Direct investment enterprises	13,4	39,5	36,392	0,464	I(1)
Wage Index	95,6	120,5	6,63	0,986	I(1)
Labor productivity	411	522	7,945	0,602	I(1)

Source: Authors

education, government gross debt, direct investment by manufacturing enterprises, wage index and labor productivity are first-order integrated processes without intercept and trend. Public funding for research and experimental development is a second-order integrated process.

During the period analyzed, there was a high degree of volatility in the indicators, which may have been caused by economic shocks, f. e. financial crisis, Covid-19 pandemic. FDI in manufacturing has been volatile during the period under analysis, with a slowdown in 2008-2013 and a peak in 2021. Lithuania's international trade was hit hardest by the 2008 crisis and the shock of the Covid-19 pandemic. However, indicators from recent years show that the main indicators reflecting the country's trade situation with other countries are on the rise. A similar trend can be seen in the analysis of gross domestic product and government debt. In the period under analysis, the value added per capita in manufacturing increased threefold from 13,4 to 39,5 thousand euros per person employed. There is an upward trend in the number of educated residents during the period under analysis. The upward trend is uneven, as there is a decrease in the number of educated inhabitants in 2011, 2016 and 2021. Public funding for research and experimental development in the manufacturing and technology sector was at its lowest in 2010, but has been increasing since 2020.

To assess the lagged effect on the dependent variable (FDI), a Granger causality test was performed. As this test can only be performed with stationary and first-order integrated processes, public funding for research and experimental development was not included in it. The table below presents the data used to test the hypothesis whether the independent variables have an impact on the dependent variable - foreign direct investment in the manufacturing industry in Lithuania. The hypothesis is tested up to a five-year lag: respectively, whether one indicator influences another, after one, two, three, four and five years.

H:	l = 1	l = 2	l = 3	l = 4	l = 5
$\Delta$ (Export) $\rightarrow \Delta$ (FDI)	0,711	0,8635	0,8346	0,5880	0,8417
$\Delta$ (Import) $\rightarrow \Delta$ (FDI)	0,9892	0,9949	0,5635	0,1936	0,7326
$\Delta$ (GDP) $\rightarrow \Delta$ (FDI)	0,7201	0,9831	0,4755	0,4485	0,7169
$\Delta$ (Education) $\rightarrow \Delta$ (FDI)	0,0554	0,1724	0,4171	0,0798	0,0637
$\Delta$ (Debt) $\rightarrow \Delta$ (FDI)	0,1889	0,3529	0,3923	0,4900	0,0419
$\Delta$ (Number of enterprises) $\rightarrow \Delta$ (FDI)	0,7689	0,9609	0,7637	-	-
$\Delta$ (Wage index) $\rightarrow \Delta$ (FDI)	0,5173	0,7030	0,8220	0,5020	0,8411
$\Delta$ (Productivity) $\rightarrow \Delta$ (FDI)	0,5721	0,8832	0,8915	0,8612	0,7609

Source: Authors

The Granger causality test did not reveal any significant relationship and the results of this test demonstrate that the variables have no impact on FDI in manufacturing in Lithuania in the long term. However, in practice and in the academic literature, different trends are observed: scholars (Abdul Hadi, *et.al.*, 2018; Kishor, *et. al.*, 2020) emphasize the importance of public investment in R&D, while Lee, *et. al.* (2016) emphasizes the performance of firms operating in the market.

## Results

**Table 4**

Results of the Granger causality test

A correlation analysis was carried out to determine the short-term relationship between the indicators studied; see Table 5). A significant relationship was found between FDI in manufacturing and exports, imports, GDP, and labor productivity. The existing relationship is strong, with correlation coefficients for all indicators ranging between 0,68 and 0,79. An inverse relationship is found between FDI and the number of investing enterprises, as a negative correlation coefficient is observed. Data show that there is a strong correlation between FDI and exports and imports (0,797 and 0,793) and that the relationship is significant. This confirms the assertion of scholars (Polat, 2015; Paul & Jadhav, 2019; Mora & Singh, 2013; Padhi, 2022) that openness to trade makes the manufacturing sector attractive to foreign capital. A positive correlation and significant relationship is also found between FDI in the Lithuanian manufacturing sector and gross domestic product and labor productivity. These results confirm that the analyzed work carried out

**Table 5**

The correlation matrix

	$\Delta$ (FDI)	$\Delta$ (Export)	$\Delta$ (Import)	$\Delta$ (GDP)	$\Delta\Delta$ (Education)	$\Delta$ (Debt)	$\Delta$ (Public funding for R&D, 2)	$\Delta$ (Number of enterprises)	$\Delta$ (Wage index)	$\Delta$ (Productivity)
$\Delta$ (FDI)	1	-	-	-	-	-	-	-	-	-
$\Delta$ (Export)	0,797 0,001	1	-	-	-	-	-	-	-	-
$\Delta$ (Import)	0,783 0,002	0,95 0,00	1	-	-	-	-	-	-	-
$\Delta$ (GDP)	0,680 0,015	0,54 0,005	0,58 0,002	1	-	-	-	-	-	-
$\Delta$ (Education)	-0,49 0,098	-0,54 0,065	-0,52 0,808	-0,66 0,017	1	-	-	-	-	-
$\Delta$ (Debt)	0,107 0,740	-0,08 0,758	-0,02 0,521	0,423 0,171	0,484 0,881	1	-	-	-	-
$\Delta\Delta$ (Public funding for R&D)	0,189 0,555	0,169 0,598	0,162 0,618	0,423 0,171	-0,37 0,236	0,277 0,382	1	-	-	-
$\Delta$ (Number of enterprises)	-0,69 0,012	-0,67 0,016	-0,69 0,018	-0,53 0,07	0,058 0,855	-0,04 0,899	-0,01 0,605	1	-	-
$\Delta$ (Wage index)	-0,03 0,911	0,194 0,54	0,158 0,621	-0,04 0,89	-0,28 0,344	-0,12 0,705	0,216 0,500	0,098 0,760	1	-
$\Delta$ (Productivity)	0,681 0,014	0,64 0,006	0,668 0,018	0,445 0,146	-0,35 0,250	0,214 0,530	0,193 0,546	-0,56 0,054	0,246 0,439	1

Source: Authors

by the researchers can be applied to assess the case of Lithuania in terms of increasing the attractiveness of FDI in manufacturing. Furthermore, the results of the correlation analysis confirm that the labor productivity and trends in the country's GDP indicators highlighted by the scholars (Stundziene & Saboniene, 2019; Stundziene & Baliute, 2022; Mora & Singh, 2013; Abdul Hadi, *et.al.*, 2018) are significant in ensuring the development of the country's manufacturing industry through FDI. The correlation analysis showed a significant strong inverse linear relationship (-0.69) between the volume of investment and the number of investing firms. This correlation confirms the manufacturing statistics and trends analyzed in recent years in Lithuania, which show that while investment in this sector remains stable, the number of new projects has decreased.

The correlation matrix shows that the trend of foreign direct investment in the Lithuanian manufacturing sector can best be explained by indicators such as exports, imports, gross domestic product, and labor productivity. As exports are strongly correlated with imports ( $r = 0,95$ ) and the latter is weaker correlated with the dependent variable FDI ( $0,797 > 0,783$ ), imports will be excluded from the next regression analysis.

Nonstationary time series run the risk of spurious regression. To avoid this, cointegration was evaluated to ensure that the resulting relationship between unrelated variables is statistically significant. If the variables are found to be co-integrated, a direct regression is not considered spurious. The error probabilities obtained from the Dickey Fuller test show that there is a cointegration between the dependent variable - foreign direct investment in the Lithuanian manufacturing industry and all three selected independent variables - exports, gross domestic product and labor productivity. Therefore, it can be concluded that a long-term relationship exists between these indicators.

In order to assess the effect of each independent variable on the dependent variable in the short run, an ECM model was developed. The results of the model (see Table 6) showed that an increase in exports of 1,000 euros in one year would increase the analyzed FDI by 0,0056 million euros, with an equilibrium disequilibrium adjustment of 17%. An increase of 1 million euro in gross domestic product over one year would increase FDI in manufacturing by 0,0362 million euro, and the disequilibrium is adjusted by 12% over one year. As for labor productivity, the result shows that a one thousand euro increase in value added per person employed would lead to an increase in FDI of 124 million euros. This imbalance is adjusted by 23%.

Pairwise regression models were developed to assess and analyze how the independent variables determine the dependent variable (see Table 7). Assessment of these models shows that all four assumptions of residual errors are met, but the accuracy of the models is moderate.

The regression models confirmed that FDI in Lithuanian manufacturing is influenced in the short run by the same indicators as in the short run: exports, gross domestic product, and labor productivity. In the long term, a 1,000 euro increase in Lithuanian exports would increase FDI in manufacturing by 0,0000416 million euros, while a 1 million euro increase in GDP would result in an increase

Independent variables	Dependent variable
	$\Delta$ (FDI)
C	-14,80457
$\Delta$ (Export)	0,00560
Residuals (-1)	-0,175611
Accuracy of the model (Adjusted R <sup>2</sup> )	-0,132570
C	-6,279051
$\Delta$ (GDP)	0,036218
Residuals (-1)	-0,127047
Accuracy of the model (Adjusted R <sup>2</sup> )	-0,132570
C	-114,5122
$\Delta$ (Productivity)	124,0470
Residuals (-1)	-0,230551
Accuracy of the model (Adjusted R <sup>2</sup> )	0,044149

Source: Authors

**Table 6**

Results of the ECM model

of 3064 million euros in FDI in the sector under review. The largest change is due to the change in labor productivity, which would increase the FDI in manufacturing by 0.148 million euros per thousand.

**Table 7**

Characteristics of Pair Regression Models

	Estimates from Pair Regression Models		
	Export	GDP	Productivity
C	2063,47	1834,57	1808,83
Independent variable	0,0000416	0,03064	40,148
Adjusted R <sup>2</sup>	0,58	0,66	0,56
Probability of Fisher statistics	0,0136	0,017	0,016
Mean of residuals	-6,00e-13	-4,29e-13	-7,83e-13
Normality test of residuals: Probability of Jarque-Bera criteria	0,838	0,850	0,767
Probability of Breusch-Pagan test	0,5209	0,0523	0,251
Autocorrelation	Does not exist	Does not exist	Does not exist

Source: Authors

The results of the econometric study allow us to identify the main factors of investment attractiveness of the Lithuanian manufacturing sector:

- » Export growth allows moderate inflows of foreign capital into the manufacturing industry, increasing Lithuania's attractiveness to investors. As Polat (2015) argues, FDI orientated towards manufacturing is often export-orientated, which is why trade openness is an important indicator for investors to decide where to invest.
- » The growth of a country's gross domestic product is inextricably linked to the improvement of FDI trends in manufacturing. GDP growth increases a country's attractiveness for investment, as it reflects the overall level of development of the country's economy and shows the country's economic capacity.
- » An increase in labor productivity has a significant impact on FDI in manufacturing in Lithuania. It is a crucial economic indicator that describes the efficiency of the use of labor resources. According to Stundziene and Baliute (2022), labor productivity is determined by intangible investments in human resources, knowledge and staff training. In order to improve labor productivity, it is important not only to emphasize good pay, but also to continuously improve the skills of employees and to ensure continuous learning. The use of innovative and high-quality equipment is also a key to improving productivity.

## Recommendations

The empirical and econometric study confirms the strategic plans of the Lithuanian government, which contain proposals to increase the Lithuanian manufacturing industry in relation to foreign investors.

The Ministry of Economy and Innovation's project (2020) "Roadmap for the Digitalisation of Lithuanian Industry 2020-2030" sets out Lithuania's ambitions to contribute to the development of

the industrial sector: Lithuania must remain an important export partner, with a strong focus on expansion into foreign markets, a stable business environment, and a good quality/cost ratio. However, the rate at which labor costs increase faster than labor productivity is one of the main challenges to increasing the attractiveness of FDI in manufacturing. Rapidly rising labor costs and lagging labor productivity and technological underdevelopment are hampering the development of the Lithuanian manufacturing sector. To maintain the viability of the manufacturing sector in Lithuania, the Ministry of Economy and Innovation envisages that the development of a high-tech manufacturing industry is mandatory. The knowledge, skills, technological advances, experience, and innovative methods transferred by foreign capital can help to keep the manufacturing sector strong and competitive.

The results of the econometric estimate showed that the most important influence on FDI in manufacturing in Lithuania is labor productivity, measured in terms of value added per person employed in manufacturing. However, in order to assess labor productivity and performance, it is important to understand that it is a cross-cutting indicator that not only covers technological solutions, but can also be seen as an investment in improving the competences of employees. Efficiency, performance, and productivity must be understood in a broader sense. It can be argued that the higher the productivity rate in manufacturing, the more foreign direct investment it attracts. Increasing labor productivity is influenced by “soft” indicators and productivity should therefore focus on maintaining the competences of workers. It is noted that Lithuania is lagging behind the EU average in terms of the number of people employed in high-tech manufacturing and knowledge-intensive services; therefore, it is advisable to focus on developing the competencies of people employed in the manufacturing sector, following the good practices of leading countries. This competence development should be complex, covering various areas (personal, professional, etc.), and therefore requires targeted cooperation between educational institutions, employers, the business sector, and public authorities in order to respond to the ever-changing market needs. This finding also confirms the hypothesis of Stundziene and Baliute (2022) that labor productivity can be improved in two ways: investment in technology and investment in human capital, which ensures that workers are upskilled and motivated to work productively. To promote labor productivity, it is important to think more broadly, including the factors identified by researchers.

### Limitations

The main issue with the empirical research is that time series examined are annual rather than quarterly and time series for some indicators are shorter. Such a study should be repeated in the future with longer time series, which would help to obtain meaningful results when investigating the impact of factors on attracting foreign capital to the Lithuanian manufacturing sector.

- 1 In Lithuania, investment volumes in the manufacturing sector are in flux, with the effects of the pandemic and geopolitical events slowing down the development of the manufacturing industry. This sector is particularly sensitive to foreign investment, as it helps to ensure the development and progress of the manufacturing industry. The importance of the industry under analysis for the national economy requires examination of how to increase its attractiveness for investment on the global market. There is a lack of research on the factors that determine the attractiveness of the Lithuanian manufacturing sector for foreign direct investment. This shows that the problem raised is of topical importance and needs to be investigated.
- 2 The analysis of the scientific literature shows that foreign direct investment is an integral part of a country's economic development. It is considered to be one of the key elements

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## Conclusions

of globalization, and includes management, entrepreneurship and technology. Recent scientific results suggest that not only firms, but also regions, compete to attract investment. When examining the factors that determine the regional attractiveness of FDI, the authors emphasize labor availability, technological capacity, knowledge intensity, talent availability and other important social factors. A new assessment of investment attractiveness is highlighted, which includes "soft" and smart criteria: creativity, curiosity, knowledge competences. Investment attractiveness depends on the activities carried out, the level of development of the sector in the country, geographical aspects, and different regions. In terms of the factors that determine the attractiveness of FDI in manufacturing, political, economic, social, and market indicators are relevant. Foreign investors operating in this sector assess the level of development of a country, the performance of firms operating in the market, the capabilities of the workforce, and the quality of institutions when expanding in another country.

- 3 The variables analyzed in recent years show an increasing trend, but the impact of the pandemic period is visible for all indicators. The causality test shows that the independent variables do not have a lagged effect on FDI in manufacturing. However, the results of the correlation analysis showed that the country's gross domestic product, export, and labor productivity indicators have a positive impact on the attractiveness of the Lithuanian manufacturing industry for investors. To assess short-term dependence, an ECM model was developed, the results of which showed that an increase in exports by 1,000 euros would increase FDI in manufacturing by 5,6 thousand euros. An increase of 1 million euros in gross domestic product. - would increase by 36,2 thousand euros. An increase of 1,000 euro in labor productivity in manufacturing would result in an increase of 124 million euro in foreign direct investment in manufacturing. To assess the long-term dependence of the indicators, PTR models were developed, which showed that an increase in exports of 1,000 euros would increase FDI in manufacturing by 4,000 euros, and an increase in GDP by 1 million euros. FDI would increase by 30,64 thousand euro and an increase in labor productivity by 1 thousand euro would increase investment by 40,146 million euro. The analysis of the impact of GDP, exports, and labor productivity on investment in the Lithuanian manufacturing industry shows that the attractiveness of this sector for investors is most strongly influenced by indicators related to labor efficiency and productivity. To summarize the results of the study, in order to maintain the viability of the manufacturing industry and to ensure its development, Lithuania must focus on the factors that affect labor productivity in this sector.

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