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**MASTER THESIS**

<b>IŠORĖS VEIKSNIŲ ĮTAKA EKONOMIKOS AUGIMUI IR TVARUMUI</b>	<b>INFLUENCE OF EXTERNAL FACTORS ON ECONOMIC GROWTH AND SUSTAINABILITY</b>
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## INTRODUCTION

**Relevance.** In constantly changing world economic conditions, in order to maintain economic growth and sustainability, governments must pay more attention to the external shocks and unpredictable circumstances. Although it is impossible to predict the unexpected influences by any sources, the authorities should take under control the emerging factors using the results of analysis based on previous experience.

As it assumes developed economies tend to be more sustainably arranged, compared to the transition countries, which demonstrate relatively higher GDP growth rates. In this case the intense trade and economic cooperation between open economies, the stocks of foreign investments might contribute to economic transformation and sustainability. As a result, developing countries, especially with small-sized economy, tend to be influenced by various external factors considerably. Therefore, emerging markets are frequently and repeatedly facing the problems of the high extent of dependence on the external business environment due to the cyclical nature of the world economy.

In this regard, it is relevant to improve the approach to economic growth and sustainability in the context of external factors, that constantly influence business activity. The empirically and statistically proven results of the research will be beneficial to define the possible threats clearly as well as sustainable growth opportunities. Defining the impact on economic security is crucial, in order to develop conclusions about the necessary policies, which must be applied to maintain economic growth and sustainability.

**Level of exploration.** While one type of scholars explored the influence of external factors as a whole on economic growth and sustainability (Joshua et. al (2020), Izquierdo et. al. (2007)), others had more attention to their particular and specific influences (Barguelli et. al. (2018), Asongu & Odhiambo, (2021), Shafi et.al. (2015)).

Certain elements of the external factors have been discussed by scientists in terms of trade. Most of the countries gain advantages by engaging in trade with rapidly growing and comparatively more advanced countries. , that lead to the convergence effect and higher real GDP growth rate (Arora and Vamvakidis, 2005). Apart from that, it is necessary to admit the positive role of trade unions on economic growth among developed economies (Georgiou, M., 2010).

Moreover, Ghura (1995) concluded that macroeconomic and trade policies stimulate economic growth even if the external conditions are not refined. The other scholars (Blecker, R., 2009, Loayaza et. al. (2004) underscore the significant role of the external shocks and openness of the economy as the cause of fluctuation of economic growth and negative impact on sustainability. Furthermore, the influence of oil supply shocks has been detected and the significant negative impact on the biggest US economy was approved (Killian, L., 2008).

The existence of economic convergence during the EU enlargement has been revealed and proven empirically (Vojinović, B. et. al., 2010). In addition, the problem of externalities has been investigated in a more complex way to define the spillover effect on economic growth during crisis and recovery (Poirson, H., & Weber, S., 2011). Additionally, over the short-run and long-term, it has been declared that the economic growth in China demonstrated a strong spillover effect on the other countries (Arora et al., 2011).

Joshua et. al. (2020) roughly described the led growth impact of external factors on economic growth. It was implied that foreign direct investments (FDI) had a neutral positive impact while external debt, trade openness and exchange rate demonstrated a positive effect on economic expansion. However, the existence of the positive influence of FDI among fast-growing markets like India and China has been successfully investigated by other researchers (Argwal, 2011). Nevertheless, controversial results have been obtained about the negative impact of external debt on economic growth (Mihut et. al. (2015), Ejigayehu (2013)).

Asongu & Odhiambo (2021) investigated the optimal levels of trade openness and FDI that promote green economy. Yahya, F., & Rafiq, M. (2020) concluded that trade and inflow of brownfield investments stimulate renewable energy consumption both in developing and advanced economies which in turn leads to improvements in sustainability.

**Novelty.** The influence of external factors on economic growth and sustainability is a complex and multi-faceted question that continues to be the subject of ongoing research and analysis. In spite of the elements of the topic that have been partially investigated in scientific literature, still there are a lot of possible research areas. It was chosen due to the high importance of maintaining inclusive economic growth and sustainability in the EU member states. The scope of recent novelty includes the increasing focus on problems of external shocks that limit the potential of economic growth and possible factors that facilitate cultivating growth after periods of uncertainty; effects on sustainability as a key element for the transformation to green growth and the role of factors that directly connected to the sustainability goals. The study attempts to detect the impact of external factors in EU8 countries with similar potential that recently have been recognized as developed economies. In addition, the novelty of this topic lies in the constantly changing and evolving nature of the external factors themselves.

**Problem and Question.** It is widely known that most of the countries with different types of economy have been repeatedly affected by economic shocks throughout its existence. That phenomenon have arisen spontaneously due to the interdependence between the economies. In recent two decades, the most destructive and highly challenging among them had been the World financial crisis and the COVID-19 recession. In addition, at the end of the 20<sup>th</sup> – beginning 21<sup>st</sup> centuries certain countries have been encountering local crises, influencing economies in various

extent. However, those countries that implemented transformational policy measures for the economy overcame the negative consequences pretty successfully. Nevertheless, the externalities continue to influence interdependent countries by reason of globalization and the linkage between the economies.

The role of external factors remains significant in the way of transformation from the transition to the developed economy. Apart from that economic growth and sustainability have become dependent on favorable external factors. Frequently, certain countries could demonstrate rapid and unexpected growth which was not always supported by transformational processes for sustainability. At the same time, this situation led to the fragility and certain rate of insecurity about the growth points, compared to the green growth that benefits future generations.

In this case, the author tries to find the answer to the main research question: what external factors influence the economic growth and sustainability in EU8 economies.

**Aim.** The aim of the thesis is to empirically reveal and measure the influence of external factors on economic growth and sustainability in EU8 countries.

**Objectives.** In order to achieve the main aim of the thesis the author set a number of objectives.

1. analyze and systemize current scientific research and approaches in the field of external impact on economic growth and sustainability;
2. provide the methodological basis for the empirical research of the influence of external factors on economic growth and sustainability in former transition EU countries;
3. obtain and explain the empirical results regarding the influence of external factors on economic growth and sustainability;
4. develop the recommendations and conclusions about the influence of external factors on economic growth and sustainability.

**The object of the thesis** is the economic growth and sustainability in EU8 countries.

**Methods.** Scientific literature has been analyzed using methods such as dialectical, systemic, deduction and comparative analysis. The study involves quantitative analysis of data that will be collected from open resources (IMF, World Bank, OECD, Eurostat). Regarding the model of the research panel data regression analysis has been employed in EViews, in order to reveal the relationships between the dependent (economic growth, sustainability) and independent variables (trade openness of economy, foreign direct investments, external debt and exchange rate). Testing of the model specification is applied using the methods of statistical analysis. Moreover, the graphic method is utilized to present the results of the analysis. Using these methods is beneficial to ensure the accuracy and reliability of the results, the validity of the findings and recommendations.



**Structure.** The Master thesis paper is structured as follows.

The first chapter provides a review of the scientific literature concerning the issue of external factors and the impact on economic growth and sustainability.

In the second chapter, there are theoretical and empirical methodological aspects described for the evaluation of the effect of external factors and their impact on economic growth and sustainability. The methodological approach includes an explanation of research steps, a specification of the model, an explanation of variables and the research model, data scope, analysis methods of the study and criteria for conducting and evaluating. In addition, the author formulates hypotheses according to the aim of the research and the methodology for the testing.

The third chapter contains the most significant empirical results achieved. The problem-solving decisions on the questions of influence of external factors on economic growth and sustainability of the economy are provided. In addition, there are interpreted the secondary data to the practical aspect, describing the possible effects of the external factors on economic growth and sustainability. Hypotheses were tested using modified statistical methods and technics. The findings of the research have been discussed and compared with the results of other scholars.

Finally, the author presents the conclusions and recommendations regarding the Master thesis topic. In addition, the perspectives for further studies are formulated.

# 1. THEORETICAL ASPECTS OF THE INFLUENCE OF EXTERNAL FACTORS ON ECONOMIC GROWTH AND SUSTAINABILITY

Scholars have extensively investigated how external factors affect economic growth and sustainability from various perspectives. To identify any controversial issues in the current thesis, the author believes it is crucial to examine studies conducted from diverse viewpoints. In this chapter, the author analyzes existing literature and research on the impact of external factors on economic growth and sustainability both from a theoretical and empirical perspective. Additionally, the chapter explores how external factors may promote and hinder economic growth and sustainability.

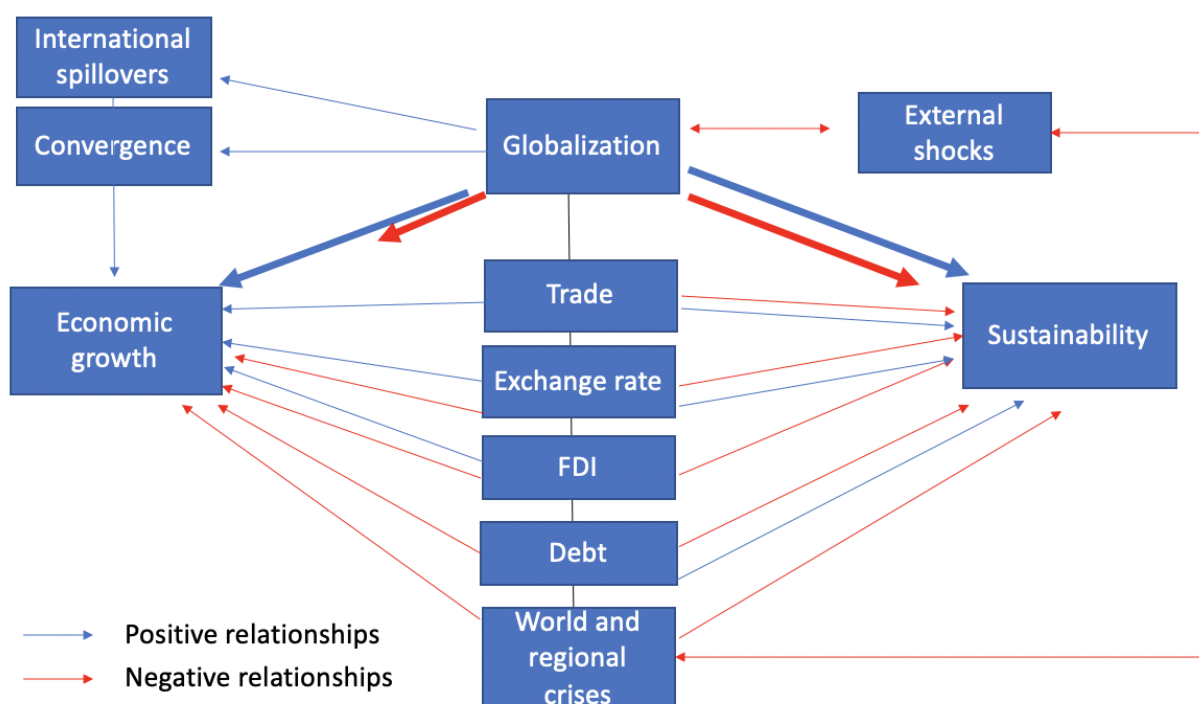


Figure 1. The external factors, which influence the economic growth and sustainability.

Source: developed by the author, based on Joshua et. al. (2020), Asongu & Odhiambo (2021), Shafi et.al. (2015), Arora and Vamvakidis (2005).

Based on the analysis of existing scientific literature author examines the linkage between the external factors and the economic growth and sustainability (fig.1), which will be particularly described further in the paragraphs below.

## 1.1 The economic growth and sustainability overview

### 1.1.1 Peculiarities of the economic growth and sustainability

In recent decades, the outstanding example of most developed countries showed that economic growth has been the main source of improving welfare of residents. A significant

amount of scholars' research projects have been devoted to the problematics of economic growth, which makes these issues occupy one of the central stages of economic theory and praxis. As for the evidence, Mihut (2015) concluded that the notion of economic growth aligns with various terms like economic welfare and economic development referring to the intricate process that encompasses large-scale macro structures.

Achieve improvements in economic growth have been possible both by increasing the quantity and the quality of the output, depending on which source of development prevails, intensive and extensive types of growth are distinguished.

It is important to note that extensive growth is usually based on the involvement of additional resources in the production with a constant level of technology and the quality of the resources themselves. As Zlotnikov & Akulich (2018) concluded that extensive growth can only be justified in countries where there is a lack of available untapped resources. For example, the Persian Gulf countries possess significant reserves of raw materials and energy resources. On the other hand, China and India are characterized by a surplus of labor resources, which gives almost unlimited opportunities for using cheap labor in order to gain rapid economic growth rates. However, the extensive growth factors cannot operate indefinitely. Moreover, they do not provide a significant change in the quality of life, since they do not contribute to a change in lifestyle or economic behavior.

In the case if the countries do not have large-scale natural and human resources, policymakers advise focusing on technological advancements and, especially innovations. Holden & Linnerud (2007) highlighted that combination of improving resource-saving technologies, equipment upgrades, increasing the efficiency of resource use, increasing labor productivity, effective government policies contribute to the evolution of economic growth and formation of new growth drivers. As the experience of developed countries confirms, only a change in the quality of growth can significantly improve the well-being of the residents. At the same time, well-being is understood not just to achieve a certain level of material consumption, but also to ensure favorable social and environmental living conditions. However, Wawrosz & Mihola (2013) believed that both extensive and intensive approaches have significantly contributed to the economic development of transition and advanced economies.

Most scholars analyzed economic growth from the domestic point of view. Neoclassical, Solow-Swan model of growth, Endogenous theory based their evidence on the internal factors as the drivers which are capable to explain the nature of economic growth. However, certain scholars (Upreti, 2015) suggested that in order to gain rapid economic growth the mix of internal and external factors should come together. These factors facilitate the progressive economic growth of a country and often being identified as stimulants.

The study of Isaak (1997) systemized the external factors which led to gain extreme growth rates in the second half of the 20th century. The author concluded that the most prominent countries demonstrated the phenomenon which is called “economic miracles”. A number of external factors including FDI, transfer of technology and management skills, easy access to the world markets were crucial in order to transform their economies from least developed to transition type, or even to the level of developed countries (South Korea, Singapore).

However, catching a wave of global economic growth is not enough to sustain economic development in the long term. Countries must also focus on cultivating a competitive advantage in specific industries and investing in sustainable development to ensure that growth is environmentally and socially responsible.

Nowadays academic society pays more attention to the term “sustainability” which has been described by scholars as elusive in various interpretations, and depends on the specific literature or the context in which it is used. There is consensus among experts (Spangenberg (2004), Poirson & Weber (2011)) that countries should strive for long-term economic growth while respecting environmental limitations and promoting policies based on knowledge and innovation, as well as more efficient resource use. Additionally, creating conditions for full employment, social and territorial cohesion are crucial steps that can help transform economies and achieve inclusive growth. Stiglitz (2016) emphasized that environment and economic growth are complementary, especially if sustainability is taken into account.

Currently, the problem of environmental pollution and depletion of resources become apparent. The issue of increasing consumption without taking into account social and environmental restrictions leads to a deterioration in the quality of life and the need to overspend budget resources on its preservation in the future. In other words, this means that unlimited consumption undermines the foundation of the economy and worsens the living standards and well-being of future generations. The economic development aimed at meeting the needs of the future generation is called sustainable.

Sustainable development implies ensuring sustained economic growth without depleting the basic elements of economic potential. This means that the key sectors of the domestic economy must be balanced. In 1998, the OECD Ministers agreed to interpret “sustainable economic growth” as including social and environmental, as well as economic, considerations.

Repetto et al. (1989) highlighted that in order to maintain and cultivate sustainable development, it is considered important to keep an eye on 3 key elements. Firstly, it is necessary to massively introduce energy-saving technologies aimed at structural changes in sectors of the economy if countries aimed to preserve the environment and natural resources, as well as to ensure comfortable living conditions for current and future generations,. Secondly, it is crucial to enhance

labor productivity, reduce the material consumption of products, increase the yield of the main types of agricultural crops, and increase the share of products in the structure of exports. Thirdly, it is significantly important to follow criteria for sustainability goals and incorporate set of macroeconomic and financial indicators, such as the budget deficit, the balance of payments deficit, public and external debt, inflation and others.

Nevertheless, the concept of sustainability has undergone a significant number of changes in favor of a shift in the criteria assessment including a number of a complex sets of indicators for the mid- and long term.

The United Nations Economic and Social Council defined in 2001 broaden the common sense of sustainability. It was assumed that a normative concept including social, economic, environmental and institutional objectives contradicts the orientation towards an international free trade economy, which had not attached to social or environmental conditions. Since the countries were mostly oriented on achieving the constant, but not always sustainable economic growth the increased level of concern claimed the long-term orienteers.

According to the “Sustainable development goals”, which have been included in the United Nation resolution Agenda 2030, the goal №8 concludes that the countries must promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all people. In this case, governments must concentrate their policy decisions on appliances with orientation on encouraging the economic business environment considering parameters of sustainability.

While developed countries implemented the international recommendations towards gaining sustainability goals in a quicker way in order to continuously enhance the quality of economic growth, most transition economies and especially least developed countries still continue to struggle.

There are a number of reasons why countries could not achieve sustainability. For example, Nawaz et. al. (2014) deduced that the external factors such as deficit of balance of payments, burden of foreign debts, low exports of products lead to unsustainable economic development. Thereby, limiting the potential of economic sustainability and capacity building. Moreover, according to Spangenberg (2004), countries must decrease total resource consumption in order to achieve sustainable economic growth in the long run. This requires a period of time during which resource productivity or ecological efficiency increases more rapidly or declines more slowly than the GDP growth rate. In other words, sustainable economic growth requires a shift in focus from resource-intensive growth to a more resource-efficient and environmentally responsible approach.

In addition, most of the scholars mentioned that one of the simplest and widely reported dimensional indicators of the economic component of sustainability is the income of the

population. They also highlight the importance of the Human Development Index as more sophisticated and complex parameter for the assessment and comparing the countries through the time. Holden & Linnerud (2007) declared that countries must preferably maintain the increase in real GDP over the population growth rates for three or more years. In some cases, for the comparison of countries' GDP per capita is recommended to apply purchasing power poverty transformation in order to exclude the fluctuation in costs of goods and services among countries with different scales of income. This will possibly facilitate to enhance the international comparison of the economic productivity and standards of living.

The recent outcomes of the study by Koçak (2020) indicated that technology and innovation, land resources, and carbon emissions are crucial indicators for green growth. Notably, promoting sustainability is primarily determined by key indicators such as the comparative advantage in environmentally-related technology, available land, global inventions, and production-based CO<sub>2</sub> emissions. Moreover, the study also emphasizes that the development of new green technologies and innovations is necessary for transitioning towards a sustainable, low-carbon economy.

In addition to the aforementioned criteria, an increase in the employment rate and the reduction of environmental pressures are also important considerations for achieving sustainability. For sustainable economic growth, the growth rate should ideally fall between the growth rates of per capita production and resource productivity. This allows for economic growth that is consistent with the efficient use of resources and does not place excessive strain on the environment. Therefore, achieving sustainable economic growth requires a balance between economic development, social progress, and environmental protection.

Currently, the combined indicators of sustainability draw scholars' attention more intensively. They generally take into account all the factors that might possibly affect sustainability and represent an innovative approach to assess and evaluate sustainable development, which is aimed at maintaining welfare in the long term. However, certain researchers (Singh et. al, 2009) argue that composite indicators suffer from subjectivity due to assumptions made in measuring errors, the process of selecting or excluding indicators for the index, and the conversion or reduction of indicators. Even though they systematically diffused in the number of research regarding the sustainability.

Through a review of existing literature and research, it is evident that sustainable economic growth is essential for ensuring long-term well-being and avoiding the negative impacts of unchecked growth on the environment and society. Moreover, the chapter emphasizes the need for extensive and intensive approaches to economic growth and the role of external factors in stimulating economic growth and sustainability. Overall, the chapter distinguishes the importance

of promoting sustainability and economic growth, highlights various factors and criteria necessary for achieving this goal. Thereby, the economic growth and sustainability commonly remain one of the most debatable topics for the scholars. In its nature often transpires a number of problems that influence considerably the society during periods of instability and crises.

### **1.1.2 Problems of maintaining the economic growth and sustainability in the context of external shocks**

It is widely known that intensive short-term rapid growth is possible to achieve due to the temporary usage of one of the main economic growth factors such as labor, capital or natural resources. However, over the time due to the incorrect policy decisions or market failures, the imbalances in domestic as well as the world economy may increase and as the economic performance decelerates, which leads to the recession, stagnation and even to certain local economic or financial, or world crisis as the worst scenario. During the last decades the imbalances have become an important factor that determines the possibility to arise the crisis phenomena in the world economic system. For example, Allegret et. al. (2012) combined over the past few decades the most significant external shocks a real oil price shock, a trade shock, a financial shock, and a monetary shock.

When the developed countries passed the stages of imbalances at the end of 20 th century, transition countries still face it repeatedly. One of the primary motivations for the early environmental accounting efforts in the mid-1980s was concern that rapid economic growth in certain developing countries was achieved through liquidation of natural capital (Repetto et al., 1989). In the long run, this practice is concerned as unsustainable, the economy will be shrinking if the resources are exhausted. As an example, Soyulu (2019) concluded that the economic slowdown due to the financial crisis has revealed the shortcomings of the economic growth model in Poland, which was based on external financing. The weakening of economic performance following the financial crisis indicated that in order to prevent imbalances in the future the new growth model must be implemented.

Apart from that, since the 1980s debt crisis becomes a considerable macroeconomic question. Following this, different studies are carried out to reveal the causes, consequences and possible solutions to the recovery. Ejigayehu (2013) discovered that Mexico was one of the first countries faced a debt crisis in 1982. It was concluded and empirically proved that certainly, debt relief does not facilitate economic growth and sustainability as one of the preventive remedies during the crisis.

The global financial crisis and the COVID-19 recession in 2020 are two major events that negatively influenced global markets in the 21<sup>st</sup> century (Chen & Yeh, 2021). It had also significant impact on economic growth and social component of sustainability.

Quite important to highlight that maintaining growth is not possible without correct macroeconomic policy and stabilization, especially during the recession. The study by IMF scholars (Poirson & Weber, 2011) described the growth spillovers in the context of the crisis and the recovery process using the VAR model. As independent variables which influence GDP it was chosen domestic and external demand, trade and net export across 17 OECD developed countries from 1975 till 2010. In addition, it was included a crisis dummy variable which takes the value from the fourth quarter of 2008 till the first quarter of 2009 during the World economic crisis in order to reflect “normal times”. The study concluded that in advanced economies the adverse growth shocks originating from the crisis countries have a spill-over effect on other countries through trade or extensive cross-border asset ownership and significantly hamper achieving sustainability.

Possibilities for maintaining sustainability during the crises are limited by interdependence in the world economy, although there are plenty of benefits during normal times and periods of recovery. It is important to note the study by Izquierdo et al. (2007) where it was investigated the role of external factors such as changes in external demand, terms of trade, and international financial conditions for business cycles in Latin America. Implemented the vector error-correction (VEC) model the scholars concluded that the period of stagnation and crisis might be a consequence of unfavorable external conditions. On the other hand, a period of sustained high growth may be the result of favorable external business environment.

Since old-fashioned economic management systems had failed to maintain acceleration of sustainable growth with the aim to improve living standards of their residents, the new market economy system has been the benchmark for adapting its economy by reforms. The transition countries struggle with maintaining sustainability even nowadays. A number of problems may arise not only in economic, but also in social and environmental fields. Inequality remains one of the main problems for the developing countries yet. In most cases the higher economic growth and welfare achieved, the higher income differentiation befalls across the population. In other words, crises generate more inequality, especially in transition economies.

In the context of sustainable development, the market economy became a viable option, which was to fix most misconducts of the command economy and, thus, lead further to the transition process and development (Zlotnikov, Akulich, 2018).

The extensive economic transformation has been accompanied by numerous reforms across various sectors and domains, which have been implemented with varying approaches in the



respective countries. Certain scholars suggested that the transformational reforms are the main source of winning the crises and gaining sustainability. The changes stretched far beyond the economic field and involved often grand shifts in political and institutional spheres

Although developing economies, which comprise about 80% of the world's population nowadays, perceive the economic growth as an essential source of improving the well-being of their residents. However, most governments of developing countries still do not pay enough attention to achieve the sustainable economic goals.

Nevertheless, certain Central and Eastern European countries pretty successfully comply with the issue of transformation and to the new business environment models. According to the outcomes of the study Soylyu (2019), it was admitted that improving sustainability has been an important goal for Poland to transform its economy on the way to the developed economy. One of the sources of encouragement for growth was and still remains the attraction of FDI. Due to the fact that general economic growth causes an increasing number of emissions, if nothing is done, it is highly necessary to keep the greenhouse emissions within the framework of the Kyoto protocol. For instance, the study emphasized that economic growth in Poland have relied on export, foreign direct investments and European Union funds.

Scholars explained that the key direction for the policymakers is to pay special attention to the creation of peculiar policies to attract foreign investors to the country. This will result in further savings growth and contribute to the economic growth respectively. Governments should provide adequate macroeconomic policies to open the economy and encourage foreign investment inflow (Soylyu, O. B., 2019). Moreover, it might transform any country into an export platform for the international market in which the export of goods and services can play crucial role.

The issues of maintaining growth and sustainability in the world economy have been attracted by scholars even strongly due to the COVID pandemic. They have explored various strategies that can promote sustainable economic growth, such as investing in green technologies, promoting innovations, and fostering social and environmental sustainability. For instance, it was verified that the lockdown measures are suggested to have a positive effect on the environment in 2020 (Abubakar et. al., 2021). Since the energy consumption level decreases and, thus, the greenhouse gas emission has been consequently shrunk. Nonetheless, the mechanism of improving sustainability in its environmental part is highly dependent on the business activity and industrial production. In this case the sustainability improves in one direction but weakens in economic and social components.

Yang et. al. (2022) suggested that a number of benefits on global environmental health and environment have appeared due to reduced air and water pollution during the COVID-19

pandemic. Scholars highlighted that crisis influenced positively by stimulating to implement more sustainable practices and desire to prolong the positive effects on sustainability.

In summary, the crisis in 2020 has made it even more apparent that maintaining economic growth and sustainability are essential to ensuring the resilience of the world economy in the face of crises. Scholars continue to explore various strategies and approaches to promote sustainable economic growth and development, which can benefit the global economy in the long term.

Above all the crises significantly lower the potential of economic growth. However, those countries that implemented the fastest and targeted measures would have leading benefits and to a higher extent. Due to the erratic nature of crises and their impact on economic growth and sustainability, scholars suggest to policymakers focus attention on certain external factors which have been systemized in the next subchapters below.

## **1.2 Types of external factors, which mostly positively influence economic growth and sustainability**

### **1.2.1 Effects of globalization and trade on economic growth and sustainability**

The question of how globalization impacts on economic performance of the countries remains debatable. The process of globalization offers a broad opportunity for the countries to accelerate economic growth through the channels such as global trade, investments, and technology transfer and gain access to innovations, expertise, and knowledge. This has the potential to increase productivity, enhance competitiveness, and accelerate economic growth. Additionally, globalization has provided transition countries with greater access to foreign investment, which is a source to finance infrastructure development, expand production capacity, and create new jobs. Furthermore, the process of globalization creates a more interconnected and interdependent global economy, leading to greater cooperation between countries.

The academic community has extensively explored the relationships between globalization and economic growth. Almas & Sangchoon (2010) investigated the correlation between economic growth, globalization and income inequality by elaborating a new globalization index. It was deeply analyzed panel of 61 advanced and transition economies during 1995-2001 using variety of GDP measures including nominal GDP, GDP growth, GDP per capita, and growth in GDP per capita. According to the results obtained by the comprehensive and systematic regression analysis authors empirically concluded a close positive relationship between globalization and economic growth. In this way, globalization improves economic component of sustainability. At the same time, the study revealed negative relationship between inequality and globalization, which in turn lead to decrease in social component of sustainability.

Much attention has been drawn to the development of trade and economic unions. Georgiou (2010) investigated the role of trade unions in the economic growth of 17 advanced economies. According to the author's econometric model, it was found that Western countries which were involved in trade unions and lowered trade barriers experienced advantages in economic growth from 1999 to 2007. Economic unions and globalization are closely linked, as economic unions are often seen as a means of promoting greater integration and cooperation among countries in a globalized world.

However, certain scholars are concerned that globalization leads to a number of advantages as well as new challenges such as external shocks. Increased cointegration can also result in heightened vulnerability to external factors. This issue of concern holds particular significance for developing countries due to factors such as production specialization, reliance on non-diversified sources of income, unstable policies, incomplete financial markets, and weak institutions.

A number of scholars (Silajdzic & Mehic (2018), Loayaza et. al. (2004), Balsalobre-Lorente et. al. (2018)) emphasized the fact that openness of the economy remains one of the key external factors that stimulate to gaining rapid economic growth. Economic or trade openness leads to the higher integration of international goods and capital markets, contributing to potential gains in growth and welfare. Scholars most commonly measure the variable as the ratio between the total amount of export and import to GDP. However, the real open economic system is considered by low entrance barriers for international competitors to their domestic market.

Trade has become widely accepted as a beneficial factor for the improvements in economic growth. After the Second World War almost 100 countries in the world set the goal to reach the economic welfare to the level of developed countries. However, only a few of them have succeeded. One of the main progressive factors was the economic openness. A great example of those countries, that implemented the reforms and canceled almost all restrictions on export and import transactions after gaining independence. A great number of them have significantly improved economic performance (Czech Republic, Slovenia, Lithuania, Estonia and others) than those which stuck during the structural transformation. It is notable the example of Baltic countries which are the most developed country nowadays among the former Soviet bloc (Lithuania – 36<sup>th</sup> place, Estonia – 37<sup>th</sup> in the world by GDP (PPP) per capita) (Akulich & Zlotnikov, 2018).

The other scholars empirically focused their studies on the effects of trade openness and external shocks on average economic growth. The study of Loayaza et al. (2004) analyzed how trade and financial openness influence the changes in economic growth rates. By taking a data set of cross-country observations among developed, transition and least developed countries for 1970-2000 the authors revealed the positive effect of trade openness on economic growth. The impact of factors strengthens as economic development progresses but diminishes at higher income levels.

Furthermore, researchers have proposed that trade openness mitigates the growth impact of trade-related shocks but amplifies shocks associated with financial markets. However, financial openness (FDI to GDP) tends to have the opposite effect. Additionally, scholars have concluded that the growth effects are economically significant for middle- and high-income countries.

There are a number of debates in the scientific literature about the problem of whether trade with poor countries is beneficial for the economic growth. In the study Arora and Vamvakidis (2005) it was discussed the net impact on a country's growth of trading with relatively less developed countries. Scholars concluded that economic growth could be positively influenced by trading with less developed countries, since it leads to the specialization in relatively advanced sectors. However, the impact also might be negative if the relative income effect dominates, and positive in the case of the relative growth effect.

Moreover, it is important to note that Joshua et. al. (2020) detected the beneficial impact of trade openness as one of the dependent variables, which generates substantial economic expansion in South Africa. As a result, openness contributes to enhancing the national economy by facilitating gains from international trade, including growth and technology transfer. The overall outcome indicates that the openness of the South African economy played a crucial role in its path toward economic advancement.

Certain elements of the external factors have been discussed by scientists in terms of trade. It has been widely applied measurement of the foreign shocks. Specifically, Ghura (1995) focused on the influence of external forces including terms of trade, the export and high world real interest rates. The findings suggest that terms of trade have a substantial impact on growth in certain regions, such as Sub-Saharan Africa, but not in Latin American countries. This highlights the importance of considering regional differences when analyzing the relationship between external factors and economic growth. In addition, the positive relationship between international trade and the economic growth has been empirically vindicated.

It is quite apparent that the decline in terms of trade could impede the prospects of achieving high rates of economic growth. The results obtained by Irandoust (2016) confirmed causal linkages between terms of trade volatility and activity of multinationals in the Baltic states. When terms of trade are volatile, multinational corporations may face increased uncertainty and risks, which restrain from investing and expanding their business. This, in turn, might limit the potential benefits that the presence of these companies brings to the local economy. Furthermore, the negative impact of volatility may extend beyond the activity of multinationals. Fluctuations can also affect export prices and the cost of imports. This can have a significant impact on balance of payments and overall economic performance.

Regarding the effects of trade on sustainability, scholars highlighted that mechanism of improving sustainability is perceived in context of its components. Competition in international trade can drive innovation in sustainable technologies and practices. For example, the demand for renewable energy sources has led to the development of new technologies that are more sustainable than traditional energy sources.

Liu et. al. (2020) evaluated the role of globalization in carbon emissions in G7 countries. Scholars concluded that relationship between economic aspect of globalization and decreasing environmental component of sustainability has U-shaped form due to the pollution haven hypothesis. Through the time more globalized countries relocate their industrial enterprises to developing countries with lower ecological standards. Study suggested that green economy would facilitate to balance between maintaining economic growth and environmental protection.

Moreover, based on the sample of 68 developing and advanced economies Yahya, F., & Rafiq, M. (2020) concluded that trade openness positively and significantly influences renewable consumption, which in turn is one of the key elements of achieving sustainability. Empirical evidence suggests that more efficient trade promotes renewable energy technologies in a country, which leads to improving environmental component of sustainability. This process is mostly visible in developed economies that are more concerned about environmental changes and stands on the intensive way of economic growth. In addition, openness leads to the adoption of sustainable practices. When countries engage in international trade, they may need to meet environmental and social standards set by their trading partners. This can stimulate the adoption of innovations to comply with these standards, leading to reduced environmental impact and improved social conditions.

According to the long-run estimations Romer (1990) indicated that openness is beneficial for economic growth due to the increased availability of technologies and concomitant knowledge spillovers. In this part, the economic component of sustainability is considerably positively influenced by establishing new export-oriented enterprises which benefit the building competitive market economy in general and improve the welfare of residents.

Balsalobre-Lorente et. al. (2018) explained the relationship between CO<sub>2</sub> emission, renewable energy consumption, trade openness and economic growth in 4 biggest EU economies and the UK. Scholars empirically vindicated that in developed high-income countries renewable electricity consumption and trade openness are positively correlated with economic growth. In this case, trade also facilitates to maintain higher GDP growth. In addition, study revealed that increase in trade openness is positively correlated with carbon emissions, which in turn hamper the environmental component of sustainability.

Moreover, based on the global data from 1966-2019 Sowah & Kirikkaleli (2022) concluded that in the long run increase in trade openness has relatively higher effect on environmental sustainability compared to the situation when this indicator is shrinking.

In developing countries, scholars highlighted that enhancing trade openness leads to the decrease in environmental component of sustainability. Based on the sample of 49 Sub-Saharan African countries Asongu & Odhiambo (2021) concluded that trade openness has a net positive effect on carbon emissions, which in turn decrease the sustainability. The practical explanation of this situation is that the more export-oriented enterprises produce industrial goods, the higher is probability that they might hinder implementing sustainable technologies due to the minimization of the cost. However, the study revealed that in order to promote the green economy the minimum threshold of trade openness should be above 100% of GDP. In this case, when enterprises receive extra margins, they might be able to make more efforts and spend relatively more financial resources on implementing and developing sustainable technologies.

Highly important to mention that Xu et. al. (2020) analyzed the impact of international trade on global sustainability, using multiregional input–output method. Specifically, scholars presented findings that trade is a beneficial factor of sustainable development goals target scores for developed countries, but for developing countries the impact was negative. At the same time, the EU countries experienced improvements in eight out of 9 SDG target scores from international trade. The study explains this process due to the practice, when multinationals transfer carbon emissions from developed to developing countries.

Thereby scholars agree that globalization mostly brings plenty of benefits for economic growth. However, in developing countries trade might negatively influence environmental component of sustainability. In general, globalization offers a unique opportunity to accelerate economic growth and development through increase in trade, investment, and technology transfer. Through the intensification of linkage between national economies and business entities free trade and cooperation significantly contributes to new opportunities for cultivating economic growth and possibilities to develop sustainability.

### **1.2.2. Impact of economic convergence and international spillovers on economic growth and sustainability**

Scientists agreed that in most countries globalization leads to the **interdependence of the economic systems** between countries. Establishing alliances or blocks with key trading partners permit manufacturing to take place where labor is skilled, but its cost is lower (Isaak, R., 1997).

In addition, involvement in global or regional alliances with the most freedom and flexible economies has been one of the key external factors to gain better economic performance.

While one types of scholars underline the importance of regional cooperation on the way to achieving sustainable economic growth, the others concentrate their research on the favorable effects of trade in line with the positive trends in the world economy. Arora and Vamvakidis (2005) defined how much a country's long-term economic growth depend on economic conditions in the rest of the world. Based on panel and cross-section data across 101 industrial and developing countries the research findings revealed a high correlation between a country's economic growth and the growth of its trading partners. The results suggested that a 1 percentage point increase in economic growth among trading partners is associated with a potential increase in domestic growth of up to 0.8 percentage points. Furthermore, the study highlighted that this relationship is stronger for countries with relatively open economic systems. Additionally, a significant portion of the impact of trading partners on growth is driven by regional trends rather than global economic growth.

There is another term such as **convergence** is commonly employed by scholars and often included in the external factors of the economic growth. Economic convergence refers to the process by which countries with lower levels of income and development catch up to the levels of more advanced economies. This can lead to increased economic growth and reduced poverty, which can support sustainability efforts. According to Arora and Vamvakidis (2005) the countries benefit from trading with fast-growing and relatively more developed countries, which led to the convergence effect and higher real GDP growth rates. Moreover, using the dynamic ordinary least squares (DOLS) approach Blecker (2009) concluded that formation of free trade zone like NAFTA in 1994 created a statistically significant dependency of economic growth in Mexico with the USA.

The impact of the European Union enlargement in 2004 on the economy of new members has been investigated in the context of the existing of s- and b-type of economic convergence by Vojinović, B. et. al. (2010). The study revealed that relatively poorer new EU member states generally grew faster in the transition period than richer new EU members (b-type). As a result, the income gap between these countries narrowed, although it remained quite large. During 1995-2006 and 2002-2006 convergence occurred at rates of 7% and 9.6% respectively, which indicated very fast income level influence. The speeding up of the convergence process was partially attributed to trade liberalization, which involved substantial reductions in tariffs. It must be noted that s-convergence among the new EU-10 members after 1995 had 2 implications. The tendency of long-term convergence in GDP per capita as long as the current EU policies are sustained. In

addition, low-income EU-10 countries have shown further prospects of capital inflow from developed EU countries.

**International spillovers** are one of the effects of globalization on economic growth and sustainability which arise internationally between the economic systems. The most obvious channel of international spillovers is trade linkages. It means that upsurge in trading partners' growth leads to an increase in their demand for imports (Poirson, H., & Weber, S., 2011), which then considerably contributes to an increase in the trade balance.

In addition, Arora and Vamvakidis (2005) concluded that trade stimulates the economic growth through spillover effects. For relatively open developing countries these effects are larger. According to the results of the research this situation happens because countries benefit from the large knowledge stock of their more developed trading partners. The scholars suggest that countries grow faster if they trade more with the developed economies. This situation may be explained by specialization in technologically advanced sectors when exporting to a richer country, which may also result in positive spillovers to other sectors of the economy.

It is highly important to mention the influence of the EU enlargement spillovers for the new member countries. With reference to a case study of Croatian economy Krznar et. al. (2010) defined that external shocks in the economic activity of the EU are the key determinant of the domestic economic reaction and the main source of GDP fluctuations. These findings deduce that a 1 % increase in EU GDP growth caused an approximately equivalent increase in Croatian economy as early as after one quarter, and a double increase after two years, when the effect of the initial GDP-induced shock is almost fully absorbed.

The big economies tend to influence the smaller countries quite intensively. The results of the research presented by Poirson & Weber (2011) suggest that the USA remains the largest source of spillovers to all countries. A 1 percent growth shock in the American economy leads to increase in output growth within 10 quarters by about 0.3% in Germany, 0.4% in Italy and France and 0.1% in Spain in normal times. In addition, certain EU countries (for instance Lithuania) are strongly affected by growth results in Germany, since they are part of a single market. However, positive growth shocks in France and Italy generate larger spillover effects to the European periphery. While spillovers from all the large economies are found to increase during times of crisis.

Moreover, Poirson and Weber (2011) found that Germany stands out for its prompt and direct response to growth shocks originating from the USA or Japan. In contrast, France, Italy, and other core members of the euro area tend to experience these shocks to a greater extent through third countries before they affect their domestic economies. The third-country indicator, which is relatively high for non-German euro area countries, indicates that interconnectedness between



euro area nations plays a significant role in transmitting shocks from outside the euro area to Europe. Considering Germany's efficient reaction to shocks from the USA and Japan, this discovery suggests that Germany is important transmitter and amplifier of external shocks to other euro area members.

Regarding international spillovers it is important to mention the research conducted by Arora et al. (2011), where it was measured the influence of the second largest Chinese economy on economic growth in the rest of the world in both the short term and the long run. Based on the panel data of 172 countries for the period of 1960-2007 the study revealed the following. Using a combination of vector autoregression and error correction models it was concluded the existence of spillover effect of China's economic growth. The most notable intensification of spillover effect has been developed in recent decades in short-term and long run. In addition, the robust estimation of VAR model revealed significant correlation, where a 1-percentage point shock to China's GDP growth is followed by a cumulative response in other countries' GDP growth of 0.4 percentage points in short-term and 0.5 percentage points in long-run over the 5 years. Economic growth has become one of the key external variables which explain fluctuations in the world economy. Moreover, over a span of five years, the impact of China's growth on Asian countries is significantly greater than its impact on the rest of the world. Scholars declared that trade was one of the key channels through which spillover effects are transmitted.

Summarizing the thoughts that were described above the author considers that the spillover effects of economic growth has been significantly investigated. However, there were not as many studies regarding its impact on sustainability.

In conclusion, scholars defined several types of external factors that can influence economic growth and sustainability, including globalization and international trade, spillover effect and convergence. These factors can help countries to build new industries, create jobs, improve infrastructure, and increase competitiveness, while also promoting sustainable development and reducing poverty.

### **1.3 Potential variations of influences of distinct external factors on economic growth and sustainability**

#### **1.3.1 Impact of external shocks, debt and exchange rate on economic growth and sustainability**

It is highly important to mention that externalities may change the influence extent of external factors on economic growth and sustainability. Concerning these issues in scientific

papers relatively critical impact of various effects on economic development has been revealed by scientists.

Crises often have a significant adverse effect on both economic growth and sustainability, sometimes resulting from the **external shocks**. One such shock is the unpredictable and rapid decline in world commodity prices, which can pose new challenges for growth. Oil supply shocks are an example of this, and they can have negative consequences for both producers and suppliers in the global economy.

Since the oil crises in the 1970s there have been extensive discussions surrounding the effects of OPEC countries' oil production shortfalls caused by wars and other external political events on the economic growth of the United States. The significant negative impact of exogenous oil supply shocks on US economy have been detected by Killian (2008). Specifically, it was demonstrated that exogenous oil supply shocks attributable to a sharp decline in US economic growth after five quarters rather than an immediate and sustained reduction in growth and a spike in inflation after three quarters. Overall, exogenous oil supply shocks have had minimal impact on the trajectory of the American economy.

Later on, the effects of fluctuations in oil prices have become important in the 2000s. Blecker (2009) investigated the impact of the external shocks on economic growth. The author concluded the positive impact of increased world oil prices on the economic growth in Mexico between 1996-2000 and in 2003-2007. It was explained by the significant shares of oil products in exports and budget revenues.

Most of the scholars included in their research impact of crisis or external shocks as dummy variables in order to minimize the impact of external factors and fluctuation in data set concerning robust results. In the context of the global financial crisis in 2008-2009 for all countries, but, especially, for the smaller open advanced economies such as Austria, Belgium, the Netherlands and Finland, Poirson and Weber (2011) concluded the following. The economic growth was predominantly influenced by the consequences of external growth shocks, while domestic shocks made a relatively low contribution. The findings indicate that the synchronized decline in Japan and the European advanced economies played a significant role in exacerbating the severity of the recession in the United States.

A number of empirical studies made an attempt to reveal the relationships between the **debt** and economic growth. Previous research findings have exhibited variations in terms of the geographical and economic areas studied, the analytical methods employed, and the resulting outcomes. The analysis of the studies expressed controversial outcomes such as both positive and negative effects of external debt on economic growth and sustainability exist.

The studies about the external debt as one of the factors affecting the economic growth and sustainability have been examined differently across least developed, developing and advanced economies.

Ejigayehu (2013) discovered the impact of the external debt on the economic growth in African countries. The author concluded that 1% increase in debt service-export ratio negatively influences economic growth by 0.14%. It might be explained that in most cases governments utilize the income from trade to service their accumulated debt which leads to a loss in investing these funds in sustainable economic development. Upreti (2015) considered that the slightly less negative relationship between accumulation of external debt and economic growth exist. Specifically, the increase of debt by 1% leads to the decrease in GDP by 0.04%. In addition, payments for the public debt to the foreign creditors also linked with the exchange rate. The depreciation of the national currency leads to increase in budget expenditure on debt payments, which usually balanced by increase in tax burden or decrease in government investments in the real sector of economy and thereafter, to the slowdown in the economic growth.

Quite important to mention that certain scholars highlighted that the relationship between the external debt and economic growth differs from developed to developing countries. It is important to note that the least advanced economies often face higher debt service payment requests, if so, they might be forced to reduce spending on public investments. As the Ejigayehu (2013) evaluated that it is related to the crowding out effect of debt. In this case, countries transfer resources, including foreign aid and international reserves to service their accumulated debt. The obtained results showed that external debt influences economic growth by the debt crowding out effect rather than debt overhang, when the accumulation of the debt determines the slowdown of the economic growth process.

Moreover, the empirical findings by Mihut et. al (2015) indicated that low level of external debt is associated with a high rate of economic growth and vice versa. In addition, scholars suggest evaluating the public external debt, while the private external debt imperceptibly influences the economic growth. The study revealed that there is a negative relationship between the external debt and GDP growth in the EU member countries. Moreover, it was highlighted that the impact of the external debt in relatively rich countries (Luxemburg, Sweden, Ireland) tends to be lower compared to the transition EU member states.

However, Ogunmuyiwa (2011) using the Vector Error Correction Method (VECM) for Nigeria and data from 1970 till 2007 concluded that in the developing countries external debt is a symptom rather than a cause of economic slowdown.

Certain scholars agreed that in some cases the debt accumulation might lead to acceleration of economic growth over the short term. The research on external factors led growth by Joshua et.

al. (2020) demonstrated that external debt influenced economic expansion slightly positively. It might be explained by the fiscal policy measures when governments stimulate spending by borrowing the financial sources internationally, which additionally encourages the recovery in the economic activity and leads to increase in real GDP. In this case, increased spending and debt mean an investment in people or private markets that facilitate to the improvement in sustainability though. Moreover, accumulation of external debt might facilitate to support social sector and provide financial resources to the governments for the investment in resource-saving technologies and improve sustainability.

In recent studies, scholars attempted to evaluate how external debt influences components of sustainability. Sadiq et. al. (2022) concluded that in BRICS countries the long-run relationship of 1% increase in the level of external debt will lead to decrease in the human development and environmental pollution level by 0.0002%, and 0.07% respectively. In this case, positive effect of reducing of pollution due to the rising level of external debt exceeds compared to its negative impact on society. Researchers explained it by the fact that countries borrow financial resources to finance environmental protection and certain alternative energy projects. The study suggested policymakers use external debt as a benefit to improve environmental quality and invest in healthcare and education, which in turn would result in acceleration to achieving the sustainable development goals.

However, Grigoroudis et. al. (2021) highlighted that lower level of debt contributes to the improvement in sustainability, since if governments do not need to service and pay debts, they are able to spend more on the development projects in social sector.

Due to the effects of globalization and international trade the open economies have been influenced by the changes in **the exchange rate**. Scholars emphasized that real exchange rate plays the role of backbone in the economic growth of the country. At the same time, Joshua et. al. (2020) concluded the positive impact of exchange rate for South Africa and made the conclusion that the governments should pursue exchange rate stability for the economy. In this reason, currency depreciation should not be considered an option, even it might stimulate export sales and economic growth in short term.

Nevertheless, certain scholars claim that not depreciation, but the undervalued exchange rate might promote the economic growth. Rodrik (2008) presented the empirical evidence based on cross-country panel regressions. It was highlighted that developing countries that systematically undervalue their national currencies in real terms have faster economic growth than their counterparts that do not. A 50% undervaluation of the exchange rate is associated with a five-year growth rate that is about 1.3 percentage points above the country-specific mean.

For certain developed export-oriented economies this tool might be also beneficial in short term. Shafi et. al. (2015) empirically obtained significant results that the impact of real exchange rate volatility in Germany had positive impact on GDP. In this case, the devaluation of currency in short term to the US dollar makes the export of goods and services more competitive from the point of price in the international markets, while making foreign goods and services less competitive in the domestic market by becoming more expensive. This is one of the reasons why certain EU export-oriented countries (Sweden, Poland, Czech Republic) still did not join the Euro area since their Central Banks will not be able to utilize monetary tools and influence the exchange rate flexibility to maintain export and economic growth. However, the depreciation of the exchange rate decreases elements of sustainability through the social channel: welfare of the citizens through the channel of import inflation and lowering purchasing power. Thereby, if socio-economic conditions are worsened it leads to the unsustainable consequences. In this case, the exchange rate volatility is considered in the long run as a threat both to economic growth and sustainability.

However, in the study of Barguelli et. al. (2018) was detected that in developing countries the relationship between exchange rate volatility and dynamics of economic growth is negative. Based on the panel of 45 countries during 1985-2015 the authors concluded that in the long run countries with flexible exchange rate regime experience from -0.08% to -0.04% decrease in economic growth due to the volatility in exchange rate. At the same time, in the countries with fixed exchange rate regime the relationship was not detected.

Not many studies were devoted to the relationship between exchange rate and sustainability. Karagiannopoulou, et. al. (2022) analyzed relationship between exchange rate and carbon emissions in socially responsible companies. The results of the research vary in the time-range and suggest that in the short run, the exchange rate of euro to US dollar has a positive effect on the global emission, while in the long run, it has a negative impact. Over the short-term, scholars explain such differences as the effect of company's policies, when they incorporate alternative energy resources to evade the effects of high crude oil prices, which are denominated in US dollars. At the same time, depreciation of US dollar in the long run might increase cost of sustainability projects in the companies and might slow down the achievement of sustainability goals. In this case, when the US dollar strengthens against other currencies, it results in increased trade transaction costs for non-American companies. Consequently, this discourages companies from considering environmental concerns in their business operations.

Furthermore, changes in the cost of national currency may lead to financial vulnerability, which can have broader implications for sustainability. For instance, currency crises resulted in

large-scale capital flight and economic dislocation, which exacerbated poverty, inequality, and environmental degradation.

Thereby, the insights of scholars about the impact of exchange rate and debt on economic growth differ regarding developed and developing countries. The public external debt might be a source for future economic growth and improve sustainability, when countries experience lack of financial resources, as a significant problem in the long run. If only the accumulation of government debt is not perceived as systematic source of financing budget deficit, but most probably signifies the cause of the other problems in the economy. Moreover, it is important for policymakers to carefully consider the potential impacts of exchange rate on economic growth and sustainability, and to develop strategies that balance short-term economic stability with long-term orientation to sustainable development goals.

### **1.3.2 Relationships between foreign direct investments and economic growth, sustainability**

One of the key results of globalization is that there has been tremendous growth in global foreign direct investments (FDI) specifically to the developing economies. This considerable development has taken place simultaneously with a significant growth in international trade.

The inflow of foreign direct investments has been a big source of external funding in transition and developed countries. The relationship between FDI and economic growth has been extensively discussed in academic research. Previous studies obtained contradictory results regarding the effect of foreign direct investments on the economic growth and sustainability. These studies most commonly used autoregressive models and panel data analysis to establish the linkage between FDI and growth.

The positive effects of FDI are admitted more frequently in scientific literature. Argwal (2011) utilized the production function, adding the FDI as one of the independent variables in the model. Using the OLS (Ordinary Least Square) method for the empirical research it was concluded that a 1% increase in FDI would result in steady increase in GDP of China 0.07% and India 0.02%. In this case, economic growth in China is more affected by FDI, than in India due to the stronger inflow into the real and financial sectors of the economy.

Since the current study is going to verify if the inflow of foreign direct investment has an impact on the economic growth in EU8 countries it is necessary to mention the research regarding the relationship between FDI and economic growth in the Baltic states. The study Irandoust (2016) obtained quite controversial results, for instance, it has been shown that the bidirectional causality between FDI and economic growth in Estonia exists. However, in Latvia and Lithuania, there was unidirectional nexus such as running from FDI to growth. The results suggested that by promoting

growth and structural reforms, the recipient countries can encourage FDI inflows and, in turn, can affect positively economic growth.

Furthermore, the relationship between economic growth rate, savings and foreign direct investment have been examined for the economy of Poland over the period 1992-2016 by using the Autoregressive Distributed Lag (ARDL) bounds testing approach. According to the results Soyulu (2019) a 1% increase in FDI leads to a significant 1.52% increase in the economic growth rate. Besides, foreign investments are one of the main driving forces for economic growth in Poland.

There are obvious differences in the comparison between transition and developed countries. The advanced economies do not have to rely only on foreign direct investments or foreign capital as a main factor of their economic growth. (Mihut, I. et. al, 2015). However, Joshua et. al. (2020) concluded that foreign direct investments had a neutral positive impact on the economic expansion in developing countries.

Moreover, certain scholars suggested that the inflow of FDI could have both positive and negative impacts on economic growth rate. For instance, Upreti (2015) concluded that the coefficient of impact the FDI was positive in the year 2010, while in the year 2000 was negative. As for the economic meaning of the parameter in regression for 2010 it was concluded that a 1% increase in FDI was equivalent to 0.13% GDP per capita growth among the least developed countries.

Those countries that are more globalized and relatively more open to international trade and foreign direct investments, register higher levels of development compared to the ones that are considered as closed. Conventional literature asserts that trade liberalization and increased economic integration with more developed countries bring higher growth to transition economies.

FDI has gained substantial importance in the last decade as a means of accelerating the growth and development of economies (Soyulu, 2019). Moreover, Mihut. et. al (2015) concluded that the impact on the economic growth is positive when developing countries are open to the capital inflows and external financial resource.

Scholars suggested that not only attraction of traditional foreign direct investments, but investments in greenfield projects to be efficient way to achieve the sustainability. Neto et.al. (2008), Yahya & Rafiq (2020) agreed that the inflow of greenfield investments exert a significant positive impact on economic growth and achieving sustainability in both developed and developing countries. The forms of greenfield investments enhance the productivity capacity of the firms, and increase the employment, which in turn is crucial factor for the economic growth of host countries.

Laeven (2005) emphasized that the poor quality of institutions can significantly impede sustainable development and growth in developing countries. Upgrading these institutions may face substantial obstacles, particularly in cases where there is heavy reliance on natural resources and ineffective governance hindering necessary reforms. Moreover, for transition economies, the successful and sustainable restructuring of the economy necessitates the acceleration of reform policies in external spheres.

It is important to mention that FDI was one of the drivers of the improvements in sustainability. Asongu & Odhiambo (2021) declared that increasing FDI has a net negative effect on CO<sub>2</sub> emission. In this case promoting investments positively affects the sustainable development due to the environmental activities and corporate social responsibility of investors. FDI inflows gap between 28.6% and 66.6% to GDP is assumed as the most favorable level for promoting green economy.

Therefore, scholars obtained controversial results about the role of FDI in cultivating economic growth and sustainability. That is why it is important to investigate in current research to what extent FDI as one of the external factors affects the economic growth and sustainability in the selected former transition countries.

It is crucial for governments to take into account the changing external conditions which can significantly impact economic growth and sustainability. This is precisely the reason why the external factors have to be contracted in close regard with the specific needs of the economy. The author concludes that the existing literature provides a systematic and symmetric empirical analysis of the influence of the external factors on economic growth, but still there is a lack of such studies regarding sustainability.

The review of academic literature indicates that many scholars have raised concerns about the identification of the benefits of external factors for the economy. The relationships between economic growth and sustainability and external factors have been investigated using various methods such as comparative analysis, econometric VAR models, dynamic and stationary ordinary least square method, VEC method and others. In certain cases, the external factors demonstrated positive and negative effects regarding investigations across developed or transition economies. Scholars admit the dominance of globalization in the externality's forces. In more detailed way trade linkage and trade openness of the economy leads to better economic growth. Moreover, the existing convergence effect and international spillovers drive economic growth but might influence sustainability both in negative and positive ways. Regarding the attraction of foreign direct investments scholars have detected mostly positive impact on growth and sustainability. The role of vulnerability reflected by external shocks (oil price fluctuations, debt and financial crises) mostly negatively influences economic growth and sustainability.



## 2. METHODOLOGY FOR THE ASSESMENT THE INFLUENCE OF EXTERNAL FACTORS ON ECONOMIC GROWTH AND SUSTAINABILITY

In this chapter of the Master thesis the author describes the research methodology, which is applied to the assessment of the influence of the external factors on economic growth and sustainability. The current study utilizes a panel multiple regression analysis to accept or reject the hypotheses.

### 2.1 Justification of the research model and research steps

The purpose of the current research is to empirically reveal the influence of external factors on economic growth and sustainability in former transition countries. The assessment of the impact of the external factors is based on multiple indicators that are mainly related to the risky and possible consequences of globalization and are reflected in the research model. The external factors are identified by the literature review and other research reports, scientific articles regarding the problem of maintaining economic growth and sustainability. The research model (figure 2) of the current study includes such elements as:

1. Dependent variables are the economic growth and sustainability.
2. Independent variables such as foreign direct investments, trade openness, public debt, exchange rate and crises.

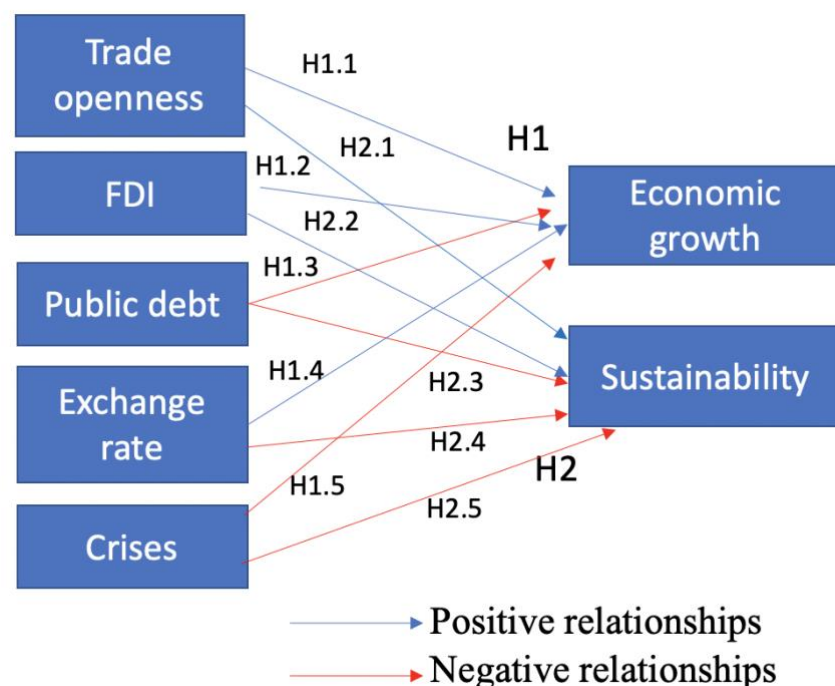


Figure 2. Research model.

Source: developed by the author, based on the literature analysis.

In this case, current research model indicates (figure 2) that in former transition EU8 countries such external factors as trade openness, foreign direct investments and exchange rate positively influence the economic growth, while the increase in debt and crises have a negative impact. Sustainability is influenced by the inflow of foreign investments, trade openness and crises positively, while the exchange rate and increase of the debt provoke the decline in sustainability in selected EU countries.

In order to conduct the empirical study, the research process is divided into steps that are presented in figure 3. The detailed process of the work done, and the explanations are provided below.

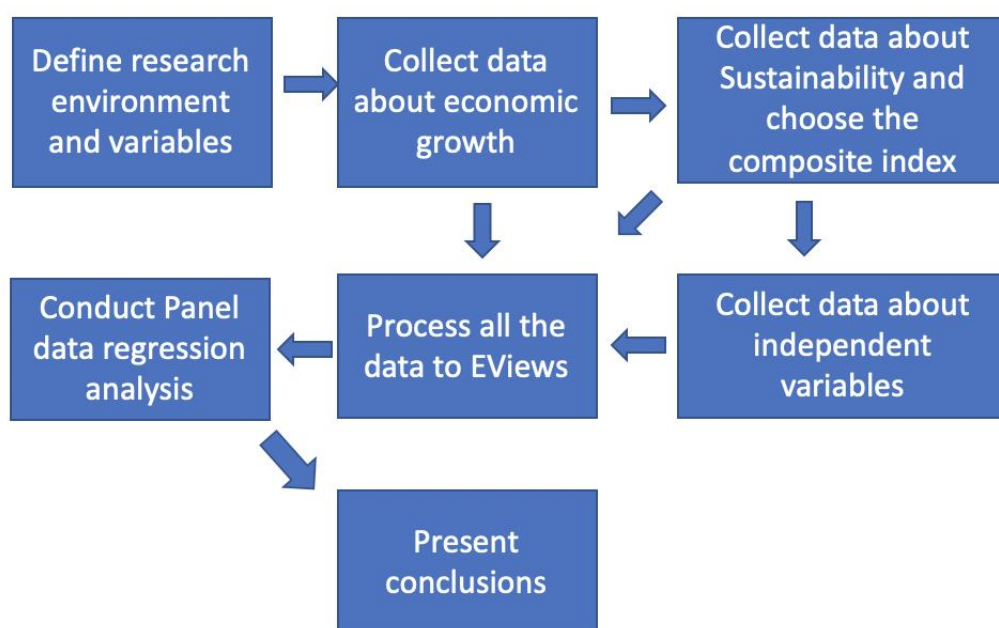


Figure 3. Steps of research process.

Source: developed by the author, based on Mućk (2018).

**The main research question** is to identify to what extent external factors influence the economic growth and sustainability in the EU8 economies. In order to answer this question, the author assumes **2 main hypotheses**, that subdivided into 5 sub-hypotheses each, according to the impact of 4 main independent variables and dummy variable on 2 dependent variables.

H1: In the EU8 countries the external factors such as trade openness, inflow of foreign direct investments, public debt, exchange rate and crises considerably influence the economic growth:

H 1.1 trade openness positively influences economic growth;

H 1.2 FDI inflow positively influences economic growth;

H 1.3 increasing public debt negatively influences economic growth;

H 1.4 depreciation of exchange rate positively influences economic growth;

H 1.5 crises negatively influences economic growth.

H2: In the EU8 countries the external factors such as trade openness, foreign direct investments inflow, public debt, exchange rate and crises considerably influence sustainability:

H. 2.1 trade openness positively influences sustainability;

H 2.2 FDI inflow positively influences sustainability;

H 2.3 increasing public debt negatively influences sustainability;

H 2.4 depreciation of exchange rate negatively influences sustainability;

H 2.5 crises negatively influences sustainability.

The final decision whether the hypothesis is accepted or rejected will be made in accordance with the research methodology presented below.

## 2.2 The explanation of research variables and research methodology

**Description of variables.** The selection of variables is generally based on the literature review regarding the influence of external factors on economic growth and sustainability. The variables have been incorporated in the functional model, which includes 2 dependent variables (1-2), 4 main independent variables (3-6) and dummy variable (7) that are measured by:

1. economic growth as GDP in constant prices of 2015 in US dollars (RGDP).
2. sustainability as sustainable development goals index (SDGI);
3. foreign direct investments (FDI) as net inflow ratio % of GDP;
4. trade openness as trade flow ( $|\text{export}| + |\text{import}|$ ) to GDP in percentages (TO);
5. public debt (DBT) as general government gross debt (% of GDP);
6. exchange rate (EXR) as the official exchange rate of local currency unit in US dollars;
7. dummy variable of crisis in 2008-2009 and 2020 (CRS) equal to 1.

**Description of data.** The dataset for the current research is collected from open sources and statistical databases such as World Bank (World Development Indicators), IMF (World Economic Outlook), Eurostat database, Bank of Lithuania, Statistical committees of selected countries (Annex 1).

For the empirical calculations, the dynamics of the real GDP for the variable **economic growth** were taken from the World Bank database “World Economic Indicators”. Since the GDP presented in constant prices of 2015 (real GDP) the inflation factor is excluded and the results of analysis will not be misrepresented. In addition, it contributes to the precise estimations of the model. Joshua et. al. (2020) used real GDP in constant prices of 2010 as a measurement of dependent variable of economic growth in order to evaluate influence of external factors and construct the model.

**Sustainable development goals index (SDGI).** In order to evaluate the impact of external factors on sustainability the author utilizes the sustainable development goals index. It is important to note that the aggregated indicators of sustainability are employed for a generalized assessment taking into account the set environmental, economic and social goals. The time series data is taken from the United Nations initiative “Sustainable development solution network” for the period of 2000-2021.

According to Sachs et. al. (2022) SDG index includes 94 global indicators as well as 26 additional indicators specifically for OECD countries. The SDGI is calculated in conformity with the OECD Handbook on constructing composite indicators methodology and user guide. It is measured to assess each country's progress towards achieving the 17 sustainable development goals and covers 163 countries. The index ranges from 0 to 100 and comprises a broad range of issues such as poverty, hunger, health and well-being, education quality, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice and strong institutions, partnership for the goals. Moreover, Xu et. al. (2020) utilized this indicator to evaluate the relationship between trade and sustainability.

The author selected the **trade openness** as the indicator of the economy which explains the extent of the dependency of the national economy on the external demand and linkage to the rest of the world. This variable (TO) is calculated as the ratio of the sum of the exports and imports of the countries to the GDP. The time series was taken by the author from the World Bank database. Arora & Vamvakidis (2011), Silajdzic & Mehic (2018) utilized this indicator as one of the variables in order to assess if the relationship exists between trade and economic growth. Sowah & Kirikkaleli (2022) evaluated the impact of world trade on environmental sustainability utilizing indicator of trade openness.

Such independent variable as **Foreign direct investment (FDI)** is measured as net inflow of FDI ratio in percentages to GDP. Soylyu (2019) utilized this measurement of variable for the assessment the relationship between FDI and economic growth. The series of the net inflow was extracted from the World Bank database. Since this indicator might be both positive and negative, the data of FDI will be differentiated for the regression estimations.

The variable **public debt (DBT)** is measured as the general government public debt in percentages to GDP. Grigoroudis et. al. (2021) utilized the general government public debt as one of the indicators included in tertiary variable and component wealth which influence social component of sustainability. Upreti (2015) measured the debt similarly as the ratio between government debt and GDP in order to reveal the relationship between economic growth. The time

series on general government public debt extracted from the IMF World Economic Outlook database.

**The exchange rate (EXR)** was chosen as one of the independent variables since Nawaz et al. (2014), Joshua et. al. (2020) concluded that it has been one of the factors which influence economic growth. In the current research, it is going to be verified if this relationship exists since transition countries are liable to the fluctuations in exchange rates, since export-oriented countries benefit from the undervaluation of their currency. However, the exchange rate influences sustainability negatively through the social channel. Since Slovenia, Lithuania, Estonia, Latvia, Slovakia have been accepted to the Euro zone in 2007, 2015, 2011, 2014, 2009 respectively, there were recalculated the exchange rates of USD to their national currency according to the ratio between USD/EUR and EUR/SLO, EUR/LTU, EUR/EEK, EUR/LVL, EUR/SKK. The data set on the exchange rates was taken from the Eurostat database and statistical comities of the selected countries.

**Dummy variable of crises (CRS)** is used to improve the whole quality of the models due to the significant fluctuations both in the independent and dependent variables of the panel. Selection of the time based on the research of Chen & Yeh (2021), where it was concluded that the most significant impact of external shocks was conditioned due to the global financial crisis in 2008-2009 and the COVID-19 recession in 2020. The World Bank estimated these periods when world economic growth amounted to its minimum values for the past two decades (2% in 2008, - 1.3% in 2009, - 3.1% in 2020).

**Location and time frame of the research.** The panel data consists of 176 total observations of units since T time periods ( $t = 22$ ) and N the number of countries ( $i = 8$ ). The recent study by Jenkins & Quintana-Ascencio (2020) suggested that not heavily concentrated sample size should be equal to  $N \geq 8$  with minimal deviation or  $N \geq 25$  with greater variability. In this case, the current models meet the regression assumptions.

The scope of the study includes annual cross-country series for 2000-2021 per EU8 Central and Eastern European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia). Those countries have been selected among the panel of countries that joined the EU during the enlargement in 2004, due to their common economic development level, similar background, income level, and geographical location in mainland EU. The selected formerly transition countries are considered at present times as the developed economies according to the World Bank.

**Model specification.** In order to reveal the influence of the external factors on economic growth and sustainability there will be designed 2 main equations, which will be the basis to check the subhypotheses H1.1-H1.5 and H2.1-H2.5.

The author proposes to test 2 models taking into account external factors which promote economic growth (RGDP) and sustainability (SDGI). The linear form of the models is expressed as regression equations for the panel of selected countries :

$$RGDP_t = \beta_0 + \beta_1 FDI_t + \beta_2 TO_t + \beta_3 DBT_t + \beta_4 EXR_t + \beta_5 CRS + \varepsilon_t , \quad (1)$$

$$SDGI_t = \beta_0 + \beta_1 FDI_t + \beta_2 TO_t + \beta_3 DBT_t + \beta_4 EXR_t + \beta_5 CRS + \varepsilon_t , \quad (2)$$

where  $\beta_n$  and  $\varepsilon_t$  are the influence of coefficients and residual terms, respectively.

To be specific the positive influence on economic growth and sustainability in hypotheses of FDI, trade openness, exchange rate and crises are confirmed if the estimated parameters follow  $\beta_1 > 0$ ,  $\beta_2 > 0$  and  $\beta_4 > 0$  (equation 1, H 1.4); negative relationship if debt reducing hypotheses (H 1.3 and H 2.3) are confirmed in case of  $\beta_3 < 0$ , exchange rate (equation 2, H 2.4)  $\beta_4 < 0$ , crises  $\beta_5 < 0$ . In addition, the coefficients of equations must be significant at 95% level, where probability level  $p < 0.05$ .

**Methods of the research.** The quantitative analysis will be implemented to achieve the main purpose of the Master thesis. Regarding the model of the research panel multiple linear regression analysis will be utilized in order to reveal the relationship between the variables. After the data was collected, the author proceed them into the EViews software to obtain the results and testing at various stages of the modeling.

The stages of panel data analysis and methodology are presented in figure 4 and explained below.

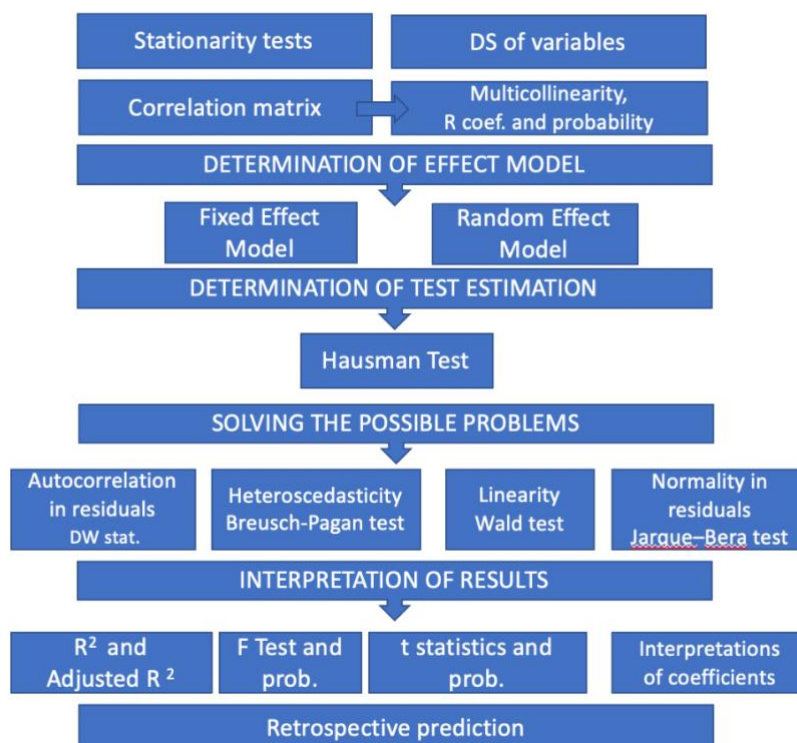


Figure 4. Panel regression analysis structure.

Source: developed by the author, based on Rhoton (2014), Brooks (2008).

In the current study, the diagnostic test is applied to ensure the appropriateness of the panel ordinary least squares (POLS) estimation based on both theory and statistics tools. The primary technique used for analyzing the panel data is OLS regression. Utilizing the POLS approach for estimating economic growth and sustainability models proves to be highly advantageous, as it facilitates the straightforward examination of model assumptions, such as linearity and the impact of outliers, through tests and graphical methods.

In order to stabilize dispersion and exclude impact of trend and cycle components to achieve **stationarity** and normality of panel data (Annex 1) certain variables such as economic growth (DLOG RGDP), sustainability (DLOG SDGI), exchange rate (DLOG EXR) are transformed using natural logarithms according to Brooks (2008). Taking a logarithm benefits rescaling the data, so that their variance is more constant, which overcomes a common statistical problem. It is also useful to adjust a positively skewed distribution closer to a normal distribution, as well as to convert a non-linear, multiplicative relationship between variables into a linear form. To avoid compromising the model's significance, the equations are represented in a 'logarithmic form' with the aim to render the elasticities of the coefficient estimates. In addition, the variables mentioned above and the others such as trade openness (D TO), foreign direct investments (D FDI), public debt (D DBT) are going to be differentiated in order to obtain elasticity coefficients among these parameters that cannot be taken logarithm. The 1st difference variables are represented as D.

According to Liu et. al. (2020) Im, Pearsan and Shin W-statistic, Fisher ADF and PP Fisher panel unit root tests will be applied to estimate **the stationarity** (figure 4) of the data. In order to verify the stationarity of the data p-levels of the tests must be lower than 0.05 at confidence level 95%.

In addition, the author included time-lagged variables in the models. In that step the auxiliary influence of delay on dependent variables will be checked. If certain lagged variables represent higher coefficients of correlation compared to the normal ones and will be statistically significant, they are eligible to be used during the panel data regression analysis. This manipulation helps to improve quality of the model and build more accurate and nuanced understanding of the relationship between the variables.

**Descriptive statistics of variables** (figure 4) outlines the fundamental characteristics of datasets and the foundation of quantitative analysis, which involves determining the central tendency and variability. This type of analysis includes two types of averages (mean and median), mathematical and positional averages, that help to measure these characteristics.

In order to obtain relevant results using OLS method (Rhoton, 2014) the following preconditions must be verified:

1. Multicollinearity, when there is no strict or strong linear relationship between the explanatory variables (correlation matrix and  $p < 0.1$ );
2. Absence autocorrelation in residuals, when random deviations must be independent of each other (Durbin-Watson statistics in the range 1.5-2.5);
3. Homoscedasticity (constancy of variance of deviations). The variance of random deviations  $\varepsilon_t$  is constant for all observations (Breusch-Pagan test,  $p < 0.05$ );
4. The model is linear with respect to the parameters (Wald test,  $p < 0.05$ );
5. Errors  $\varepsilon_t$  have a normal distribution (Jarque-Bera statistic test,  $p > 0.05$ );
6. The random deviation should be independent of the explanatory variables (F test,  $p < 0.05$ ).

It is important to mention that during the **correlation analysis** (figure 4) there will be evaluated the relationship between all variables included in the model. It is considerably necessary to check the results of the analysis for collinearity as the dataset may have high correlations between the independent variables. **Multicollinearity** is an assumption in which the variables do not produce a correlation of an R value of 0.7 or greater (Tabachnick & Fidell, 2007). A value of greater than critical level suggests the variables are too highly correlated and therefore not needed to be included in the sample analysis. In this case, the collinearity issue could be solved by dropping one of the collinear variables in the model.

According to Maune (2019) determination of the effect in model is based on **Hausman Test** (figure 4), which is most appropriate to use in estimating panel data. If the probability of the test is more than 0.05 then the random effects model is appropriate, fixed effects model is appropriate if  $p < 0.05$ . If the fixed effect model demonstrates satisfying quality of the regression in the end of the analysis it will be presented the separate cross-country effects of factors on the dependent variable.

**Homoscedasticity** is an assumption in which data is expected to be spread evenly near the line of best fit in a bivariate relationship (Brooks, 2008). Analyzing the residuals graphically can be helpful in verifying if the random deviations are normally distributed. Furthermore, the Breusch Pagan test is utilized to determine if the variance of the errors in a regression model is related to the values of the independent variables. In this case, residual cross-section dependence test was performed in EViews. If the test statistic yields a p-value less than the chosen significance level (0.05), the hypothesis that the variance is constant across the data is rejected and the presence of heteroscedasticity is concluded. In addition, the results of regression analysis will be tested using Durbin-Watson statistic (DW) in order to assess the presence of autocorrelation in residuals of the first order. The normal level of DW statistics must be in the range of 1.5 to 2.5 and compared to the critical level for the regression regarding number of observations and number of independent



variables. On the contrary, if heteroscedasticity will be discovered then t- and F- statistics as well as the interval estimations are considered as unreliable.

Moreover, in order to check the **normality** of residuals in the model, Jarque-Bera statistic test of residuals will be utilized in EViews software. Thadewald, T., & Büning, H. (2007) specified that this test measures the difference of the skewness and kurtosis of the series with those from the normal distribution. A probability level of Jarque-Bera statistic test, if  $p\text{-level} < 0.05$  leads to the rejection of the null hypothesis of a normal distribution in residuals. In order to accept the normality precondition,  $p$  level must exceed 0.05 at the significance level of 95%.

**Linear restrictions** in the model are checked by the Wald test and assess the significance of a set of parameters in a regression model. Mućk (2018) suggests that the hypothesis  $H_0$  is rejected in case of level of probability of Chi-square and F-statistic is lower than 0.05

Checking the quality of the estimated regression equations is carried out in the following directions:

1. checking the overall quality of the regression equation ( $R^2$ );
2. checking the statistical significance of the coefficients in the regression equations ( $p < 0.05$ );
3. checking the data characteristics, the feasibility of which was assumed when evaluating the equation (checking the preconditions OLS 1-6 listed above).

The testing of the specification of the model will be applied to approve the reliability and validity of the parameters by methods of statistical analysis such as standard deviation, regression, hypothesis testing and sample size determination. **Descriptive statistics of the model** will be applied for the analysis of the regression. It explains the coefficients of determination, standard deviation values in the data. In addition, regression analysis explains the relationship between independent and dependent variables as well.

After checking the significance of the regression coefficients, the general quality of regression equations will be verified using the coefficient of determination  $R^2$  (R square). If the value is more than 0.5 then the ability of the predictor variable is strong in explaining the response variable.

Aiming to confirm the goodness of fit of the models and the **statistical significance** of the estimated parameters the results of F-statistics and p-value will be obtained. Statistical significance will be checked by Fisher test of the overall fit, followed by t-statistics of individual parameters in comparison with the critical values of those parameters. F value indicates the significance level of influence of predictor variable on response variable. If the p value is less than the critical limit 0.05 then rejecting  $H_0$  or which means simultaneous influence of predictor variable to the response

variable proved statistically significant. On the contrary, if the p value is more than the critical limit then  $H_0$  is accepted and simultaneous influence of predictor variables to the response variable is not proven to be statistically significant.

The last step of the panel data regression is to make a **retrospective prediction** (figure 4) in order to assess the performance of the model on historical data. This involves comparing the actual values of the dependent variable with the projected numbers. The graphic method is utilized to verify the ability of the model to capture spikes in the data, because it can help identify the quality of the equations for forecasting.

Summarizing the implications of the current research methodology there are 2 main hypotheses and 10 subhypotheses will be verified and tested using the panel regression analysis in order to examine the influence of external factors on economic growth and sustainability in EU8 countries. The approach to be utilized in the study are the least squared panel multiple regression analysis. The description of variables, data, sources and the collection methods were presented and described. The statistical information includes annual time series for the period 2000-2021 across EU8 former transition countries. In addition, procedures for the research were explained, and it was provided the methods by which the secondary data will be tested and analyzed.

### 3. RESULTS OF THE EVALUATION OF THE INFLUENCE OF EXTERNAL FACTORS ON ECONOMIC GROWTH AND SUSTAINABILITY

In this chapter of the Master thesis, the author provides the empirical results of the research and conclusions regarding the analysis. The following evaluation of the influence of external factors on economic growth and sustainability was performed based on the methodology mentioned in the previous chapter.

The independent and dependent variables were coded and should be interpreted as follows: DLOG (RGDP)\*100 stands for economic growth, DLOG(SDGI)\*100 refers to sustainability, D (OPN) is trade openness, D (FDI) denotes to foreign direct investments, DLOG (EX) \*100 stands for exchange rate, D (DBT) refers to public debt. The first difference variables are represented as D, logarithm transformation of series refer to LOG. The time-lagged factor variable is presented as (-1).

Table 1

*Panel unit root tests*

	Im, Pearsan and Shin W-stat.	probability	Fisher ADF	probability	PP Fisher	probability
DLOG(RGDP)	-4.8	0.00	52.8	0.00	71.2	0.00
DLOG(SDGI)	-4.9	0.00	53.3	0.00	174.7	0.00
D (TO)	-6.7	0.00	73.3	0.00	96.7	0.00
D (FDI)	-10.3	0.00	114.5	0.00	671.7	0.00
DLOG (EX)	-5.3	0.00	56.9	0.00	79.6	0.00
D (DBT)	-3.3	0.00	37.9	0.00	70.0	0.00

*Source:* calculated by author in EViews.

The results of panel unit root tests (table 1) show that independent and dependent variables are stationary at 1 difference level. The probability of Im, Pearsan and Shin W-statistic, Fisher ADF and PP Fisher tests are significant ( $p < 0.05$ ), therefore, these variables are to be applied for conducting the regression analysis.

#### 3.1 Analysis of the influence of external factors on economic growth

The testing of hypotheses regarding the influence of external factors on economic growth has been performed according to the methodology of the regression panel data analysis. It was done in order to obtain empirically proven analysis and statistically significant results.

Since the variables have been transformed into nonstationary time series during the coding by methods of differences and logarithm and verified by Panel unit root tests, the author concludes that the effects of the independent variables on economic growth are the same for all units in the panel (table 1).

As it is shown in the table 2, the descriptive statistics indicate the behavior of transformed variables. Relatively low standard deviations of all variables to mean, except D(FDI), suggest that data are clustered around the mean and are reliable for further analysis. Moreover, series of D(FDI) are relatively more volatile compared to other variables.

Table 2

*Descriptive statistics of variables*

	DLOG(RGDP)	D(TO)	D(FDI)	D(DBT)	DLOG(EXR)
Mean	3.04	2.43	0.13	1.13	1.27
Median	3.49	1.77	0.11	-0.24	2.0
Max	11.30	26.9	100.30	17.7	20.9
Min	-16.06	-25.8	-90.50	-7.0	-25.9
Standard deviation	4.32	8.95	14.98	4.53	8.15

*Source:* calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

According to the results of correlation analysis, the author deduces the following (table 3). The level of probability of correlation coefficient which is less than 0,1 fit to be applied in the further analysis.

Table 3

*Correlation matrix in the economic growth model*

	DLOG(RGDP) *100	DLOG(RGDP (-1)) *100	DLOG (EXR) *100	D(TO)	D(DBT)	D(FDI)	C R S
DLOG(RGDP) *100	1						
probability							
DLOG(RGDP (-1))*100	0.3214	1					
probability	0.0						
DLOG (EXR) *100	0.3049	0.2556	1				
probability	0.0	0.001					
D(TO)	0.4223	-0.3675	0.1316	1			
probability	0.0	0.0	0.097				
D(DBT)	-0.6784	-0.2568	-0.148	-0.224	1		
probability	0.0	0.001	0.062	0.004			
D(FDI)	0.011	0.0937	-0.007	0.032	0.007	1	
probability	0.889	0.238	0.93	0.685	0.924		
CRS	-0.6302	0.103	-0.053	-0.482	0.547	-0.059	1
probability	0.0	0.195	0.507	0.0	0.0	0.46	

*Source:* calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

First of all, variables have been checked on the existence of multicollinearity. The matrix shows that there is no strong correlation between independent variables ( $R < 0.7$ ). In this way, independent variables do not indicate multicollinearity and may be utilized further for building the model. Trade openness positively correlated with exchange rate ( $R = 0.13$ , (0.09)) and negatively with debt ( $R = -0.22$  (0.0)) and crisis ( $R = -0.48$ , (0.0)). The exchange rate has a negative relationship with debt ( $R = -0.15$ , (0.06)). The FDI has not demonstrated any significant relationship between independent variables.

Secondly, the coefficients of determination between economic growth (DLOG (RGDP)) and independent variables are statistically significant and can be relayed further for the construct of regression equation, except the D FDI,  $R = 0.01$  (0.89). In this case, during the construct of the model, FDI is excluded due to the statistically insignificant results.

Furthermore, the selected variables mostly indicate the optimal level of coefficient of determination  $R$  and  $p$ -levels. For instance, the positive relationship between economic growth and variables such as trade openness D TO,  $R = 0.42$  (0.0), one time-lagged D LOG RGDP(-1),  $R = 0.32$  (0.0) and exchange rate DLOG (EXR),  $R = 0.3$  (0.0). At the same time, the debt  $R = -0.678$  (0.0) and dummy variable of crisis CRS,  $R = -0.63$ , (0.0) are strongly negatively correlated to economic growth.

The results of Hausmann test suggest that the random effect model should be used for the estimation the model of the influence of external factors on economic growth (Chi square = 2.1,  $p = 0.83$ ).

The full results of the panel regression analysis of the influence of external factors on economic growth are presented in Annex 2 and the most important descriptive statistics of the model in the tables 4-5 below.

Taking into account that the Durbin-Watson statistic amounted to  $1.76 > 1.5$ , that reports conclusive results that there is slight positive autocorrelation in residuals and model has quite good quality for further utilization and diagnostic.

Table 4

*Descriptive statistics of the model*

R-squared	0.707
Adjusted R-squared	0.697
S.E. of regression	2.37
F-statistic	74.2
Prob(F-statistic)	0
Schwarz criterion	4.72
Hannan-Quinn criter,	4.65
Durbin-Watson stat	1.76

Source: calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

Table 5

*Descriptive statistics of the model*

Variable	Coefficient	Std. Error	t-Statistic	Probability
DLOG(RGDP(-1))*100	0.364	0.05	56.74	0
D(DBT)	-0.3	0.054	-5.55	0
DLOG (EXR)*100	0.057	0.025	2.31	0.02
D(TO)	0.147	0.027	5.5	0
CRS	-4.12	0.71	- 5.84	0.035
C	2.138	0.448	4.78	0

Source: calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

In addition, proceeding the residuals cross-section dependence analysis using Breusch Pagan test (annex 3), it was revealed that the residuals are homoscedastic ( $t=62.5, p=0.6$ ). Graphic visualization of the residuals in the current model (figure 5) additionally demonstrates the normal random distribution of the residuals. It verifies that there is no visual heteroscedasticity and the model is perceived as stable, so it can be beneficial for the research.

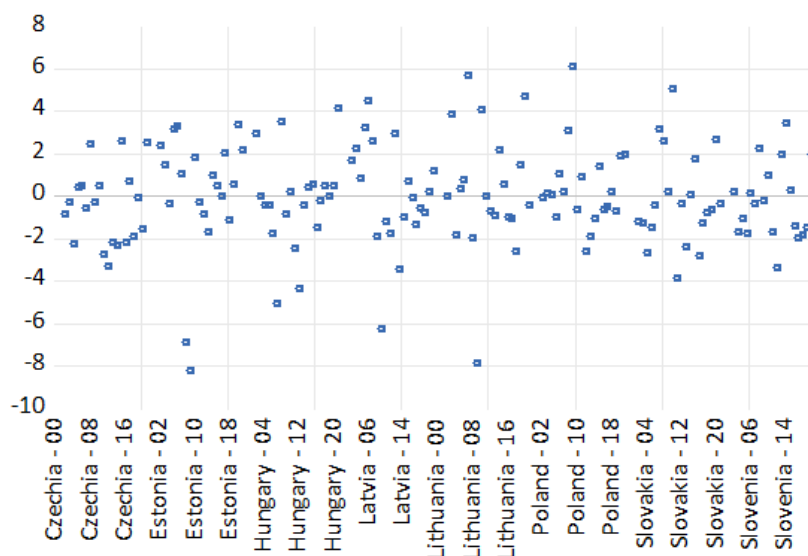


Figure 5. Residual plot in the economic growth model.

Source: developed by author in EViews, based on IMF, WordBank, Eurostat, 2023.

In addition, the parameters of the model are presented as statistically significant, and the assumption of linearity of the model has been verified by the results of Wald test ( $F=72, p=0$ ) where values of the coefficients are not equal to 0 (annex 4).

Moreover, the Jarque-Bera residuals test of normality approved the goodness of fit in the regression model ( $p=0.07$ ). Thereby, the goodness of fit of the model is confirmed, and it properly explains the influence of analyzed external factors on economic growth (figure 6).

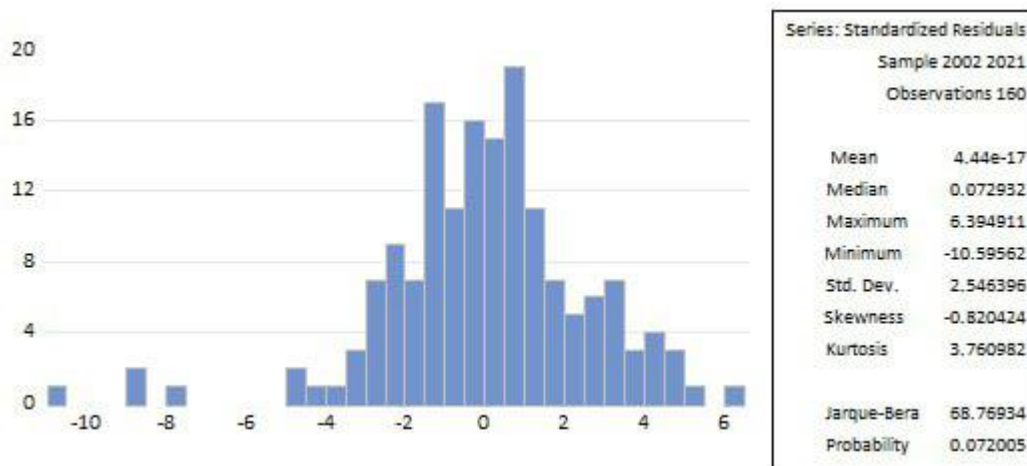


Figure 6. Normality test in the economic growth model.

Source: developed by author in EViews, based on IMF, WordBank, Eurostat, 2023.

The regression analysis obtained a satisfactory outcome since the descriptive statistics represented quite adequate quality of the model. The numbers of adjusted and R-squared equal to 0.71 and 0.7 respectively, suggested that this model has successfully explained more than two-thirds (70%) of the variance in economic growth in selected EU8 countries (table 4).

The overall significance of the equation is verified by the Fisher test, which indicates that the set of independent variables and model as a whole is statistically significant at a 95% confidence level ( $F=74.2$ ,  $p=0$ ). The t statistical analysis of the equation shows that all independent variables are statistically significant at a 95% confidence level, as indicated by their t-statistics and p-values ( $p<0.05$ ).

The equation for the model of economic growth has the following form:

$$\text{DLOG RGDP} = 2.06 + 0.36 \times \text{DLOG RGDP} (-1) + 0.15 \times \text{D TO} + 0.06 \times \text{DLOG EXR} - 0.3 \times \text{D DBT} - 4.12 \times \text{CRS} \quad (3),$$

The above regression equation 3 estimates the relationship between real gross domestic product (RGDP) and macroeconomic external variables in selected former transition economies.

The economic implication of the equation above defines that trade openness and exchange rates, public debt and crises are important determinants of economic growth in EU8 countries.

Specifically, the increase in trade openness in the selected countries by 1 % influence positively the economic growth by 0.15 %. This indicates that EU8 countries benefit from policies that promote trade liberalization and reduce barriers to international trade. An empirical investigation of Silajdzic & Mehic (2018) suggests the slightly lower impact of openness on

economic growth. In Central and Eastern European countries during the transition period scholars revealed that a 1% increase in trade openness will lead to the incline in GDP growth rate by an average of about 0.08%. The difference from the current analysis might be explained by the contrast period of analysis (1995-2013) and methods utilized for the assessment (Prais-Winsten-correlated panels corrected standard errors (PSCE)). Another example of common results was developed by Ribeiro et. al. (2012). Scholars suggested, that for Belgium and Denmark positive impacts vary from 0.26% to 0.28%. Joshua et al. (2020) concluded an empirical evidence that 1% improvement in trade openness will generate an equivalent of 0.3% GDP growth in South Africa. Comparing the findings of scholars and the current model author assumes that among the external factors, the positive role of trade openness remains considerable in the EU8 countries.

According to the equation 3, increase in exchange rate by 1 % leads to the improvement in economic growth by 0.06%. This suggests that EU8 countries could benefit from a flexible exchange rate regime that allows for slight fluctuations in the exchange rate, as it could lead to increased competitiveness and exports. Similarly, Joshua et al. (2020) revealed that 1% improvement in exchange rate will generate an equivalent of 0.0008% increase in economic growth in South Africa. Moreover, Shafi et. al (2015) concluded that 1 unit increase in exchange rate will cause 0.0002 units increase in GDP.

Furthermore, the lagged value of RGDP shows a positive persistence of current economic growth. Specifically, an increase in economic growth by 0.36 % in the next year (t+1) will be achieved by the acceleration and efforts in the current year. This suggests that the economy tends to continue its potential growth trajectory over the short run if there are no unpredicted negative effects. Quite similar results have been concluded in the study by Jianu at. al. (2017), where the increase of the economic growth in the previous year by one percentage point in the EU-15 countries led to acceleration in economic growth by 0.54 percentage points.

On the other hand, the increase of public debt by 1% drives the substantial decline of GDP by 0.3 %. This implies that the accumulation of the debt in long term by governments is one of the causes of the plummet in the economic growth and factor that limit the potential for GDP. The current findings comply with the investigation of Mihut et. al. (2015) where it was concluded that in the EU countries, the accumulation of debt brings negative consequences on economic growth. Similarly, Ribeiro et. al. (2012) evaluated that the negative impact of general government debt on GDP in Belgium and Lithuania is equal to -0.24 and -0.38 respectively.

The dummy independent variable of the crises revealed the significant decline in economic growth on average by 4.12%. Ribeiro et. al. (2012) concluded that dummy variable of financial crisis in Portugal and Italy hamper the GDP growth by 0.26% and 0.43%.



The economic explanation of equation 3 indicated that the policies of openness such as establishment of export-oriented enterprises, free movement of goods and services lead to the promotion of the economic growth in EU8 countries. Moreover, flexible exchange rate slightly benefits for the analyzed counties to increasing GDP. Improvement in these factors will proportionately favor economic growth.

According to the confidence intervals for the estimated independent variables (table 6) it is concluded that with 95% probability of the variance in coefficients of regression for public debt is in the gap from -0.41 till -0.19, for the exchange rate from 0.01 to 0.1 and the trade openness from 0.09 till 0.2. The negative impact of crises varies between -5.5 and -2.7 percentage points.

*Table 6*

Confidence intervals in the economic growth model

Variable	Coefficient	95%	
		Low	High
DLOG(RGDP(-1)) *100	0.364	0.257	0.47
DLOG (EXR) *100	0.057	0.008	0.106
D(TO)	0.147	0.094	0.199
D(DBT)	-0.299	-0.06	-0.93
CRS	-4.129	-5.525	-2.733
C	2.492	1.907	3.077

*Source:* calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

The analysis of the influence of external factors on economic growth suggests that subhypotheses 1.1, 1.3-1.5 are accepted, and 1.2 is rejected. The economic growth is positively influenced by trade openness and exchange rate, and negatively by the public debt and crises in the EU8 economies.

The results of the retrospective prediction of the dependent variable are presented in Annex 5 and in figures 7-9 below. According to the coefficients of the equation and real data of independent variables, projected values of DLOG RGDP have been obtained. The charts visually suggest that the equation specification correctly identifies the sudden rises or “spikes” that may be present in the data. For instance, the model demonstrates correct negative trends of economic growth in 2008-2009 and 2020 for all countries due to the external shocks. This indicates that the model is capable of accurately capturing any abrupt changes in the relationship between the external factors and economic growth. Moreover, equation perfectly finds initial values of independent variables for Czechia, Latvia and Estonia. However, there is a slight overestimation of the projected values of dependent variable in the period of normal times which is explained by the influence of the other non-included external and non-external factors.

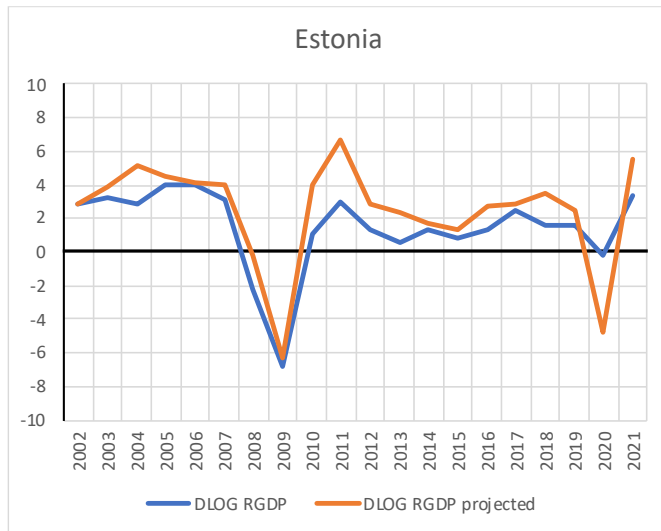


Figure 7. Retrospective prediction of economic growth for Estonia.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

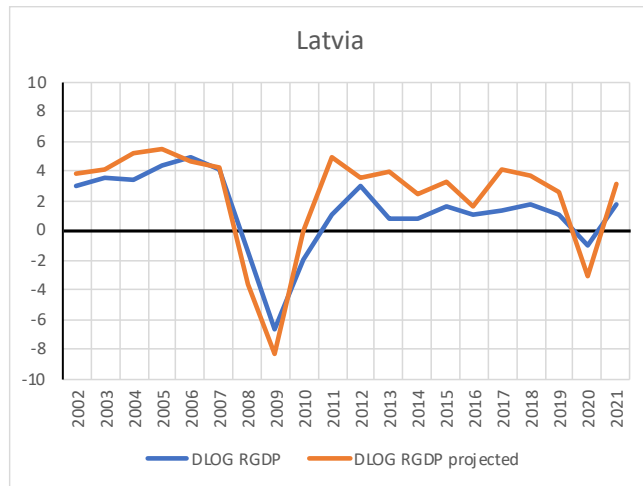


Figure 8. Retrospective prediction of economic growth for Latvia.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

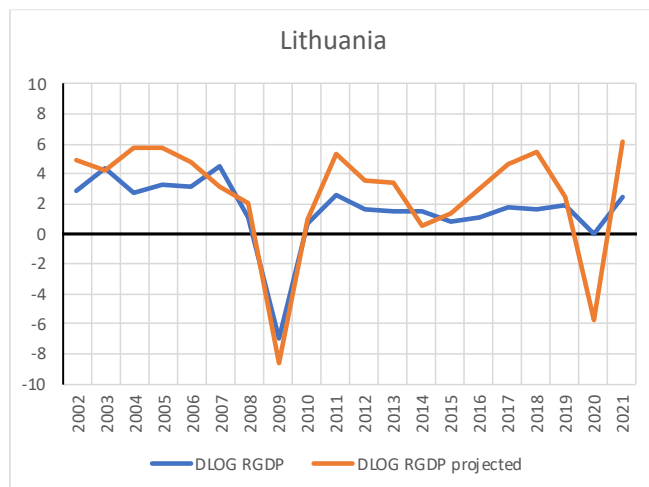


Figure 9. Retrospective prediction of economic growth for Lithuania.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

Overall, these findings provide important insights for the scholars and experts, as the model suggests that policies promoting trade openness of the economy, while controlling debt and exchange rate, can lead to the acceleration in the economic growth.

### 3.2 Analysis of the influence of external factors on sustainability

According to the methodology presented in the chapter 2 and the data presented in Annex 1 there was made correlation analysis (table 7) between transformed independent variables and SDG index in order to check multicollinearity and if needed exclude interdependent variables.

Table 7

Correlation matrix in sustainability model

	DLOG(SDGI)*100	D(TO)	D(FDI)	D(DBT)	DLOG (EXR)*100	CRS
DLOG(SDGI)*100 probability	1					
D(TO) probability	-0.074	1				
D(FDI) probability	0.025	0.028	1			
D(DBT) probability	0.065	-0.23	0.012	1		
DLOG (EXR)*100 probability	-0.091	0.158	0.006	-0.123	1	
CRS probability	0.029	-0.509	-0.061	0.554	0.028	1
	0.736	0	0.482	0	0.743	

Source: calculated by author in EViews, based on IMF, WordBank, Eurostat, Sustainable Development Report, 2023.

The results of correlation analysis show that DLOG (SDGI) has a low and insignificant correlation with all transformed variables. For instance, openness D (TO)  $R = -0.07$  (0.4), the exchange rate DLOG (EXR)  $R = -0.09$  (0.3), public debt D(DBT)  $R = 0.06$  (0.45) and foreign investments D (FDI)  $R = 0.02$  (0.77). Moreover, the author deduces that there is no multicollinearity between the selected above dependent variables since the R coefficient of correlation is lower than 0,9.

However, in order to doublecheck the subhypotheses 2.1-2.5 using a slightly different approach and improve the whole quality of the sustainability model, the author excluded the logarithm transformations of the statistical data and run the analysis again. In this case, non-stationary data would demonstrate the nature of the relationship between the variables in the regression model. Without the logarithm transformations, the sustainability analysis would rely

solely on the original scale of the data, which may reveal patterns or trends that were not visible in the transformed data.

As shown in Table 8, the descriptive statistics of the panel cross-country time series indicate the behavior of variables. Relatively low standard deviations of most variables to mean, except FDI and exchange rate, suggest that data are clustered around the mean and are reliable for conducting regression analysis.

Table 8

*Descriptive statistics of variables*

	SDGI	TO	FDI	DBT	EXR
Mean	75.9	129.65	5.8	39.3	0.32
Median	75.9	130.2	3.9	39.7	0.06
Max	80.6	189.8	106.6	82.6	2.08
Min	68.0	58.2	-40.1	3.8	0.00
Standard deviation	2,82	29.65	11.9	20.68	0.56

*Source:* calculated by author in EViews, based on IMF, WordBank, Eurostat, Sustainable Development Report, 2023.

The correlation matrix of non-stationary variables is presented below (table 9). According to the analysis coefficients of correlation R between sustainability and debt ( $R=0.38$ ,  $p=0$ ), trade openness ( $R=0.39$ ,  $p=0$ ) and dummy variable ( $R=0.14$ ,  $p=0,06$ ) are statistically significant. Such variables as exchange rate EXR and FDI have been excluded since the parameters were not statistically significant according to the p-levels in the correlation matrix. At the same time, there is no problem of multicollinearity between independent variables ( $R<0.7$ ).

Table 9

Correlation matrix in sustainability model

	SDGI	DBT	TO	EXR	FDI	CRS
SDGI probability	1					
DBT probability	0.375	1				
TO probability	0.393	0.285	1			
EXR probability	-0.0003	-0.212	-0.372	1		
FDI probability	0.04	0.089	0.108	-0.094	1	
CRS probability	0.144	0.023	0.026	0.013	0.196	1
	0.057	0.76	0.736	0.868	0.009	

*Source:* calculated by author in EViews, based on IMF, WordBank, Eurostat, Sustainable Development Report, 2023.

In this case, the subhypotheses 2.2 and 2.4 are completely rejected and concluded that FDI and exchange rate have no influence on sustainability.

Furthermore, the results of Hausmann test suggested that the specification of fixed effect model should be used for the assessment of the influence of external factors on sustainability (Chi square = 16.0, p=0).

The results of the panel regression analysis of influence of external factors on sustainability are presented in Annex 2 and in the tables 10-11 below. Descriptive statistics of the sustainability model reflect meaningful information on the quality of the equation coefficients. It provides the outcome for the current analysis of the impact on sustainability. The Durbin-Watson statistics (0.44) suggest that there is a positive autocorrelation in residuals (table 10).

Table 10

*Descriptive statistics of the model*

R-squared	0.803
Adjusted R-squared	0.7906
S.E. of regression	1.29
F-stat	67.09
Prob (F-stat)	0.0
Schwarz criterion	3.61
Hannan-Quinn criter.	3.48
Durbin-Watson stat.	0.44

Source: developed by author in EViews.

Table 11

*Descriptive statistics of the model*

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	62.1	0.69	90.1	0.0
DBT	0.04	0.01	3.8	0.0
TO	0.093	0.007	13.98	0.0
CRS	1.31	0.29	4.6	0.0

Source: developed by author in EViews.

Moreover, the results of Breusch Pagan test (t=158.4, p=0.13) revealed that there is no problem of cross-sectional dependence in the model and the coefficients of elasticity correctly describe the model (annex 3).

Utilizing the graphic visualization of the residuals in the sustainability model author confirms that the residuals in the sustainability model are homoscedastic (figure 10). In this case the model implies as stable one.

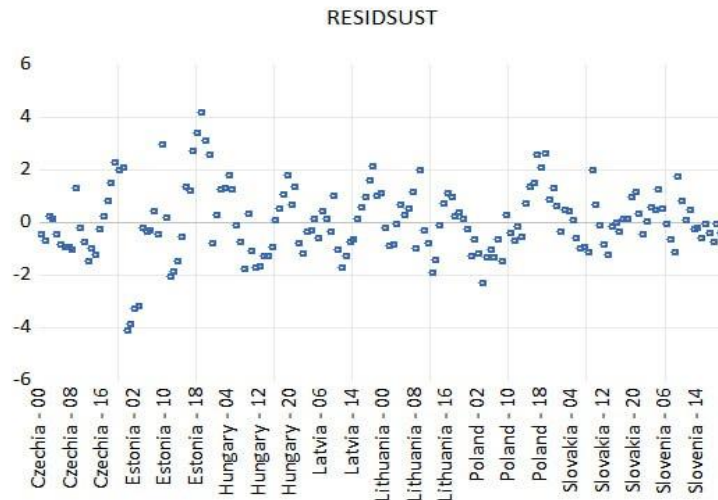


Figure 10. Residual plot in the sustainability model.

Source: developed by author in EViews.

Furthermore, the results of Wald test ( $F=143.5$ ,  $p=0$ ) verified the significance of the coefficients and assumption of the linearity of the model, since probability of F statistic is less than the significance level of 0.05 and the values of the coefficients are not equal to 0 (Annex 4).

Moreover, the results of Jarque-Bera test of normality of the model (figure 11) confirm the acceptance of the null hypothesis that residuals are normally distributed ( $p=0.52 > 0.05$ ). In this case, the validity of the model is confirmed with the limitation of autocorrelation in residuals.

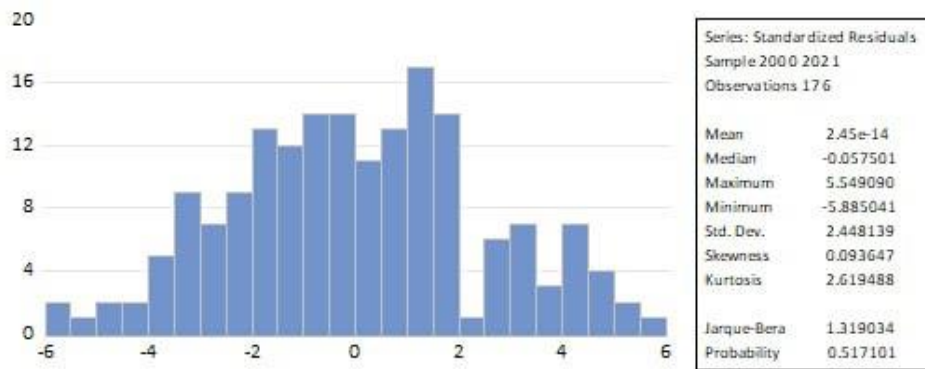


Figure 11. The results of residuals test of normality

Source: developed by author in EViews.

According to the results of panel regression analysis the independent variables explain over 80% of the changes in sustainability (table 10). Although this amount is probably overestimated, all other factors mostly satisfy the critical criterion and tests. For instance, the Fisher test (table 10) confirms the overall importance of the equation, revealing that the independent variables and the model as a whole are statistically significant with a 95% confidence level (67.1,  $p=0$ ).

The results of t test suggest that the coefficients of the equation exceed critical t criterion ( $t_{cr.1}>|1.985|$ ) and have a meaningful impact on the dependent variable. The p-levels of confidence of t-statistics across variables are less than 0.05 (table 11) that means with the 95% probability the coefficients of the equation are statistically significant and describe correctly the effects in the model.

The final equation of the sustainability model has the following form:

$$SDGI = 62.1 + 0.04 \times DBT + 0.093 \times TO + 1.31 \times CRS \quad (4)$$

According to the regression equation 4 the economic explanation of the model presented above suggests that debt, trade openness and crises influence sustainability in the selected panel of countries.

Moreover, findings suggest that the more open economy becomes the more sustainability index improves. A 1 point increase in trade openness leads to 0.093 surge in sustainable development goals index. Similarly, Xu et. al. (2020) concluded that sustainability index in developed countries is positively influenced by the trade openness. In addition, current findings comply with Asongu & Odhiambo (2021) that the minimum threshold of trade openness should be above 100% of GDP for promoting sustainability. For instance, in 2021 trade openness in EU8 member states vary from 112.4% in Poland to 187.8% in Slovakia, while mean is equal to 129.6% (table 8). Therefore, regression analysis suggests that subhypothesis 2.1 is accepted.

The incline in gross government debt by 1 point leads to a slight improvement in SDG index by 0.04 points. The results of the equation comply with findings Sadiq et. al. (2022) regarding favorable impact of debt funds on environmental component of sustainability. Since the positive relationship in the current model is quite low, it might be explained by the ways of managing and using borrowed financial resources in EU8 countries. If countries continue the debt policy aimed at construction of renewable energy infrastructure, green transportation systems, and sustainable agriculture practices it will reduce greenhouse gas emissions, protect biodiversity, and promote sustainable use of resources. However, current findings contradict the research model and findings of some scholars (Grigoroudis et. al. (2021), Ejigayehu (2013)), therefore the subhypothesis 2.3 is rejected.

Nonetheless, including the dummy variable of 2008-2009 and 2020 in the model helped to improve the whole quality of the equation. Such external shocks as crises led to the improvement in sustainability index by 1.3 points in the selected panel of countries. It is important to note that this impact may vary depending on the severity and nature of the crisis, as well as other external

factors. In this case, crises are assumed not a way of improving sustainability, but a possible opportunity to implement structural shifts. The current findings comply with the opinion of Abubakar et. al. (2021), Yang et. al. (2022) that due to the decrease in environmental pollution countries improve their sustainability, when crises times lead to a decrease in output and resource usage. However, the findings contradict the research model and, in this case, the subhypothesis 2.5 is rejected.

According to the estimation of coefficients in the model (table 12) it is concluded that with 95% probability, the variances are found for public debt in the gap from 0.02 till 0.06, the trade openness from 0.08 till 0.106 and the impact of crises varies between 0.75 and 1.88.

Table 12

Confidence intervals in the sustainability model

Variable	Coefficient	95%	
		Low	High
TO	0.093	0.079	0.106
DBT	0.041	0.019	0.062
CRS	1.313	0.748	1.878
C	62.1	60.736	63.457

Source: calculated by author in EViews.

In order to assess the forecasting quality of the current model and compare the projected and actual values of SDG index of a selected panel of EU8 countries, retrospective predictions have been conducted (Annex 6, figures 12-15).

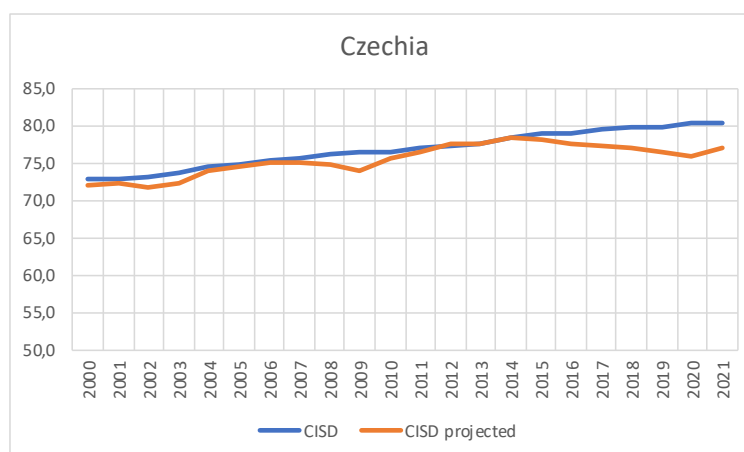


Figure 12. Retrospective prediction of SDGI for Czechia

Source: developed by author, based on Sustainable Development Report, 2023.



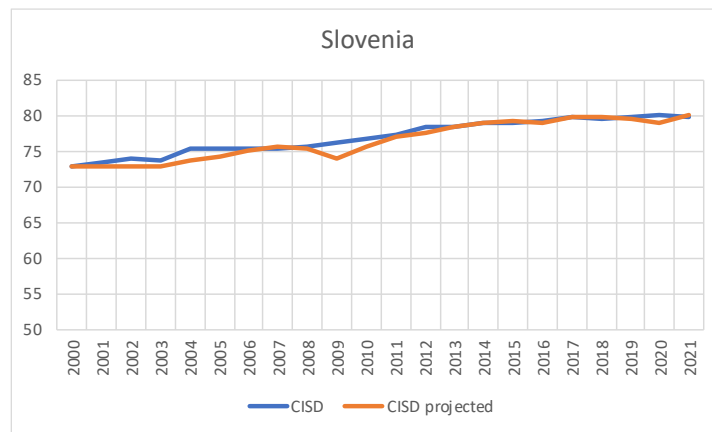


Figure 13. Retrospective prediction of SDGI for Slovenia

Source: developed by author, based on Sustainable Development Report, 2023.

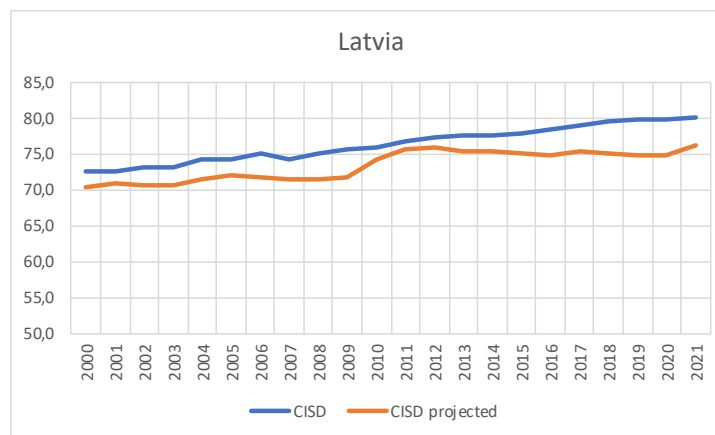


Figure 14. Retrospective prediction of SDGI for Latvia

Source: developed by author, based on Sustainable Development Report, 2023.

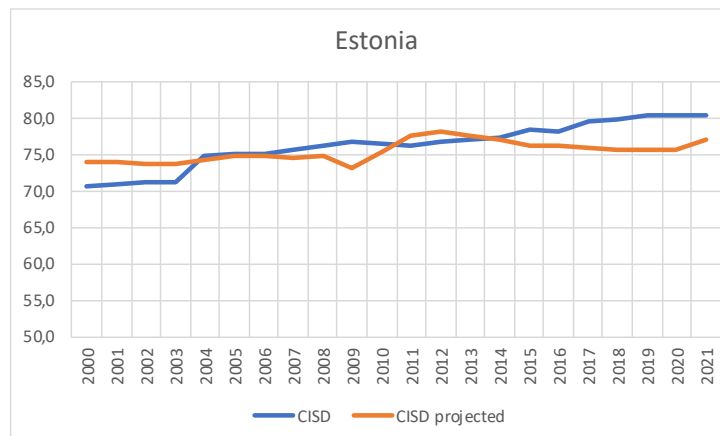


Figure 15. Retrospective prediction of SDGI for Estonia

Source: developed by author, based on Sustainable Development Report, 2023.

The estimations of figures 12-15 demonstrate that the equation has relatively good quality in predicting the SDG index and explains a significant amount of the time series during the analyzed period. Specifically, the figures show that the projected values of the SDGI are quite similar to the actual values in Czechia, although there is an increasing gap after 2015. For Slovenia,

the equation predicts sustainability even better, where the projected values of SDGI were slightly and visibly underestimated during the years of 2004, 2009 and 2020. The maximum relative error for Slovenia does not exceed 2.8%.

However, for certain countries, such as Czechia, Latvia, Estonia and Poland, the projected SDGI values at the end of the analyzed period are scarcely lower than the actual numbers. This is explained mainly due to the influence of other factors that have not been included in the model of sustainability in these countries. On the other hand, for Hungary, Lithuania and Slovakia, the projected values of the SDG index are located slightly above their actual numbers for the entire analyzed period of time.

At the same time all countries from the panel in the period of crises (2008, 2009, 2020), except Lithuania in 2008 and Poland in 2020 could achieve improvement in SDG index.

The cross-section effects analysis (table 13) provides meaningful insights about the relationship between external factors and sustainability in the selected panel of EU countries. Specifically, the results suggest that, on average, external factors have a positive effect on sustainability in Czechia, Estonia, Latvia, Poland and Slovenia, while having a negative impact in Hungary, Lithuania and Slovakia.

*Table 13*

Cross-section fixed effects

Country	Effect
Czechia	1.25
Estonia	0.56
Hungary	-2.85
Latvia	2.93
Lithuania	-2.83
Poland	4.49
Slovakia	-3.96
Slovenia	0.4

*Source:* calculated by author in EViews.

Summarizing the analysis of the impact of external factors on sustainability author concludes the following. According to regression equation 4 the hypothesis 2 is rejected, since only trade openness, crises and debt had statistically significant impact on sustainability. These external factors explain over 80% of changes in sustainability in fixed effect panel regression model.

Nevertheless, the subhypothesis 2.1 has been accepted due to the fact that analysis revealed the positive influence of trade openness on sustainability in EU8 countries, when increase in trade openness by 1 point leads to 0.093 increase in sustainable development goals index. The results

of current analysis comply with the opinion of other scholars that trade in developed countries is a beneficial external factor for sustainability.

In addition, the analysis showed that subhypotheses 2.2 and 2.4 are rejected since FDI and exchange rate had no impact on sustainability, these factors neither promote nor hamper the sustainability directly. Furthermore, the subhypotheses 2.3 and 2.5 are also rejected and concluded that there are positive relationships between debt accumulation, crises and sustainability. An increase in public debt and crisis terms lead to increase in SDG index by 0.04 and 1.3 point respectively. Additionally, retrospective prediction of sustainability model across selected EU8 countries demonstrated very good quality for forecasting. However, the quality of the presented above equations might be improved by including non-external factors. The limitations of the sustainability model are that the initial data is not stationary, and the issue of autocorrelation.

## CONCLUSIONS AND PROPOSALS

The literature review of the influence of external factors on economic growth and sustainability revealed that globalization plays a significant role as an external force shaping economic outcomes (Almas & Sangchoon (2010) and Balsalobre-Lorente et al. (2018)). Specifically, trade linkages and the openness of an economy are identified as key drivers of improved economic growth (Georgiou (2010), Silajdzic & Mehic (2018)) and in some cases for sustainability (Liu et al. (2020), Yahya and Rafiq (2020)). Furthermore, the convergence effects and international spillovers contribute to economic growth (Poirson and Weber (2011), Arora and Vamvakidis (2005)). In terms of attracting FDI, scholars have generally found a positive impact on both growth and sustainability. However, the vulnerability of an economy to external shocks and debt tends to have a predominantly negative influence on economic growth and sustainability.

In the current research panel data regression models have been developed in order to determine the impact of external factors on economic growth and sustainability and answer the main research question. Findings of the current study have been concluded based on the empirical assessment of the regression models and revealed that economic growth was influenced by trade openness, public debt, exchange rate and crisis, while trade openness, public debt and crises had a relationship with sustainability.

The main conclusions and suggestions regarding the impact of external factors on economic growth and sustainability include the following:

1) improvement in trade openness led to the acceleration of economic growth and sustainability in EU8 countries.

2) debt accumulation has hampered the EU8 countries' ability to increase GDP and has had a negative impact on the growth-enhancing process. At the same time debt sources had a positive effect on sustainability.

3) undervalued currencies to the US dollar slightly facilitated the economic growth in the analyzed panel of countries.

4) crises significantly decreased economic growth, but in times of crises sustainability improved. Most probably it is explained by the positive impact of decrease in greenhouse emissions when companies cut their production and energy usage. In this case, environmental component of sustainability improves, while economic and social might be damaged.

However, there were a few limitations of the current research that were mainly based on such issues as:

1) The dynamics of FDI inflow significantly vary over time and had not demonstrated any statistically significant relationship with dependent variables as it was expected.

2) The impact of external factors on sustainability has been estimated by non-stationary data. It was obtained the alternative results to test the hypothesis 2 due to the problem of autocorrelation in residuals. The involvement of the internal factors in the model would make the quality of the estimation more accurate.

The further investigation of the impact of external factors on economic growth and sustainability should be conducted to find answers to various research questions:

1) How external factors would continue to be beneficial and improve sustainability after the pandemic and the period when the EU economy will return to the growth trajectory;

2) How to prevent the negative influence of the external factors on sustainability and maintain economic growth at the same time;

3) How the external shocks such as the war in Ukraine and energy crisis would affect sustainability and the potential of the economic growth;

4) What are the channels of trade openness that affect the components of sustainability.

The empirical results of the current research are considered highly beneficial for the governments, international organizations and business entities since they provide the reasoning for the impact of external factors on economic growth and sustainability. Those models might be used for short-term forecasting of the economic growth and sustainability in EU8 countries as well as the recommendations to other countries that aimed to become developed economies. The possible areas of usage include the following.

Firstly, policymakers must maintain and enhance the favorable business climate for multinational and local entities, stimulate attraction of the resource-saving technologies that will lead to transformation to green growth and encourage competitiveness.

Secondly, since fluctuations of the national currencies to the US dollar might be beneficial for growth, the Central banks must be very precise in their monetary policy and predict the negative consequences from the side of the international financial market. In this way, policymakers should address currency valuation issues and ensure that the exchange rates remain stable.

Thirdly, the extent of trade openness must be balanced with environmental concerns. Policymakers should promote sustainable production practices and encourage companies to adopt eco-friendly technologies to reduce their carbon footprint. Orientation on renewable energy production, decarbonization and decrease of greenhouse gas emissions as well as the implementation of new technologies and innovations will be beneficial for green economic growth and sustainability.

Fourthly, in order to effectively address the external shocks policymakers must maintain budget equilibrium, while public debt accumulation should be strongly administered.

## LIST OF REFERENCES

1. Abubakar, L., Salemcity, A. J., Abass, O. K., & Olajuyin, A. M. (2021). The impacts of COVID-19 on Environmental Sustainability: A Brief study in World Context. *Bioresource Technology Reports*, 100713. Viewed on 2022-10-25. Internet access: <https://reader.elsevier.com/reader/sd/pii/S2589014X21000906?token=2D0C778EFCFBB24AFCB5E1F7B7131D591E15D10F94FFFDFD25B68D44E090BB8AF98DEB1D0496BB6C7316A9A6B24DE70D&originRegion=eu-west-1&originCreation=20211228202535>
2. Agrawal, G., & Khan, M. A. (2011). Impact of FDI on GDP: A comparative study of China and India. *International Journal of Business and Management*, 6(10), 71. Viewed on 2021-03-23. Internet access: <https://pdfs.semanticscholar.org/ea98/44bc26a8d1245e27756cf64959d659beed6a.pdf>
3. Allegret, J. P., Couharde, C., & Guillaumin, C. (2012). The impact of external shocks in East Asia: Lessons from a structural VAR model with block exogeneity. *Economie internationale*, (4), 35-89. Viewed on 2023-04-16. Internet access:  [Cairn.info/revue-economie-internationale-2012-4-page-35.htm](http:// Cairn.info/revue-economie-internationale-2012-4-page-35.htm)
4. Almas, H., & Sangchoon, L. (2010). The relationship between globalization, economic growth and income inequality. *Journal of Globalization Studies*, 1(2). Viewed on 2021-01-24. Internet access: [http://www.socionauki.ru/journal/files/jogs/2010\\_2/the\\_relationship\\_between\\_globalization\\_economic\\_growth\\_and\\_income\\_inequality.pdf](http://www.socionauki.ru/journal/files/jogs/2010_2/the_relationship_between_globalization_economic_growth_and_income_inequality.pdf)
5. Arora, V., & Vamvakidis, A. (2005). How much do trading partners matter for economic growth?. *IMF staff papers*, 52(1), 24-40. Viewed on 2021-01-04. Internet access: <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.524.1512&rep=rep1&type=pdf>
6. Arora, V., & Vamvakidis, A. (2011). China's economic growth: international spillovers. *China & World Economy*, 19(5), 31-46. Viewed on 2021-03-26. Internet access: [https://www.researchgate.net/profile/Vivek-Arora-2/publication/228122687\\_China%27s\\_Economic\\_Growth\\_International\\_Spillovers/links/0deec52b20d1b4e21e000000/Chinas-Economic-Growth-International-Spillovers.pdf](https://www.researchgate.net/profile/Vivek-Arora-2/publication/228122687_China%27s_Economic_Growth_International_Spillovers/links/0deec52b20d1b4e21e000000/Chinas-Economic-Growth-International-Spillovers.pdf)
7. Asongu, S., & Odhiambo, N. M. (2021). Trade and FDI thresholds of CO<sub>2</sub> emissions for a Green economy in sub-Saharan Africa. *International Journal of Energy Sector Management*, 15(1), 227-245. Viewed on 2021-05-08. Internet access: [https://mpra.ub.uni-muenchen.de/107494/1/MPRA\\_paper\\_107494.pdf](https://mpra.ub.uni-muenchen.de/107494/1/MPRA_paper_107494.pdf)
8. Balsalobre-Lorente, D., Shahbaz, M., Roubaud, D., & Farhani, S. (2018). How economic growth, renewable electricity and natural resources contribute to CO<sub>2</sub> emissions? *Energy policy*, 113, 356-367. Viewed on 2023-04-11. Internet access: [https://mpra.ub.uni-muenchen.de/82252/1/MPRA\\_paper\\_82252.pdf](https://mpra.ub.uni-muenchen.de/82252/1/MPRA_paper_82252.pdf)

9. Bank of Lithuania, Statistics. (2021). Viewed on 2021-05-08. Internet access: <https://www.lb.lt/en/general-government-debt>
10. Barguelli, A., Ben-Salha, O., & Zmami, M. (2018). Exchange rate volatility and economic growth. *Journal of Economic Integration*, 33(2), 1302-1336. Viewed on 2022-02-02. Internet access: [https://www.e-jei.org/upload/JEI\\_33\\_2\\_1302\\_1336\\_2013600159.pdf](https://www.e-jei.org/upload/JEI_33_2_1302_1336_2013600159.pdf)
11. Beck, T., & Laeven, L. (2006). Institution building and growth in transition economies. *Journal of Economic Growth*, 11(2), 157-186. Viewed on 2021-01-04. Internet access: <https://pure.uvt.nl/ws/portalfiles/portal/1270571/institutionbuilding.pdf>
12. Blecker, R. A. (2009). External shocks, structural change, and economic growth in Mexico, 1979–2007. *World Development*, 37(7), 1274-1284. Viewed on 2020-12-20. Internet access: [http://fs2.american.edu/blecker/www/research/WD2192\\_finalJuly09.pdf](http://fs2.american.edu/blecker/www/research/WD2192_finalJuly09.pdf)
13. Brooks, C. (2008). *Introductory econometrics for finance*. Cambridge university press. Viewed on 2021-05-05. Internet access: [http://digitallab.wldu.edu.et/bitstream/123456789/580/1/Introductory\\_Econometrics\\_for\\_Finance\\_\\_2nd\\_Edition%20Chris%20Brooks.pdf](http://digitallab.wldu.edu.et/bitstream/123456789/580/1/Introductory_Econometrics_for_Finance__2nd_Edition%20Chris%20Brooks.pdf)
14. Chen, H. C., & Yeh, C. W. (2021). Global financial crisis and COVID-19: Industrial reactions. *Finance Research Letters*, 42, 101940. Viewed on 2023-04-04. Internet access: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8450756/>
15. Ejigayehu, D. A. (2013). The effect of external debt on Economic Growth: A panel data analysis on the relationship between external debt and economic growth. Viewed on 2021-03-21. Internet access: <https://www.diva-portal.org/smash/get/diva2:664110/FULLTEXT01.pdf>
16. Eurostat. Sustainable development indicators. (2023) Viewed on 2023-03-02. Internet access: <https://ec.europa.eu/eurostat/web/sdi/decent-work-and-economic-growth>
17. EViews. Descriptive Statistics and Tests. Viewed on 2023-03-08. Internet access: [http://www.eviews.com/help/helpintro.html#page/content/series-Descriptive\\_Statistics\\_\\_\\_Tests.html](http://www.eviews.com/help/helpintro.html#page/content/series-Descriptive_Statistics___Tests.html)
18. Georgiou, M. N. (2010). Trade Unions and Economic Growth: A Discussion Based on Panel Data Analysis (1999-2007). *Available at SSRN 1704324*. Viewed on 2021-02-20. Internet access: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1704324](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1704324)
19. Ghura, D. (1995). Macro policies, external forces, and economic growth in Sub-Saharan Africa. *Economic Development and Cultural Change*, 43(4), 759-778. Viewed on 2020-12-14. Internet access: <http://web.a.ebscohost.com/ehost/detail/detail?vid=11&sid=503ad2c0-2304-4483-b6ed-37baa8ccd28b%40sdc-v-sessmgr02&bdata=JnNpdGU9ZWwhvc3QtG12ZQ%3d%3d#A N=9508092629&db=30h>
20. Grigoroudis, E., Kouikoglou, V. S., & Phillis, Y. A. (2021). SAFE 2019: Updates and new sustainability findings worldwide. *Ecological Indicators*, 121, 107072. Viewed on 2021-12-12. Internet access: <https://www.sciencedirect.com/science/article/pii/S1470160X20310116>

21. Holden, E., & Linnerud, K. (2007). The sustainable development area: satisfying basic needs and safeguarding ecological sustainability. *Sustainable Development*, 15(3), 174-187. Viewed on 2021-05-05. Internet access: [https://www.researchgate.net/profile/Kristin-Linnerud/publication/227650698\\_The\\_sustainable\\_development\\_area\\_Satisfying\\_basic\\_needs\\_and\\_safeguarding\\_ecological\\_sustainability/links/5c6567cc299bf1d14cc62cfe/The-sustainable-development-area-Satisfying-basic-needs-and-safeguarding-ecological-sustainability.pdf](https://www.researchgate.net/profile/Kristin-Linnerud/publication/227650698_The_sustainable_development_area_Satisfying_basic_needs_and_safeguarding_ecological_sustainability/links/5c6567cc299bf1d14cc62cfe/The-sustainable-development-area-Satisfying-basic-needs-and-safeguarding-ecological-sustainability.pdf)
22. International Monetary Fund, World Economic Outlook. (2023) Viewed on 2023-04-12. Internet access: <https://www.imf.org/en/Publications/WEO/Issues/2023/04/11/world-economic-outlook-april-2023>
23. Ioana-Sorina, M. I. H. U. Ţ., & Sorin-Augustin, C. Â. L. E. A. (2015). The relation between external debt and economic growth across European Union member states. Does economic governance matters?. *Revista Economica*, 67(4). Viewed on 2021-03-23. Internet access: <http://economice.ulbsibiu.ro/revista.economica/archive/67406mihut&calea.pdf>
24. Irandoust, M. (2016). Structural changes, FDI, and economic growth: evidence from the Baltic states. *Journal of Economic Structures*, 5(1), 1-9. Viewed on 2021-01-20. Internet access: [https://www.researchgate.net/profile/Manuchehr-Irandoust/publication/301479504\\_Structural\\_changes\\_FDI\\_and\\_economic\\_growth\\_evidence\\_from\\_the\\_Baltic\\_states/links/5e035c274585159aa4988a4b/Structural-changes-FDI-and-economic-growth-evidence-from-the-Baltic-states.pdf](https://www.researchgate.net/profile/Manuchehr-Irandoust/publication/301479504_Structural_changes_FDI_and_economic_growth_evidence_from_the_Baltic_states/links/5e035c274585159aa4988a4b/Structural-changes-FDI-and-economic-growth-evidence-from-the-Baltic-states.pdf)
25. Isaak, R. (1997). Making “economic miracles”: explaining extraordinary national economic achievement. *The American Economist*, 41(1), 59-69. Viewed on 2020-12-18. Internet access: <http://web.a.ebscohost.com/ehost/detail/detail?vid=23&sid=503ad2c0-2304-4483-b6ed-37baa8ccd28b%40sdc-v-sessmgr02&bdata=JnNpdGU9ZWwhvc3QtbG12ZQ%3d%3d#AN=0437694&db=eoh>
26. Izquierdo, A., Romero, R., & Talvi, E. (2007). Business cycles in Latin America: the role of external factors. Washington, DC, Banco Interamericano de Desarrollo (BID). Viewed on 2021-06-06. Internet access: [https://www.researchgate.net/profile/Alejandro-Izquierdo/publication/228783389\\_Business\\_Cycles\\_in\\_Latin\\_America\\_The\\_Role\\_of\\_External\\_Factors/links/09e4150a515b6ce177000000/Business-Cycles-in-Latin-America-The-Role-of-External-Factors.pdf](https://www.researchgate.net/profile/Alejandro-Izquierdo/publication/228783389_Business_Cycles_in_Latin_America_The_Role_of_External_Factors/links/09e4150a515b6ce177000000/Business-Cycles-in-Latin-America-The-Role-of-External-Factors.pdf)
27. Jenkins, D. G., & Quintana-Ascencio, P. F. (2020). A solution to minimum sample size for regressions. *PloS one*, 15(2), e0229345. Viewed on 2023-03-03. Internet access: [https://web.archive.org/web/20200224185332id\\_/https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0229345&type=printable](https://web.archive.org/web/20200224185332id_/https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0229345&type=printable)
28. Jianu, I., Pîrşcoveanu, L. M., & Tudorache, M. D. (2017). The impact of financial risks on economic growth in EU-15. *The distinctivities of the*



- complexity* 3, 24(1), 23. Viewed on 2023-03-11. Internet access: <http://www.ebsco.ectap.ro/Theoretical & Applied Economics 2017 Spring.pdf#page=23>
29. Joshua, U., Adedoyin, F. F., & Sarkodie, S. A. (2020). Examining the external-factors-led growth hypothesis for the South African economy. *Heliyon*, 6(5), e04009. Viewed on 2021-03-08. Internet access: <https://www.sciencedirect.com/science/article/pii/S2405844020308537>
30. Karagiannopoulou, S., Giannarakis, G., Galariotis, E., Zopounidis, C., & Sariannidis, N. (2022). The Impact of Dow Jones Sustainability Index, Exchange Rate and Consumer Sentiment Index on Carbon Emissions. *Sustainability*, 14(19), 12052. Viewed on 2023-04-17. Internet access: [https://www.researchgate.net/profile/Grigoris-Giannarakis/publication/363844680\\_The\\_Impact\\_of\\_Dow\\_Jones\\_Sustainability\\_Index\\_Exchange\\_Rate\\_and\\_Consumer\\_Sentiment\\_Index\\_on\\_Carbon\\_Emissions/links/6331519186b22d3db4e35512/The-Impact-of-Dow-Jones-Sustainability-Index-Exchange-Rate-and-Consumer-Sentiment-Index-on-Carbon-Emissions.pdf](https://www.researchgate.net/profile/Grigoris-Giannarakis/publication/363844680_The_Impact_of_Dow_Jones_Sustainability_Index_Exchange_Rate_and_Consumer_Sentiment_Index_on_Carbon_Emissions/links/6331519186b22d3db4e35512/The-Impact-of-Dow-Jones-Sustainability-Index-Exchange-Rate-and-Consumer-Sentiment-Index-on-Carbon-Emissions.pdf)
31. Kilian, L. (2008). Exogenous oil supply shocks: how big are they and how much do they matter for the US economy?. *The Review of Economics and Statistics*, 90(2), 216-240. Viewed on 2021-02-06. Internet access: <https://direct.mit.edu/rest/article/90/2/216/57714/Exogenous-Oil-Supply-Shocks-How-Big-Are-They-and>
32. Koçak, D. (2020). Green growth dynamics in OECD countries: an application of grey relational analysis. *Grey Systems: Theory and Application*. Viewed on 2022-03-21. Internet access: [https://www.researchgate.net/profile/Deniz-Kocak-2/publication/342274984\\_Green\\_growth\\_dynamics\\_in\\_OECD\\_countries\\_An\\_application\\_of\\_grey\\_relational\\_analysis/links/5f042f6692851c52d61dd7c6/Green-growth-dynamics-in-OECD-countries-An-application-of-grey-relational-analysis.pdf](https://www.researchgate.net/profile/Deniz-Kocak-2/publication/342274984_Green_growth_dynamics_in_OECD_countries_An_application_of_grey_relational_analysis/links/5f042f6692851c52d61dd7c6/Green-growth-dynamics-in-OECD-countries-An-application-of-grey-relational-analysis.pdf)
33. Krznar, I., & Kunovac, D. (2010). Impact of external shocks on domestic inflation and GDP. *CNB Occasional Publications-Working Papers*, 26. Viewed on 2021-01-28. Internet access: <https://www.hnb.hr/repec/hnb/wpaper/pdf/w-026.pdf>
34. Loayza, N., Calderón, C., & Schmidt-Hebbel, K. (2004). External Conditions and Growth Performance. *Documentos de Trabajo (Banco Central de Chile)*, (292), 1. Viewed on 2021-01-13. Internet access: <https://dialnet.unirioja.es/servlet/articulo?codigo=1064737>
35. Liu, M., Ren, X., Cheng, C., & Wang, Z. (2020). The role of globalization in CO<sub>2</sub> emissions: A semi-parametric panel data analysis for G7. *The Science of the total environment*, 718, 137379. Viewed on 2023-04-18. Internet access: [https://www.researchgate.net/profile/Xiaohang-Ren/publication/339358088\\_The\\_role\\_of\\_globalization\\_in\\_CO2\\_emissions\\_A\\_semi-parametric\\_panel\\_data\\_analysis\\_for\\_G7/links/5e5a7577a6](https://www.researchgate.net/profile/Xiaohang-Ren/publication/339358088_The_role_of_globalization_in_CO2_emissions_A_semi-parametric_panel_data_analysis_for_G7/links/5e5a7577a6)

fdccbeba0f09ee/The-role-of-globalization-in-CO2-emissions-A-semi-parametric-panel-data-analysis-for-G7.pdf

36. Maune, A. (2019). Trade in services-economic growth nexus: an analysis of the growth impact of trade in services in SADC countries. *Journal of Economics and Behavioral Studies*, 11(2 (J)), 58-78. Viewed on 2021-03-20. Internet access: <https://ojs.amhinternational.com/index.php/jeb/article/view/2819>
37. Mućk, J. (2018). Econometrics of Panel Data. Viewed on 2021-04-23. Internet access: <https://web.sgh.waw.pl/~jmuck/EoPD/Meeting3.pdf>
38. Nawaz, M., Rafiq, M. Q., Mehmood, A., Abdullah, M., & Hussain, M. S. (2014). Which Factors Influence the Economic Growth of the Country? Evidence with Reference to Pakistan. Viewed on 2021-04-22. Internet access: <https://core.ac.uk/download/pdf/234646593.pdf>
39. Neto, P., Brandão, A., & Cerqueira, A. (2008). The impact of FDI, cross-border mergers and acquisitions, and greenfield investments on economic growth. *The IUP Journal of Business Strategy*, 24-44. [https://www.researchgate.net/profile/Antonio-Brandao-7/publication/24111675\\_The\\_Impact\\_of\\_FDI\\_Cross\\_Border\\_Mergers\\_and\\_Acquisitions\\_and\\_Greenfield\\_Inv estments\\_on\\_Economic\\_Growth/links/0912f50c5ab651626b000000/The-Impact-of-FDI-Cross-Border-Mergers-and-Acquisitions-and-Greenfield-Investments-on-Economic-Growth.pdf](https://www.researchgate.net/profile/Antonio-Brandao-7/publication/24111675_The_Impact_of_FDI_Cross_Border_Mergers_and_Acquisitions_and_Greenfield_Inv estments_on_Economic_Growth/links/0912f50c5ab651626b000000/The-Impact-of-FDI-Cross-Border-Mergers-and-Acquisitions-and-Greenfield-Investments-on-Economic-Growth.pdf)
40. Ogunmuyiwa, M. S. (2011). Does external debt promote economic growth in Nigeria. *Current research journal of economic theory*, 3(1), 29-35. Viewed on 2021-03-25. Internet access: [https://www.researchgate.net/profile/Michael-Ogunmuyiwa/publication/267566210\\_Does\\_External\\_Debt\\_Promote\\_Economic\\_Growth\\_in\\_Nigeria/links/5b9146d04585153a53fdb58b/Does-External-Debt-Promote-Economic-Growth-in-Nigeria.pdf](https://www.researchgate.net/profile/Michael-Ogunmuyiwa/publication/267566210_Does_External_Debt_Promote_Economic_Growth_in_Nigeria/links/5b9146d04585153a53fdb58b/Does-External-Debt-Promote-Economic-Growth-in-Nigeria.pdf)
41. Poirson, H., & Weber, S. (2011). Growth spillover dynamics from crisis to recovery. Viewed on 2021-03-28. Internet access: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1934655](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1934655)
42. Repetto, R. C., Magrath, W., Wells, M., Beer, C., & Rossini, F. (1989). Wasting assets: natural resources in the national income accounts (No. INVES-ET P01 R425w). Washington, DC: World Resources Institute. Viewed on 2021-04-02. Internet access: [http://pdf.wri.org/wastingassets\\_bw.pdf](http://pdf.wri.org/wastingassets_bw.pdf)
43. Rhoton, C. (2014). A Multiple Regression and Concurrent Validity Analysis of High School Seniors' Social Competence, Ability to Manage Emotions, and Their Time Spent on Facebook Viewed on 2021-06-06. Internet access: <https://core.ac.uk/download/pdf/58825569.pdf>
44. Ribeiro, H. N. R., Vaicekaskas, T., & Lakštutienė, A. (2012). The effect of public debt and other determinants on the economic growth of selected European countries. *Economics and Management*, 17(3), 914-921. Viewed on 2023-04-16. Internet access:

[https://web.archive.org/web/20170524052827id\\_/http://ecomanager.ktu.lt:80/index.php/Ekv/article/viewFile/2108/1631](https://web.archive.org/web/20170524052827id_/http://ecomanager.ktu.lt:80/index.php/Ekv/article/viewFile/2108/1631)

45. Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings papers on economic activity*, 2008(2), 365-412. Viewed on 2022-01-06. Internet access: <https://core.ac.uk/download/pdf/6340406.pdf>
46. Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, 94(5), 1002-1037. Viewed on 2021-04-22. Internet access: <https://core.ac.uk/download/pdf/190756753.pdf>
47. Sachs, J., Lafortune, G., Kroll, C., Fuller, G., & Woelm, F. (2022). *From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond*. Sustainable Development Report 2022. Cambridge: Cambridge University Press. Viewed on 2023-04-09. Internet access: <https://s3.amazonaws.com/sustainabledevelopment.report/2022/2022-sustainable-development-report.pdf>
48. Sadiq, M., Shinwari, R., Usman, M., Ozturk, I., & Maghyereh, A. I. (2022). Linking nuclear energy, human development and carbon emission in BRICS region: Do external debt and financial globalization protect the environment?. Viewed on 2023-04-12. Internet access: [https://www.researchgate.net/profile/Muhammad-Usman-436/publication/359393566\\_Linking\\_nuclear\\_energy\\_human\\_development\\_and\\_carbon\\_emission\\_in\\_BRICS\\_region\\_Do\\_external\\_debt\\_and\\_financial\\_globalization\\_protect\\_the\\_environment/links/6247e35a7931cc7ccf0d5ab9/Linking-nuclear-energy-human-development-and-carbon-emission-in-BRICS-region-Do-external-debt-and-financial-globalization-protect-the-environment.pdf](https://www.researchgate.net/profile/Muhammad-Usman-436/publication/359393566_Linking_nuclear_energy_human_development_and_carbon_emission_in_BRICS_region_Do_external_debt_and_financial_globalization_protect_the_environment/links/6247e35a7931cc7ccf0d5ab9/Linking-nuclear-energy-human-development-and-carbon-emission-in-BRICS-region-Do-external-debt-and-financial-globalization-protect-the-environment.pdf)
49. Shafi, K., Hua, L., & Idrees, Z. (2015). Exchange rate volatility and oil prices shocks and its impact on economic sustainability. *Management Science Letters*, 5(1), 59-64. Viewed on 2023-03-18. Internet access: [https://growingscience.com/msl/Vol5/msl\\_2014\\_331.pdf](https://growingscience.com/msl/Vol5/msl_2014_331.pdf)
50. Silajdzic, S., & Mehic, E. (2018). Trade openness and economic growth: Empirical evidence from transition economies. In *Trade and global market*. IntechOpen. Viewed on 2023-04-18. Internet access: [https://www.researchgate.net/profile/Vito-Bobek/publication/357152182\\_Trade\\_and\\_Global\\_Market\\_Edited\\_by\\_Vito\\_Bobek/links/61bdba93a6251b553ac7dd08/Trade-and-Global-Market-Edited-by-Vito-Bobek.pdf#page=21](https://www.researchgate.net/profile/Vito-Bobek/publication/357152182_Trade_and_Global_Market_Edited_by_Vito_Bobek/links/61bdba93a6251b553ac7dd08/Trade-and-Global-Market-Edited-by-Vito-Bobek.pdf#page=21)
51. Singh, R. K., Murty, H. R., Gupta, S. K., & Dikshit, A. K. (2009). An overview of sustainability assessment methodologies. *Ecological indicators*, 9(2), 189-212. Viewed on 2021-11-20. Internet access: [https://d1wqtxts1xzle7.cloudfront.net/46793373/An\\_overview\\_of\\_sustainability\\_assessment](https://d1wqtxts1xzle7.cloudfront.net/46793373/An_overview_of_sustainability_assessment)
52. Sowah Jr, J. K., & Kirikkaleli, D. (2022). Investigating factors affecting global environmental sustainability: evidence from nonlinear ARDL bounds test. *Environmental Science*

- and Pollution Research*, 29(53), 80502-80519. Viewed on 2023-04-11. Internet access: [https://www.researchgate.net/profile/Dervis-Kirikaleli/publication/361431805\\_Investigating\\_factors\\_affecting\\_global\\_environmental\\_sustainability\\_evidence\\_from\\_nonlinear\\_ARDL\\_bounds\\_test/links/62b2f2e96ec05339cc9a9060/Investigating-factors-affecting-global-environmental-sustainability-evidence-from-nonlinear-ARDL-bounds-test.pdf](https://www.researchgate.net/profile/Dervis-Kirikaleli/publication/361431805_Investigating_factors_affecting_global_environmental_sustainability_evidence_from_nonlinear_ARDL_bounds_test/links/62b2f2e96ec05339cc9a9060/Investigating-factors-affecting-global-environmental-sustainability-evidence-from-nonlinear-ARDL-bounds-test.pdf)
53. Soyly, O. B. (2019). Do foreign direct investment and savings promote economic growth in Poland?. *Economics and Business Review*, 5(4), 3-22. Viewed on 2019-11-06. Internet access: [https://www.researchgate.net/profile/Oezguer-Soylu/publication/337914757\\_Do\\_foreign\\_direct\\_investment\\_and\\_savings\\_promote\\_economic\\_growth\\_in\\_Poland/links/5df2901ba6fdcc28371d15ce/Do-foreign-direct-investment-and-savings-promote-economic-growth-in-Poland.pdf](https://www.researchgate.net/profile/Oezguer-Soylu/publication/337914757_Do_foreign_direct_investment_and_savings_promote_economic_growth_in_Poland/links/5df2901ba6fdcc28371d15ce/Do-foreign-direct-investment-and-savings-promote-economic-growth-in-Poland.pdf)
54. Spangenberg, J. H. (2004). Reconciling sustainability and growth: criteria, indicators, policies. *Sustainable development*, 12(2), 74-86. Viewed on 2021-10-24. Internet access: [https://www.researchgate.net/profile/Joachim-Spangenberg/publication/227650561\\_Reconciling\\_sustainability\\_and\\_growth\\_Criteria\\_indicators\\_policies/links/5b6d48bc92851ca650543b9d/Reconciling-sustainability-and-growth-Criteria-indicators-policies.pdf](https://www.researchgate.net/profile/Joachim-Spangenberg/publication/227650561_Reconciling_sustainability_and_growth_Criteria_indicators_policies/links/5b6d48bc92851ca650543b9d/Reconciling-sustainability-and-growth-Criteria-indicators-policies.pdf)
55. Stiglitz, J. E. (2016). An agenda for sustainable and inclusive growth for emerging markets. *Journal of Policy Modeling*, 38, 693-710. Viewed on 2023-04-13. Internet access: <https://core.ac.uk/download/pdf/196231269.pdf>
56. Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (Vol. 5, pp. 481-498). Boston, MA: Pearson. Viewed on 2021-03-08. Internet access: <http://www.chrishoultonmusic.com/using-multivariate-statistics-5th-edition-english.pdf>
57. Thadewald, T., & Büning, H. (2007). Jarque–Bera test and its competitors for testing normality – A power comparison. *Journal of applied statistics*, 34(1), 87-105. Viewed on 2023-03-08. Internet access: <https://amstat.tandfonline.com/doi/abs/10.1080/02664760600994539?journalCode=cjas20#.ZBJzWuxBy3I>
58. The Sustainable Development Report, Rankings. Viewed on 2023-04-07. Internet access: <https://dashboards.sdgindex.org/rankings>
59. Upreti, P. (2015). Factors affecting economic growth in developing countries. *Major Themes in Economics*, 17(1), 37-54. Viewed on 2021-01-16. Internet access: <https://core.ac.uk/download/pdf/222995578.pdf>
60. Vojinović, B., Oplotnik, Ž. J., & Próchniak, M. (2010). EU enlargement and real economic convergence. *Post-Communist Economies*, 22(3), 303-322. Viewed on 2021-02-01. Internet access: [https://www.tandfonline.com/doi/pdf/10.1080/14631377.2010.498681?casa\\_token=T3vMjWo4xJsAAAAA:jyku5LLHwJu0WPUwWijAR-JRFxxe0JaCTrpHL9dRt7kEA d8l93y3PwnLzdIlfxrQneF2svOM0Zv14](https://www.tandfonline.com/doi/pdf/10.1080/14631377.2010.498681?casa_token=T3vMjWo4xJsAAAAA:jyku5LLHwJu0WPUwWijAR-JRFxxe0JaCTrpHL9dRt7kEA d8l93y3PwnLzdIlfxrQneF2svOM0Zv14)

61. Wawrosz, P., & Mihola, J. (2013). The share of intensive and extensive factors on the GDP development of selected EU countries. *European Scientific Journal*. Viewed on 2021-05-05. Internet access: [https://gruni.edu.ge/uploads/files/kvleva/fondebi/emf\\_2013\\_vol\\_1.pdf#page=225](https://gruni.edu.ge/uploads/files/kvleva/fondebi/emf_2013_vol_1.pdf#page=225)
62. World Bank, World Development Indicators. (2023). Viewed on 2023-04-05. Internet access: <https://databank.worldbank.org/source/world-development-indicators>
63. Xu, Z., Li, Y., Chau, S. N., Dietz, T., Li, C., Wan, L., ... & Liu, J. (2020). Impacts of international trade on global sustainable development. *Nature Sustainability*, 3(11), 964-971. Viewed on 2023-04-19. Internet access: <https://par.nsf.gov/servlets/purl/10194325>
64. Yahya, F., & Rafiq, M. (2020). Brownfield, greenfield, and renewable energy consumption: Moderating role of effective governance. *Energy & Environment*, 31(3), 405-423. Viewed on 2022-01-08. Internet access: [https://www.researchgate.net/profile/Farzan-Yahya/publication/335492466\\_Brownfield\\_greenfield\\_and\\_renewable\\_energy\\_consumption\\_Moderating\\_role\\_of\\_effective\\_governance/links/5dbfed3f299bf1a47b11d855/Brownfield-greenfield-and-renewable-energy-consumption-Moderating-role-of-effective-governance.pdf](https://www.researchgate.net/profile/Farzan-Yahya/publication/335492466_Brownfield_greenfield_and_renewable_energy_consumption_Moderating_role_of_effective_governance/links/5dbfed3f299bf1a47b11d855/Brownfield-greenfield-and-renewable-energy-consumption-Moderating-role-of-effective-governance.pdf)
65. Yang, M., Chen, L., Msigwa, G., Tang, K. H. D., & Yap, P. S. (2022). Implications of COVID-19 on global environmental pollution and carbon emissions with strategies for sustainability in the COVID-19 era. *The Science of the Total Environment*, 809, 151657. Viewed on 2023-04-20. Internet access: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8592643/>
66. Zlotnikov L., & Akulich, U., (2018). Forecasting the economy: from descriptive to prescriptive analytics. *Bank bulletin (National Bank of the Republic of Belarus)*, 338.27, 28-38. Viewed on 2021-03-20. Internet access: <https://www.nbrb.by/bv/articles/10553.pdf>

## SUMMARY IN LITHUANIAN

### IŠORĖS VEIKSNIŲ ĮTAKA EKONOMIKOS AUGIMUI IR TVARUMUI

**Aliaksandr PARKHOMENKA**

**Magistro Darbas**

**Globalaus Verslo Ir Ekonomikos Studijų Magistro Programa**

Ekonomikos ir Verslo Administravimo Fakultetas, Vilniaus Universitetas

Darbo vadovė doc. Laimutė Urbšienė, Vilnius, 2023

### SANTRAUKA

82 puslapiai, 14 lentelių, 30 paveikslų, 66 nuorodos.

Magistro darbe nagrinėjami ekonomikos augimui ir tvarumui 2000–2021 m. laikotarpiu 8 ES šalims įtakojantis išoriniai veiksniai. Tyrime atlikto empirinio vertinimo pagrindas - sisteminė ir išsami mokslinės literatūros analizė, susijusi su išorės veiksnių problematika ekonomikos augimo ir tvarumo kontekste. Metodų atranka pagrįsta žymių ir gerbiamų mokslininkų išvadomis. Siekiant atsakyti į pagrindinį tyrimo klausimą: koku mastu išorės veiksniai daro įtaką ekonomikos augimui ir tvarumui, buvo sukurti 2 panelinės regresijos modeliai. Tyrimo rezultatai buvo atlikti naudojant EViews programinę įrangą.

Statistiškai reikšmingi magistro darbo rezultatai pateikia patikimų įrodymų, kad ES8 šalyse prekybos atvirumo ir valiutos kurso padidėjimas 1 % lemia 0.15% ir 0.06% BVP padidėjimą, o valstybės skolos kaupimasis ir krizių laikotarpiai lemia ekonomikos augimo sumažėjimą atitinkamai 0.3% ir 4.1%. Išoriniai veiksniai paaiškina daugiau kaip 70% ekonomikos augimo pokyčių. Be to, išoriniu veiksnių poveikio tvarumui analizė parodė, kad dėl prekybos atvirumo, skolos ir krizių tvarumas pagerėjo. Išvados rodo, kad išorės veiksniai teigiamai veikė Čekijos, Estijos, Latvijos, Lenkijos ir Slovėnijos tvarumą, tačiau neigiamai veikė Vengrijos, Lietuvos ir Slovakijos tvarumą.

Autorius teigia, kad empiriniai tyrimo rezultatai bus naudingi politikos formuotojams siekiant užkirsti kelią galimoms neigiamoms išorės veiksnių pasekmėms ir skatinti tvarumą bei ekologišką ekonomikos augimą.

## **SUMMARY IN ENGLISH**

### **INFLUENCE OF EXTERNAL FACTORS ON ECONOMIC GROWTH AND SUSTAINABILITY**

**Aliaksandr PARKHOMENKA**

**Master Thesis**

**Global Business and Economics**

Faculty of Economics and Business Administration, Vilnius University

Supervisor Associate prof., Laimutė Urbšienė, Vilnius, 2023

#### **SUMMARY**

82 pages, 14 tables, 30 figures, 66 references.

The Master thesis examines the impact of external factors on economic growth and sustainability for the period 2000 to 2021 in EU8 countries. The systematic and detailed analysis of scientific literature regarding the problematics of external factors in the context of economic growth and sustainability is the foundation for the empirical assessment in the study. The selection of methods was based on the findings of notable and respected scholars. In order to answer the main research question: what extent the external factors influence economic growth and sustainability, 2 panel regression models have been developed. The research findings have been conducted utilizing EViews software.

Statistically significant results of the Master thesis provide robust evidence that in EU8 countries a 1% increase in trade openness and exchange rate generates an equivalent of 0.15% and 0.06% increase in GDP, while accumulation of public debt and times of crises lead to a decline in the economic growth by 0.3% and 4.1% respectively. The external factors explain over 70 % of changes in economic growth. Moreover, analysis of the effects of external factors on sustainability revealed that trade openness, debt and crises led to improvements in sustainability. The findings indicate that external factors positively contributed to sustainability in Czechia, Estonia, Latvia, Poland and Slovenia, but adversely affected Hungary, Lithuania and Slovakia.

The author believes that the empirical results of the study will be beneficial for policymakers to prevent possible negative consequences of externalities and promote the sustainability and green economic growth.

## ANNEXES

### Annex 1. Time series for regression analysis

Table 14

*Time series for regression analysis*

Time	Country	Dependent variables			Independent variables		
		economic growth	sustainability		external factors		
		GDP (constant 2015 mln US\$)	Sustainable development goals index	Trade (% of GDP)	Official exchange rate (US\$ per LCU, average)	Foreign direct investment , net inflows (% of GDP)	General governm ent public debt (% of GDP)
2000	Czechia	126 265,4	72,8	98,0	0,02591	8,1	17,0
2001	Czechia	130 107,7	72,9	99,0	0,02629	8,3	22,7
2002	Czechia	132 150,2	73,3	91,3	0,03055	10,3	25,8
2003	Czechia	136 886,0	73,6	95,0	0,03545	2,0	28,2
2004	Czechia	143 476,1	74,7	113,5	0,03891	5,4	28,4
2005	Czechia	152 947,8	74,9	121,3	0,04174	10,0	27,7
2006	Czechia	163 297,7	75,3	127,0	0,04426	4,6	27,6
2007	Czechia	172 393,9	75,6	129,8	0,04928	7,3	27,3
2008	Czechia	177 025,1	76,1	123,7	0,05858	3,7	28,1
2009	Czechia	168 780,5	76,6	112,8	0,05246	2,5	33,4
2010	Czechia	172 890,1	76,6	128,0	0,05236	4,9	37,1
2011	Czechia	175 933,6	77,0	137,9	0,05651	1,8	39,7
2012	Czechia	174 552,5	77,3	146,5	0,05108	4,5	44,2
2013	Czechia	174 472,4	77,8	146,4	0,05110	3,5	44,4
2014	Czechia	178 419,1	78,4	157,6	0,04818	3,9	41,9
2015	Czechia	188 033,1	79,1	155,2	0,04065	0,9	39,7
2016	Czechia	192 804,0	79,0	150,6	0,04092	5,5	36,6
2017	Czechia	202 769,5	79,5	150,5	0,04278	5,1	34,2
2018	Czechia	209 255,4	79,9	147,9	0,04602	3,3	32,1
2019	Czechia	215 640,3	80,0	141,8	0,04361	4,3	30,0
2020	Czechia	203 773,7	80,4	133,1	0,04308	3,5	37,7
2021	Czechia	210 995,9	80,4	142,5	0,04613	2,7	42,0
2000	Estonia	13 914,2	70,6	126,5	0,05893	7,3	5,1
2001	Estonia	14 749,5	70,8	126,5	0,05721	9,5	4,8
2002	Estonia	15 748,3	71,2	123,3	0,06020	4,6	5,7
2003	Estonia	16 945,2	71,2	122,8	0,07217	10,5	5,6
2004	Estonia	18 098,1	74,8	130,0	0,07939	8,9	5,1
2005	Estonia	19 822,2	75,1	135,9	0,07947	21,7	4,7
2006	Estonia	21 758,0	75,3	136,6	0,08022	10,3	4,6
2007	Estonia	23 407,1	75,7	134,0	0,08746	13,5	3,8
2008	Estonia	22 205,8	76,2	136,7	0,09351	8,1	4,5
2009	Estonia	18 957,3	76,9	116,8	0,08883	9,5	7,2
2010	Estonia	19 420,7	76,5	143,7	0,08470	13,3	6,7
2011	Estonia	20 831,2	76,3	167,4	0,08897	4,8	6,2
2012	Estonia	21 503,7	76,9	170,8	0,08211	7,8	9,8
2013	Estonia	21 817,3	77,0	166,5	0,08488	4,4	10,2
2014	Estonia	22 474,3	77,4	160,2	0,08491	6,7	10,6
2015	Estonia	22 890,8	78,4	150,9	0,07091	-3,1	10,1
2016	Estonia	23 613,1	78,3	150,4	0,07074	3,8	10,0
2017	Estonia	24 980,8	79,5	147,6	0,07220	6,4	9,1
2018	Estonia	25 926,1	80,0	145,9	0,07548	4,0	8,2
2019	Estonia	26 895,7	80,5	143,8	0,07155	9,8	8,5
2020	Estonia	26 747,5	80,6	138,5	0,07300	11,5	18,5
2021	Estonia	28 890,9	80,5	157,0	0,07559	19,8	17,6



2000	Hungary	91 568,9	73,5	137,4	0,00354	5,8	55,7
2001	Hungary	95 299,5	73,9	131,0	0,00349	7,6	52,3
2002	Hungary	99 817,9	73,9	118,3	0,00388	5,4	55,6
2003	Hungary	103 884,7	73,9	116,6	0,00446	4,9	58,1
2004	Hungary	109 083,8	75,0	123,4	0,00493	4,4	58,8
2005	Hungary	113 768,1	74,9	127,8	0,00501	24,3	60,1
2006	Hungary	118 257,5	75,6	149,0	0,00475	16,1	64,1
2007	Hungary	118 585,5	75,6	155,5	0,00545	50,4	65,1
2008	Hungary	119 776,0	76,2	158,3	0,00581	47,4	71,1
2009	Hungary	111 873,4	76,3	145,0	0,00494	-2,1	77,2
2010	Hungary	113 077,4	76,1	157,5	0,00481	-15,7	80,0
2011	Hungary	115 188,4	76,2	166,4	0,00497	7,6	80,3
2012	Hungary	113 748,3	76,2	165,6	0,00444	8,4	78,2
2013	Hungary	115 798,6	76,4	164,3	0,00447	-2,6	77,2
2014	Hungary	120 699,5	76,7	168,4	0,00430	9,3	76,5
2015	Hungary	125 174,2	76,9	167,3	0,00358	-4,2	75,8
2016	Hungary	127 929,3	77,7	164,4	0,00355	54,2	74,9
2017	Hungary	133 394,4	78,0	165,2	0,00364	-8,5	72,1
2018	Hungary	140 547,4	78,3	163,3	0,00370	-40,1	69,1
2019	Hungary	147 374,9	78,6	160,8	0,00344	60,2	65,3
2020	Hungary	140 673,4	78,8	155,5	0,00325	106,6	79,3
2021	Hungary	150 685,6	78,9	162,8	0,00330	16,1	76,8
2000	Latvia	15 922,6	72,5	81,5	1,649	4,1	14,7
2001	Latvia	16 929,4	72,7	86,4	1,593	2,1	17,5
2002	Latvia	18 129,4	73,1	83,2	1,618	1,7	14,9
2003	Latvia	19 656,4	73,3	84,6	1,750	2,7	14,3
2004	Latvia	21 284,8	74,4	93,1	1,851	4,1	14,1
2005	Latvia	23 566,6	74,2	100,2	1,771	4,8	11,5
2006	Latvia	26 388,0	75,1	100,1	1,784	7,9	9,6
2007	Latvia	29 011,4	74,4	95,6	1,946	8,7	8,1
2008	Latvia	28 068,8	75,0	91,2	2,080	4,0	17,9
2009	Latvia	24 066,2	75,7	86,4	1,978	-0,6	35,6
2010	Latvia	22 993,9	76,1	108,6	1,885	2,0	46,5
2011	Latvia	23 585,7	76,8	125,5	1,995	5,5	44,5
2012	Latvia	25 246,6	77,4	128,2	1,829	3,8	42,7
2013	Latvia	25 753,6	77,5	125,2	1,889	3,3	40,4
2014	Latvia	26 243,5	77,7	125,2	1,890	3,3	41,6
2015	Latvia	27 263,1	78,0	122,3	1,579	3,0	37,1
2016	Latvia	27 908,8	78,3	118,9	1,575	1,2	40,4
2017	Latvia	28 833,3	79,1	123,8	1,607	3,9	39,0
2018	Latvia	29 984,3	79,6	123,6	1,680	1,2	37,1
2019	Latvia	30 754,8	79,9	120,3	1,593	3,2	36,7
2020	Latvia	30 077,3	80,0	118,8	1,625	2,7	42,1
2021	Latvia	31 300,9	80,1	130,4	1,683	9,3	44,7
2000	Lithuania	22 479,0	68,0	83,4	0,250	3,3	23,5
2001	Lithuania	23 946,0	68,2	93,7	0,250	3,6	22,9
2002	Lithuania	25 562,7	68,8	100,5	0,272	4,6	22,2
2003	Lithuania	28 263,6	69,3	98,2	0,327	1,2	20,4
2004	Lithuania	30 120,4	70,5	104,6	0,360	3,9	18,7
2005	Lithuania	32 449,4	71,2	117,5	0,360	5,0	17,6
2006	Lithuania	34 855,3	72,0	124,3	0,363	7,5	17,3
2007	Lithuania	38 726,8	71,9	116,4	0,396	6,6	15,9
2008	Lithuania	39 739,3	71,7	126,8	0,424	3,6	14,6
2009	Lithuania	33 842,5	72,3	105,3	0,403	-1,0	28,0
2010	Lithuania	34 401,4	72,5	129,9	0,384	3,0	36,2
2011	Lithuania	36 478,9	73,7	148,4	0,403	4,3	37,1
2012	Lithuania	37 881,1	73,4	155,8	0,372	1,6	39,7
2013	Lithuania	39 225,9	73,8	155,9	0,384	1,7	38,7
2014	Lithuania	40 613,3	74,1	142,7	0,385	0,7	40,5
2015	Lithuania	41 435,5	74,6	138,6	0,321	2,5	42,7
2016	Lithuania	42 479,2	74,5	134,5	0,321	2,7	39,9
2017	Lithuania	44 298,4	75,3	144,9	0,327	2,9	39,3
2018	Lithuania	46 067,4	74,6	148,6	0,342	2,4	33,7

2019	Lithuania	48 198,1	74,9	149,3	0,324	6,3	35,9
2020	Lithuania	48 187,6	75,2	137,2	0,331	7,9	46,3
2021	Lithuania	51 069,7	75,3	156,5	0,343	4,4	44,0
2000	Poland	280 976,0	72,5	60,9	0,23009	5,4	36,4
2001	Poland	284 512,3	73,0	58,2	0,24427	3,0	37,1
2002	Poland	290 304,5	72,9	61,0	0,24510	2,1	41,5
2003	Poland	300 460,5	72,7	69,4	0,25713	2,5	46,4
2004	Poland	315 432,0	73,8	71,4	0,27340	5,4	45,1
2005	Poland	326 493,7	74,1	70,5	0,30907	3,6	46,6
2006	Poland	346 511,5	74,5	78,0	0,32225	6,2	47,3
2007	Poland	370 980,5	75,3	80,8	0,36128	5,8	44,5
2008	Poland	386 561,6	75,7	80,9	0,41507	2,7	46,7
2009	Poland	397 509,7	76,0	75,3	0,32050	3,2	49,8
2010	Poland	409 175,2	76,1	82,6	0,33164	3,9	54,0
2011	Poland	429 806,6	76,3	87,3	0,33751	3,5	55,1
2012	Poland	436 448,1	77,0	89,3	0,30707	1,4	54,8
2013	Poland	440 186,5	76,9	90,8	0,31639	0,2	57,1
2014	Poland	457 076,3	78,0	92,6	0,31700	3,8	51,4
2015	Poland	477 111,3	78,7	92,8	0,26529	3,3	51,3
2016	Poland	491 202,8	79,4	97,5	0,25363	3,8	54,5
2017	Poland	516 450,7	80,6	101,3	0,26460	2,3	50,8
2018	Poland	547 154,8	80,2	103,5	0,27688	3,3	48,7
2019	Poland	571 503,1	80,6	102,7	0,26046	3,0	45,7
2020	Poland	559 958,3	80,2	100,3	0,25643	3,2	57,2
2021	Poland	598 302,7	80,5	112,4	0,25894	5,5	53,8
2000	Slovakia	48 038,3	71,2	108,8	0,02172	7,5	50,5
2001	Slovakia	49 601,3	71,4	121,7	0,02068	5,0	51,1
2002	Slovakia	51 838,1	71,9	120,4	0,02206	11,9	45,3
2003	Slovakia	54 688,7	72,2	125,1	0,02719	2,1	43,2
2004	Slovakia	57 575,7	73,0	139,7	0,03100	7,1	41,7
2005	Slovakia	61 389,2	72,7	147,7	0,03224	6,2	34,7
2006	Slovakia	66 603,0	73,6	164,6	0,03367	8,1	31,4
2007	Slovakia	73 817,5	73,8	166,3	0,04050	5,8	30,3
2008	Slovakia	77 932,7	74,3	162,1	0,04681	4,6	28,6
2009	Slovakia	73 681,1	74,4	136,2	0,04630	1,7	36,4
2010	Slovakia	78 630,0	74,8	153,5	0,04401	2,3	40,6
2011	Slovakia	80 730,6	75,4	168,0	0,04621	5,4	43,2
2012	Slovakia	81 795,2	75,7	176,2	0,04265	1,9	51,7
2013	Slovakia	82 312,8	75,9	181,4	0,04408	1,0	54,7
2014	Slovakia	84 532,9	76,7	178,0	0,04410	-0,4	53,5
2015	Slovakia	88 900,9	76,9	180,2	0,03683	1,7	51,7
2016	Slovakia	90 629,1	77,0	184,0	0,03674	5,3	52,3
2017	Slovakia	93 291,8	77,7	188,1	0,03750	4,4	51,5
2018	Slovakia	97 051,8	77,8	189,8	0,03920	2,1	49,4
2019	Slovakia	99 497,2	78,0	183,5	0,03716	2,2	48,0
2020	Slovakia	96 139,5	78,5	168,5	0,03791	-1,1	58,9
2021	Slovakia	99 037,5	78,4	187,8	0,03926	0,8	62,2
2000	Slovenia	32 301,4	72,8	103,9	0,00449	0,7	25,9
2001	Slovenia	33 340,4	73,4	104,5	0,00412	2,4	26,1
2002	Slovenia	34 509,2	73,9	103,7	0,00416	7,9	27,4
2003	Slovenia	35 530,8	73,7	102,3	0,00483	1,8	26,8
2004	Slovenia	37 079,6	75,3	111,6	0,00520	2,2	26,9
2005	Slovenia	38 487,9	75,3	120,3	0,00519	2,7	26,4
2006	Slovenia	40 699,6	75,5	129,8	0,00523	1,8	26,1
2007	Slovenia	43 540,5	75,4	137,1	0,00572	3,9	22,8
2008	Slovenia	45 068,7	75,8	134,7	0,00614	1,9	21,8
2009	Slovenia	41 666,7	76,2	113,1	0,00582	-0,7	34,5
2010	Slovenia	42 226,6	76,7	127,5	0,00553	0,7	38,3
2011	Slovenia	42 590,3	77,4	139,3	0,00581	1,7	46,5
2012	Slovenia	41 466,2	78,4	142,4	0,00536	0,1	53,6
2013	Slovenia	41 039,4	78,5	143,8	0,00554	0,2	70,0
2014	Slovenia	42 175,4	79,2	145,5	0,00554	2,0	80,3
2015	Slovenia	43 107,5	79,0	146,3	0,00463	4,0	82,6

2016	Slovenia	44 483,4	79,4	146,7	0,00462	3,2	78,5
2017	Slovenia	46 625,5	79,7	157,3	0,00471	2,5	74,2
2018	Slovenia	48 702,4	79,6	161,1	0,00493	2,8	70,3
2019	Slovenia	50 383,1	79,8	158,8	0,00467	4,0	65,4
2020	Slovenia	48 205,9	80,1	146,2	0,00477	0,9	79,6
2021	Slovenia	52 164,1	79,8	160,9	0,00494	3,5	74,5

*Source:* IMF, WordBank, Eurostat, Sustainable Development Report, 2023.

## Annex 2. Results of panel regression analysis

Dependent Variable: DLOG(GDP)\*100  
Method: Panel Least Squares  
Date: 04/18/23 Time: 03:25  
Sample (adjusted): 2002 2021  
Periods included: 20  
Cross-sections included: 8  
Total panel (balanced) observations: 160

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(GDP(-1))*100	0.363688	0.053953	6.740891	0.0000
DLOG(EXR)*100	0.057142	0.024717	2.311879	0.0221
D(TO)	0.147190	0.026694	5.513871	0.0000
D(DBT)	-0.299426	0.053938	-5.551280	0.0000
CRS	-4.128921	0.706722	-5.842353	0.0000
C	2.491978	0.296195	8.413299	0.0000
R-squared	0.706650	Mean dependent var	3.042730	
Adjusted R-squared	0.697126	S.D. dependent var	4.315853	
S.E. of regression	2.375186	Akaike info criterion	4.604808	
Sum squared resid	868.7926	Schwarz criterion	4.720127	
Log likelihood	-362.3846	Hannan-Quinn criter.	4.651635	
F-statistic	74.19413	Durbin-Watson stat	1.756899	
Prob(F-statistic)	0.000000			

Figure 16. The panel model of economic growth.

Source: developed by author in EViews, based on IMF, WordBank, Eurostat, 2023.

Sample: 2000 2021  
Periods included: 22  
Cross-sections included: 8  
Total panel (balanced) observations: 176

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TO	0.092558	0.006618	13.98524	0.0000
DBT	0.040910	0.010751	3.805127	0.0002
CRS	1.313119	0.286116	4.589457	0.0000
C	62.09624	0.689046	90.11920	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.802608	Mean dependent var	75.88364	
Adjusted R-squared	0.790645	S.D. dependent var	2.820804	
S.E. of regression	1.290667	Akaike info criterion	3.408657	
Sum squared resid	274.8606	Schwarz criterion	3.606812	
Log likelihood	-288.9618	Hannan-Quinn criter.	3.489028	
F-statistic	67.09020	Durbin-Watson stat	0.442973	
Prob(F-statistic)	0.000000			

Figure 17. The panel model of sustainability.

Source: calculated by author in EViews, based on IMF, WordBank, Eurostat, 2023.

### Annex 3. Results of cross-section dependence test

Residual Cross-Section Dependence Test  
 Null hypothesis: No cross-section dependence (correlation) in residuals  
 Equation: Untitled  
 Periods included: 20  
 Cross-sections included: 8  
 Total panel observations: 160  
 Note: non-zero cross-section means detected in data  
 Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	62.53973	28	0.5802
Pesaran scaled LM	4.615566		0.7104
Pesaran CD	3.809060		0.9301

Figure 18. The results of cross-section dependence test.

Source: calculated by author in EViews.

Residual Cross-Section Dependence Test  
 Null hypothesis: No cross-section dependence (correlation) in residuals  
 Equation: Untitled  
 Periods included: 22  
 Cross-sections included: 8  
 Total panel observations: 176  
 Cross-section effects were removed during estimation

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	158.3531	28	0.1308
Pesaran scaled LM	17.41917		0.4729
Bias-corrected scaled LM	17.22870		0.5043
Pesaran CD	10.18460		0.8597

Figure 19. The results of cross-section dependence test.

Source: calculated by author in EViews.

#### Annex 4. Results of Wald test

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	71.95877	(5, 154)	0.0000
Chi-square	359.7939	5	0.0000

Null Hypothesis: C(1)=0, C(2)=0, C(3)=0, C(4)=0, C(5)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.363688	0.054784
C(2)	0.057142	0.025098
C(3)	-0.299426	0.054770
C(4)	0.147190	0.027106
C(5)	-4.128921	0.717615

Figure 20. The Wald test for the model of economic growth

Source: calculated by author in EViews.

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	143.5137	(3, 165)	0.0000
Chi-square	430.5412	3	0.0000

Null Hypothesis: C(1)=0, C(2)=0, C(3)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.045001	0.011039
C(2)	0.088098	0.006766
C(3)	1.099664	0.349393

Restrictions are linear in coefficients.

Figure 21. The Wald test for the model of sustainability

Source: calculated by author in EViews.

## Annex 5. Retrospective prediction of RGDP

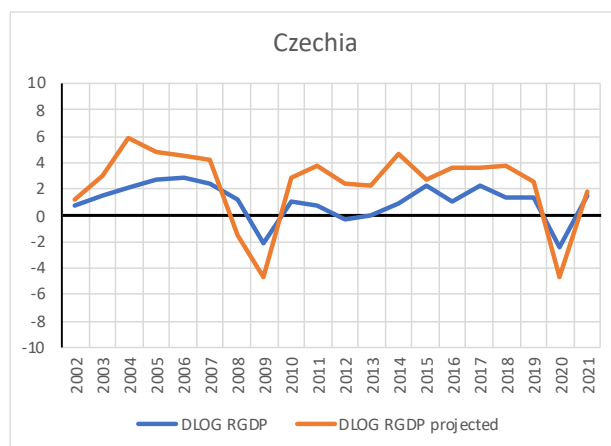


Figure 22. Retrospective prediction of economic growth for Czechia.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

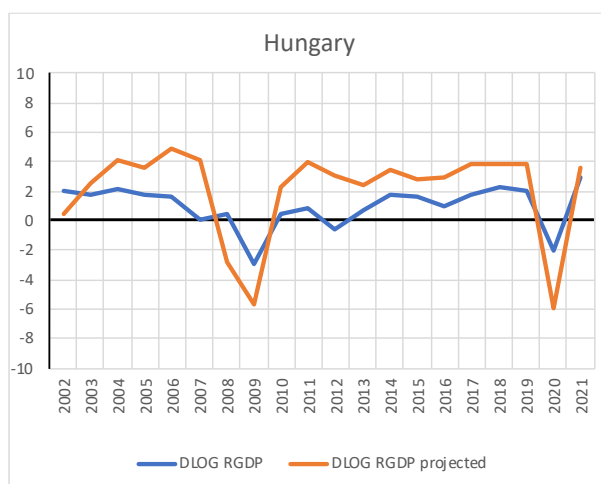


Figure 23. Retrospective prediction of economic growth for Hungary.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

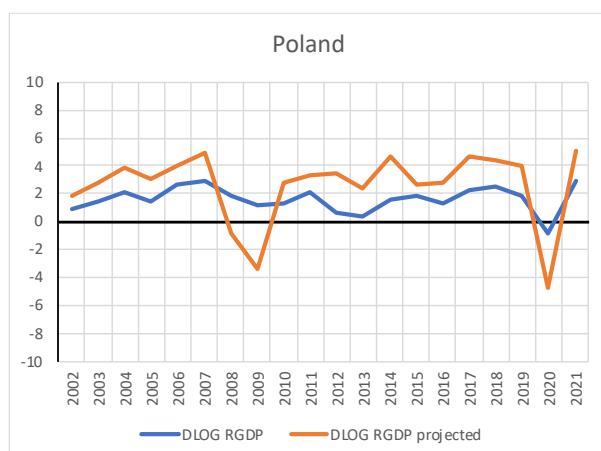


Figure 24. Retrospective prediction of economic growth for Poland.

Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

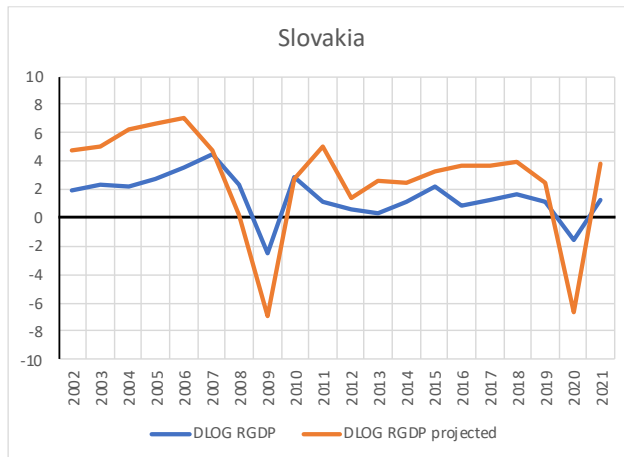


Figure 25. Retrospective prediction of economic growth for Slovakia.  
 Source: developed by author, based on IMF, WordBank, Eurostat, 2023.

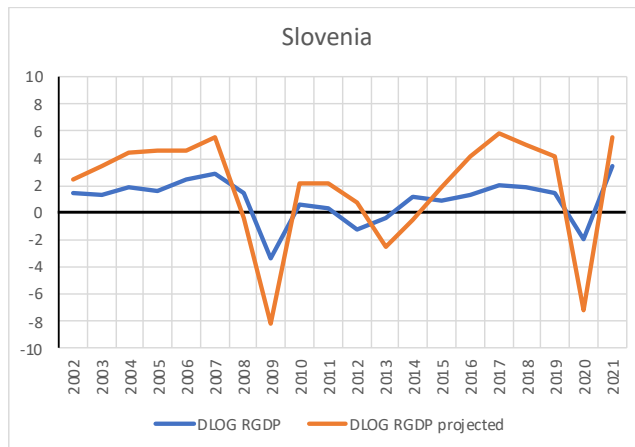


Figure 26. Retrospective prediction of economic growth for Slovenia  
 Source: developed by author, based on IMF, WordBank, Eurostat, 2023.



## Annex 6. Retrospective prediction of SDGI

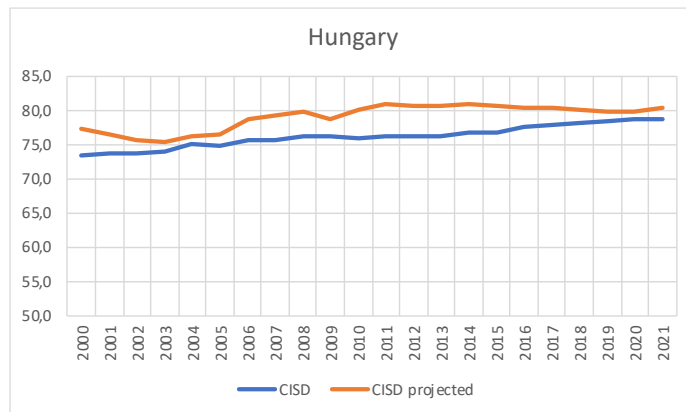


Figure 27. Retrospective prediction of SDGI for Hungary

Source: developed by author, based on Sustainable Development Report, 2023.

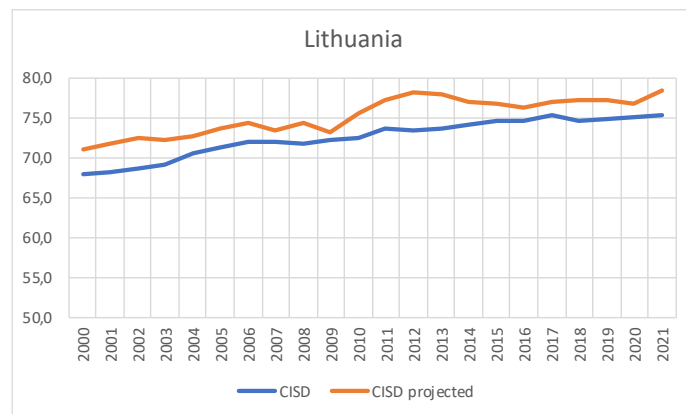


Figure 28. Retrospective prediction of SDGI for Lithuania

Source: developed by author, based on Sustainable Development Report, 2023.

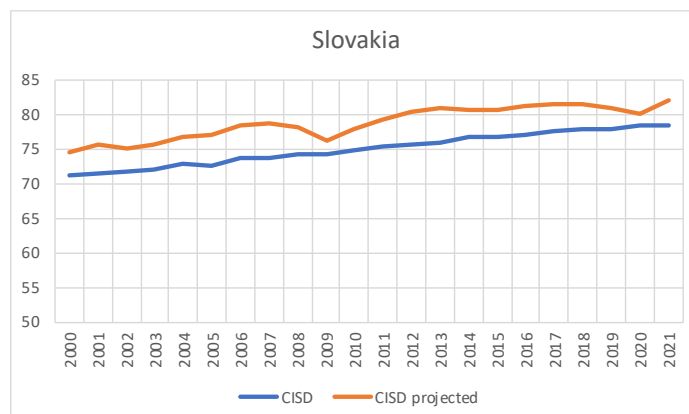


Figure 29. Retrospective prediction of SDGI for Slovakia

Source: developed by author, based on Sustainable Development Report, 2023.

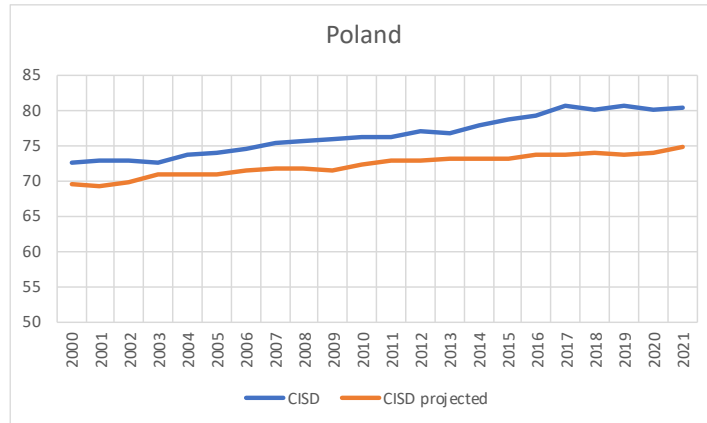


Figure 30. Retrospective prediction of SDGI for Poland

Source: developed by author, based on Sustainable Development Report, 2023.