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The Role of GDP in Shaping Socio-Economic Development in Eastern Europe: A Comparative Analysis

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ABBERVATIONS AND ACRONYMS

GDP	Gross Domestic Product
FDI	Foreign direct investment
DGH	Domestic general government health expenditure per capita
REC	Renewable energy consumption
EMP	Employment to population ratio
EAS	Educational attainment, at least completed lower secondary
MMQR	Method Of Moments Quartile Regression
UNCTAD	UN Trade and Development
OECD	Organisation for Economic Co-operation and Development
IPS	Im–Pesaran–Shin
CIPS	cross-sectional augmented IPS
OLS	Ordinary Least Squares
ADF	Augmented Dickey-Fuller
CADF	Cross-sectionally Augmented Dickey-Fuller
SME	Small and Medium-sized Enterprises
GHG	Greenhouse Gas Emissions
EU	European Union
AI	Artificial Intelligence

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1. INTRODUCTION

One of the important economic indicators across countries is Gross Domestic Product (GDP), which shows the market value of all goods produced in an economy during a specific period, ideally annually or quarterly. Although this is a number, it tells us of the economic activity and prosperity within many regions in an economy. For example, the GDP accounts for a country's goods and services from the manufacturing and service sectors and agriculture. It gives a complete view of the economy and what is going on with living standards. GDP is more than just a benchmark; it is important in economic growth measurements and policymaking since the GDP figure can be compared worldwide. This makes it a standard tool for policymakers, economists, and analysts.

A growing GDP usually reflects a healthy economic situation, more jobs, and higher living standards. Conversely, a drop in GDP could mean troubled economic times, including recession, high unemployment, and disheartening consumer confidence in separate sectors. Foreign investors and financial organizations will demand GDP. High GDP will attract Foreign Direct Investment (FDI) as investors seek established and souring economies. However, a contracting GDP may deter investment as it often encapsulates the aggregate economic syndrome of a nation and, no less, corporations. The GDP performance is paramount for countries like Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic in East and Southeast Europe. These nations have undergone a transition from centrally planned economies to market-driven systems. Their robust economic growth, as evidenced by their GDP, has played a crucial role in attracting FDI, promoting closer ties with the European Union, and propelling regional development.

There is a further relationship between GDP and the living standards of an entire country. Higher GDP generally leads to better infrastructure, healthcare, education, and lifestyle. This is especially true for Eastern Europe, where GDP grew, and life improved significantly since the end of the Cold War. As these nations progress, tracking GDP enables governments to evaluate whether economic advancements produce concrete advantages for their citizens or whether national resources have been limited (Kazakevitch and Akimov, 2020).

In addition, GDP is an important prism through which the cyclical pulses of economic life may be grasped. It shows how the economy has expanded and helps to make recommendations to prevent future oscillatory movements and achieve convergence in economic fluctuations. For Eastern European countries, this insight has been indispensable in addressing the demands of economic transitions facing Europe and global financial crises that anthems a new generation only around three decades. Responding to the economic downturn has been critical for social stability and sustainable development (Locatelli, 2017).

Finally, GDP is more than a number alone. It measures the economy, quality of life, and place on the world stage. East European countries should care about their GDP the most as it is essential for FDI, shaping policies, and improving the general welfare of people living there. With these nations' endless growth and connection to the global economy, monitoring GDP will remain a significant obligation.

Its importance has been described in this study when introducing variables that make this notion influential. There is GDP growth (GDP), Foreign direct investment (FDI), Domestic general government health expenditure per capita (DGH), Renewable energy consumption (REC) Employment to population ratio (EMP), and educational attainment at least completed lower secondary (EAS). In the next Section, I demonstrate the importance of this claim by running some experiments. This claim's robustness is verified using the method of moment quartile regression (MMQR), which is the most recent method. Finally, I mentioned a few of the implications and caveats of this assertion.

The importance of GDP can be seen in the light of Eastern European countries. National economies have seen significant ebbs and flows in the last few centuries. This change has led to slightly different socioeconomic options being available. However, one of the most significant changes has been that GDP in every region is way up. After all, the former was increased and redefined by a tremendous boost to GDP in Eastern Europe, which transformed national policies and enhanced socioeconomic progress. It has given policymakers a measurable tool for driving economic stabilization and growth. Also, GDP has exerted considerable influence on higher living standards and provided investment opportunities across many sectors, leading to a better life for the populace.

GDP measures economic performance and is prominent in Eastern Europe's larger economic reform and prosperity narrative. The measure's ability to reflect the complexity and nuances of economic transition highlights its significance in historical and present economic development evaluations.

Former centrally planned economies in Eastern Europe, which have been transitioning to market economies since the early 1990s and are going through significant changes regarding GDP growth in some regions or sectors, are an excellent candidate as a case. The importance of the association between GDP and FDI is that once economic output increases, this contributes to foreign investments, which ultimately lend itself towards more monetary expansion. Similarly, GDP growth can impact the country's spending on healthcare in a big way. It may influence how healthcare resources are allocated and, thereby, the overall health outcomes of the population and the quality of life in a nation.

1.1 Objectives to achieve

Using data from the seven Eastern European countries, namely Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic, the study assesses how changes in GDP influence a variety of indicators meant to capture the fragility situation. This dissertation is a well-developed analysis of these countries' economies and social transitions by taking GDP growth as an effect factor. The foremost variables are FDI, health expenditure, renewable energy utilization, employment status, and literacy rate. Furthermore, the outcomes are expected to yield valuable perspectives for policymakers who want to design interventions that foster sustainable economic growth and improve national welfare.

It is also important to closely analyze the relationship between GDP growth and renewable energy consumption. With rapid economic growth seen in these countries, there is an effect on energy consumption patterns, especially the one that allows them to shift towards renewable sources to design proper policies targeting specific areas for effective implementation of decentralized energy projects in the future. This, too, is a need for any society that will take him out of the labor market at certain times and when work has low qualifications. Growth in the economy leads to new job

creation and higher employment rates. It could boost educational infrastructure and accessibility, leading to an increase in overall levels of education, which are crucial for any nation.

I have shown that these connections matter, but I need to investigate their interplay further and precisely what this means for the selected Eastern European countries. This underscores the importance of in-depth analysis that identifies these problems and supplies concrete ideas for policymakers. Policymakers can utilize this research gap to harness their power in designing tools for accelerating GDP growth and fostering full-fledged socio-economic development, thereby ensuring them the perks of economic upsurge.

To address GDP-related policies to facilitate sustainable socioeconomic development, the specific economic contexts of Eastern Europe need to be considered and analyzed in more detail. It is the primary concern of this study. Human capital development remains different among the selected Eastern European countries. A higher quality workforce through education and skill enhancement will increase countries' productivity, which in turn must lead to economic advancement. The financial profiles in Eastern Europe are varied, and real potential is spawning rapidly for them as a market rich with talent and technology. Nurturing innovation can stimulate growth in GDP by generating new high-value industries and promoting greater economic competitiveness on the world stage.

The Eastern European countries remain dependent on specific sectors, called locked-in industries like manufacturing, agriculture, import, export, etc., which cause these derivatives to suffer more heavily than other more developed Western European economies. Decreasing reliance on a few industries and fostering new growth areas like renewable energy, IT services, and organic farming. My findings will also help new industries with grants, funding, and infrastructure projects to encourage entrepreneurship and stimulate SME growth, leading to a GDP increase.

2. LITERATURE REVIEW

In the dissertation, I propose the influence of GDP among seven Eastern European countries. The following literature review supports our claim.

2.1 GDP Growth

GDP is the benchmark for evaluating a country's economic and social advancement (Marcuss and Kane, 2007). It is widely recognized as the most comprehensive indicator of a nation's economic performance. GDP measures the overall economic activity of a country by calculating the total market value of all goods and services produced and exchanged within its borders in a specific year. The GDP addresses how an economy expands, the proportion of production gains attributed to inflationary tendencies, and the allocation of gross income towards consumption, investment, or savings (McCulla and Smith, 2007). Considering that the boundaries of GDP align with those used to assess a country's population and employment, this indicator is utilized to formulate national policies, design programs, and, regrettably, evaluate the standard of living across other nations. Governments frequently employ fluctuations in GDP to indicate the effectiveness of economic and monetary policies.

Table 1: Systematic Review of GDP Growth (Dependent variable)

Authors	Methods	Context, Country, and Periods	Determining Variables
(Xia Chen *et al.*, 2020)	Regression	Country: China Period: 2002 – 2016	GDP growth, incentive measure
(Jardet and Meunier, 2022)	FA-MIDAS model LASSO-MIDA	Worldwide Period: Covid-19 period	GDP growth
(Svenfelt *et al.*, 2019)	Scenario narratives	Worldwide Period: Forecasting 2050	GDP growth

(Jakovljevic, Timofeyev, *et al.*, 2020)	Panel regression analysis	GDP growth rates and healthcare Spending Country: G7 and EM7 (Emerging Markets Seven) countries Period: 2000–2016	Current health expenditure (CHE as a percentage of GDP)
(Chica-Olmo, Salaheddine and Moya-Fernández, 2020)	Durbin model with panel data	Spatial dependence between GDP and renewable energy consumption Country: 26 European countries Period: 1991–2015	Renewable energy consumption, gross fixed capital formation
(Dabboussi and Abid, 2022)	Threshold detection method	Association between economic growth, capital, labor, and sectoral renewable energy consumption. Country: United States Period: 1981Q1-2021Q1	sectoral renewable energy consumption, capital, and labor.
(Vasylieva *et al.*, 2019)	Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) panel cointegration techniques.	The association between economic, social, and environmental dimensions of sustainable development. Country: EU countries and Ukraine Period: 2000–2016	GDP per capita (GDP), Control of Corruption Index (CORRUPTION), renewable energy consumption (REC)
(Bui Minh and Bui Van, 2023)	autoregressive distributed lag model (ARDL)	Association between renewable energy consumption	renewable energy consumption

		and economic growth. Country: Vietnam Period: 1995-2019	
(Singh and Shastri, 2020)	Autoregressive distributed lags (ARDL).	The relation among public expenditure allocated to education, educational attainment at the secondary level, and unemployment rate. Country: India Period: 1987–2017	public spending on education, output growth (GDP)
(Klinger and Weber, 2020)	Constant parameter OLS regression, TVP regressions	Association between German output and employment growth. Country: Germany Period: 1993-2018	employment growth and GDP
(Demirgüç-Kunt, Lokshin and Torre, 2024)	OLS regression	The effectiveness of income protection and job protection policies. Country: 154 Country Period: 2020-2021	GDP, Income Protection GDP, employment Protection GDP
(Moghaddasi Kelishomi and Nisticò, 2022)	Regression analysis	The effect of economic sanctions on employment. Country: Iran Period: 2005-2012	annual change in import exposure, e industry's export exposure
(Gallipoli and Makridis, 2022)	The method generalizes insights of Okun (1963) by leveraging measures of industry heterogeneity	Association between GDP and Employment Country: Canada Period: 2020	employment growth

(Li *et al.*, 2023)	Hierarchical linear modeling (HLM)	How cultural trade affects Chinese firms' outbound foreign direct investment Country: China Period: 2005-2016	cultural trade between China and its partners
(Benfratello, D'Ambrosio and Sangrigoli, 2023)	Regression Analysis	Are investors in Africa differ between Chinese and non-Chinese firms? Country: 43 African destinations Period: 2004-2017	GDP growth, FDI stock, and many more
(Ngoc, Xuan and Huong, 2024)	The unrestricted fixed and random panel data method.	The association between carbon dioxide emissions, population dynamics, migration patterns, foreign direct investment, and gross domestic product. Country: Vietnam	Foreign direct investment (FDI)

A country can increase its GDP and overall well-being by transferring a negative impact of its growth to other countries. It comes at the cost of harming ecosystems and the well-being of workers in developing countries. It also has implications for the policies towards these developing countries, which supply raw materials, manufactured goods, and services to the developed economies. It is worth noting that some of these goods and services were previously produced by the same developed countries (Helm, *et al.*, 2007; Trendov and Vasa, 2015; Jakovljevic, Matter-Walstra, *et al.*, 2020). One specific issue with using GDP as a metric for progress is the assumption that an increase in GDP will automatically improve the general quality of life. Once a certain threshold is reached, any increases in GDP are offset by the negative consequences of rising economic inequality, limited leisure opportunities, and degradation of natural resources.

A more severe issue is the environmental cost paid for GDP growth (Kireyeva *et al.*, 2021). Over-exploitation of nature can eventually lead to depletion of resources and pollution that permanently damages the environment, affecting ecological integrity and threatening public health. This is especially insidious for GDP growth since the quicker a developing country exploits its agricultural and natural resources, the more environmental damage occurs, and there is no way to have that reflected somehow in the calculation of GDP.

Only by urgently addressing the three planetary pressures of climate change, stratospheric ozone depletion, and ocean acidification can Earth remain a planet that supports life as we know it. Options to address other priority challenges, such as freshwater management or tropical land use change (among others), must also be pursued vigorously. These have significant local consequences while embracing global implications. It is an existential threat to the stability of the worldwide ecology and potentially to human civilization. For instance, there is the challenge of economic growth (and, more specifically, GDP growth, which has tended to increase greenhouse gas emissions (GHG). This linkage between GDP growth and the environmental crisis highlights how difficult it is to balance economic wants with ecological needs. Even rapid economic growth and consumption might, therefore, prevent societies from achieving critical environmental objectives.

Numerous motives make the provincial governments hyperventilate when they massage their GDP figures. However, perhaps most crucially, GDP growth is the primary yardstick by which local governments and their officials are judged; failure to hit aggressive targets can lead to sacking. For example, instead of serving the people as much as possible since the 1990s, most Chinese governments have been engaging in economic development guided by GDP-led growth. This move has transformed GDP growth into the scorecard that determines government job performance, making career capacity for bureaucrats inextricably linked to economic outputs. As a result, GDP growth as an indicator has taken over the career prospects of local officials (Shi *et al.*, 2018).

When it is, but not enough, GDP manipulation becomes a trick of last resort for those provincial officials who need to keep up appearances. As stated earlier, government officials routinely coerce firms to report accounting figures and inflate GDP numbers while altering official statistics. However, this practice corrupts the data on which economic decisions are based, leading to

catastrophic long-term planning consequences. Speciously high GDP figures can lull policymakers, investors, and even the public into a false sense of economic security, taking attention away from debt-driven growth, which is ultimately unsustainable. This abuse of GDP indicators is more broadly symptomatic: growth-driven governing approaches tend to create short-term incentives at the expense of transparency, accountability, and sustainable development.

Provincial officials have varying degrees of incentive to boost GDP growth. By contrast, provincial-level officials instead have the incentive to overstate GDP figures when growth in the respective province lags or neighboring provinces lag further behind associated with tagged data on meeting quotas at that level. That underperformance can hurt local officials' career development prospects as economic growth is still a crucial part of the evaluation criterion. Moreover, the previous point also suggests that due to (vice potential) spillover effects from neighboring provinces being in similar economic circumstances, there will be competition between provincial officials for promotion. Indeed, career prospects for provincial officials in regions with lower GDP growth rates than neighboring areas might hinge on fudging the figures (Xia Chen *et al.*, 2020).

Additionally, when policymakers take GDP as an indicator of where their country stands relative to others and against some standard, progress can be lost over time because policy decisions might be based on short-term economic gain rather than long-term sustainable development. The focus of economics on GDP has encouraged governments to boost economic activity in ways that can be economically beneficial in the short term (e.g., scale industrial projects) but very damaging to social and environmental well-being over the long run. This narrow perspective can hamper efforts to adopt important but counter-intuitive tenets towards sustainable development, one which is fully conscious of the well-being and good fortune experienced by future generations.

However, the obsession with the GDP might sometimes differentiate between developed and developing nations (Lederman *et al.*, 2013). The burden on developing countries to boost their GDP can, in turn, make them pursue policies that heavily favor multinational corporations and advanced economies, even at the cost of local livelihoods or ecological degradation. This dynamic can perpetuate existing inequalities or impede fair and sustainable economic models. People might not have liked this, but a significant increase in a nation's economy can be achieved later.

Finally, the assumption that GDP growth equates to improved quality of life is increasingly being challenged. As economies grow beyond a certain point, the benefits of additional GDP growth may

be outweighed by the harmful effects of factors such as environmental degradation, loss of biodiversity, and social inequality. This realization has led to calls for the development of alternative metrics that better capture the multifaceted nature of human well-being and sustainable development. While GDP remains a crucial indicator of economic performance, its limitations necessitate a broader perspective, including social, environmental, and equity considerations. The future of economic measurement may lie in a more holistic approach that better reflects the actual well-being of societies and the sustainability of their development paths (Didenko *et al.*, 2022).

The GDP growth trends among Eastern European countries from 2010 to 2019 reveal a landscape characterized by varied economic performance and resilience amidst global and regional challenges. This analysis interprets the GDP growth data for Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic, offering insights into their economic trajectories over the decade.

Table 2: GDP Growth of seven Eastern European countries.

GDP Growth							
year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	1.55536	2.434902	1.076254	3.358751	-3.90124	0.731045	6.716633
2011	2.090176	1.76036	1.866837	2.339886	4.517087	2.036277	2.671453
2012	0.748815	-0.785	-1.25023	-0.45618	1.924993	-0.68154	1.318802
2013	-0.54275	-0.0459	1.802522	2.925258	0.269964	2.892637	0.63274
2014	0.949449	2.262103	4.23221	3.629124	4.120675	-1.58951	2.69719
2015	3.397554	5.388381	3.707316	3.855865	3.160504	1.806059	5.167182
2016	3.026628	2.537285	2.201002	2.848205	2.857546	3.338587	1.943951
2017	2.745927	5.168724	4.271976	1.081773	8.196507	2.101164	2.938069
2018	2.694907	3.220088	5.362348	2.880597	6.029019	4.495121	4.03039
2019	4.035189	3.029879	4.864226	3.91042	3.853164	4.331735	2.511256

Source: World Bank's data bank.

Despite fluctuations, Bulgaria's GDP growth was moderate. After a low of -0.54% in 2013, growth recovered and peaked at 4.03 % by the end of 2019, shortly after bottoming out (Table 2). Bulgaria

maintains one stable upward trend, fueled by stabilization measures implemented years ago, which can be an example for other countries.

Hungary has seen wide swings in GDP growth, suggesting a dynamic and possibly unstable economy. After relatively moderate growth rates of 1.07% in 2010 to the highest of 5.36 percent in 2018, Hungary experienced a near-zero deflation rate (-1.25%) during the recession year -12%. Hungary's economy is dynamic because it impedes and favors global trends. It also prevents growth and stability, making Hungary crucial in its economic activity.

This dissertation has been relatively straightforward but shows that the GDP growth in North Macedonia had only small to minimal hiccups. The country's economic growth rate started from 3.35% in 2010. Although there was a slight decline in 2012, with -0.45%, the government did not stop growing and achieved its most considerable increase at 3.91% in 2019. This fundamental economic drive is responsible for the economy's continued push for growth as it seeks to develop a stable business ecosystem.

Czechia's GDP growth, on the other hand, was more variable due to changes in economic cycles and policy. Following an initial rate of 2.43% in 2010, the country substantially declined in 2013, with a contraction of -4.59%. Nevertheless, implementing resilient economic strategies resulted in a significant rebound, reaching its highest point at 5.38% in 2015 and stabilizing at approximately 3% by 2019. The economy of Czechia is fast-moving and leans towards local and global events.

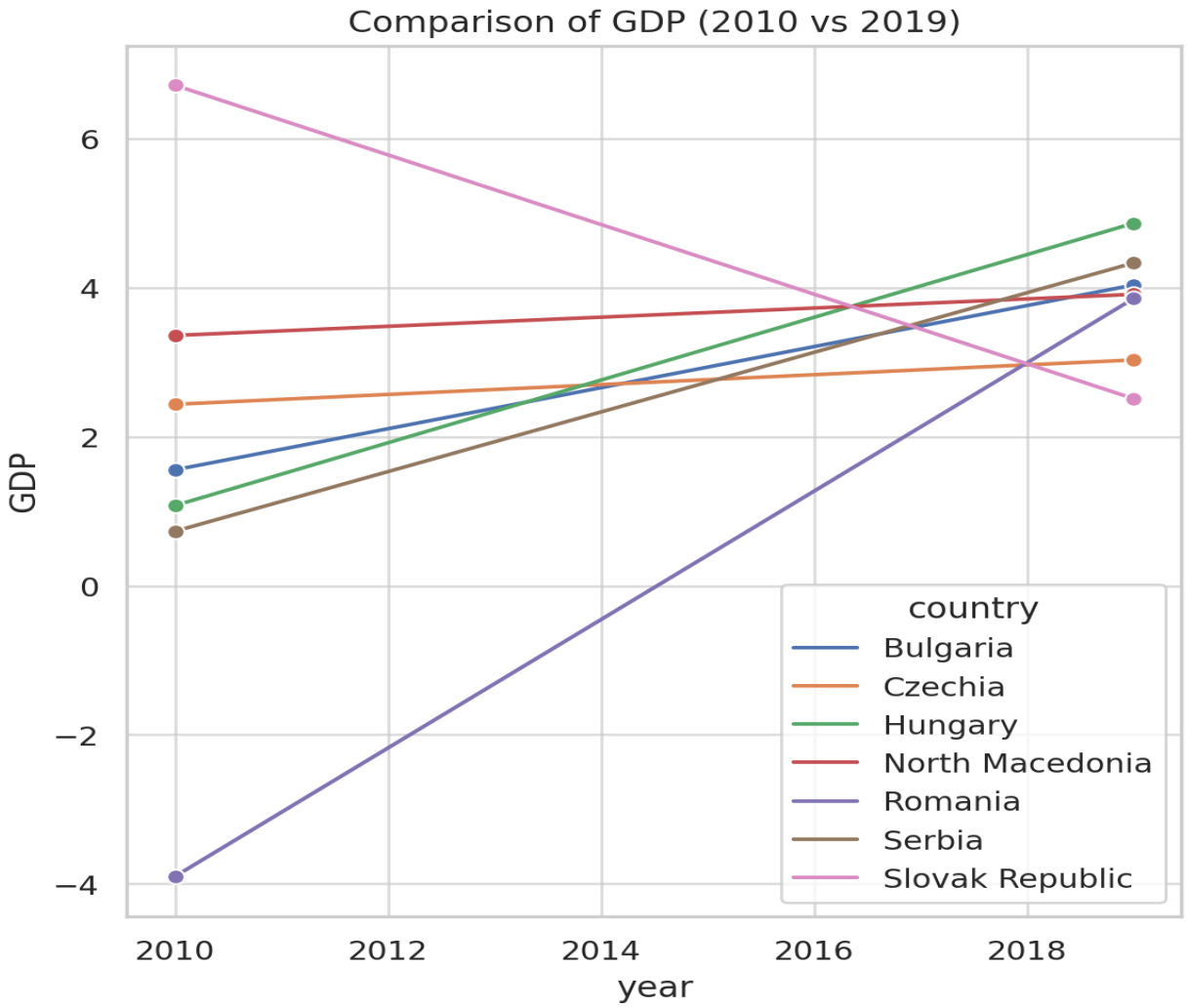


Figure 1: Comparison of GDP growth over the years among Eastern European countries.

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's [data bank](#).

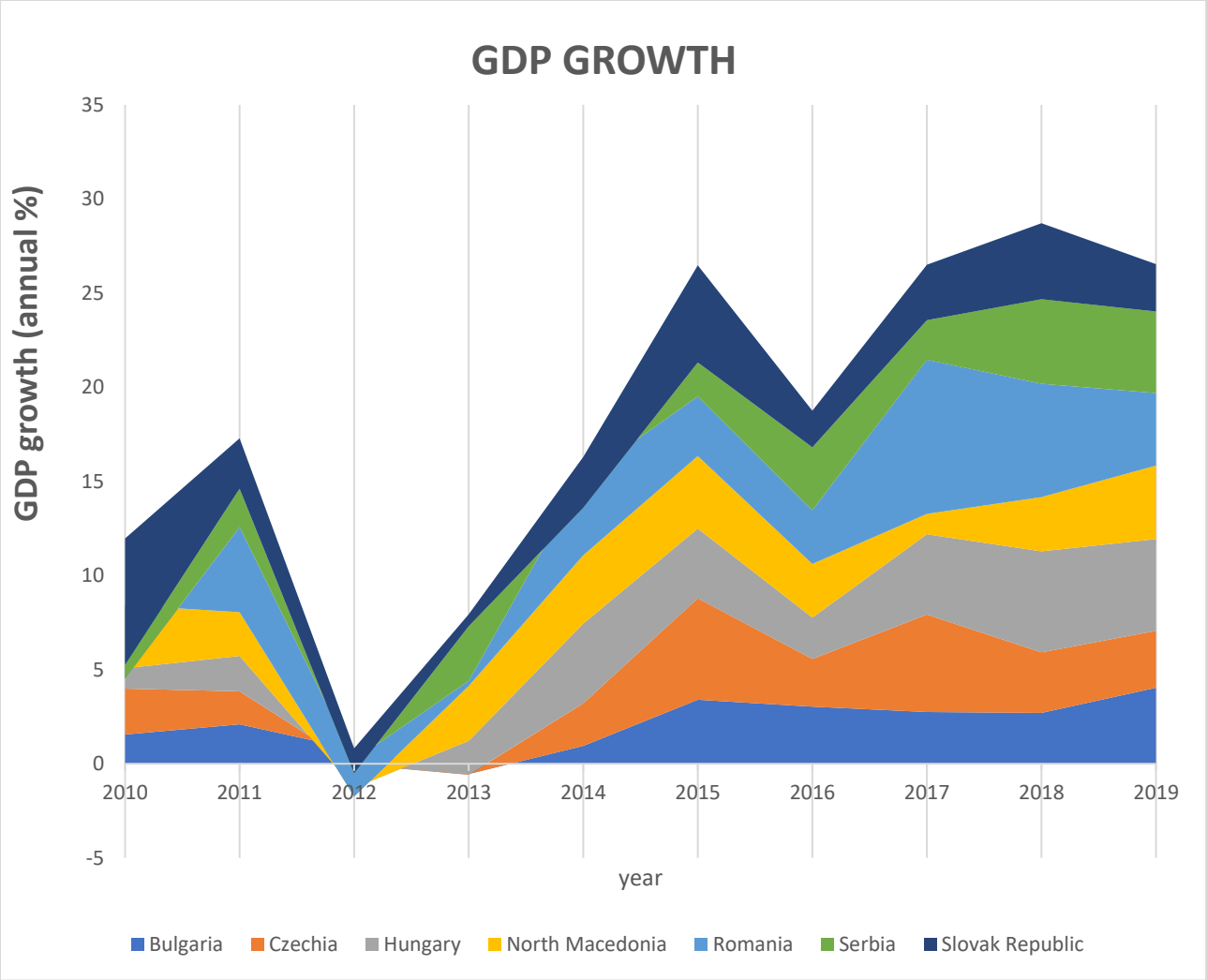


Figure 2: Visual representation of GDP growth over the year in a stacked column among Eastern European countries.

Source: World Bank's data bank.

The results in Romania were less clear that there was a period of recovery followed by reliable growth. Following a decline of -3.90% in 2010, the country saw a significant recovery, with growth rates surging to 8.19% in 2017. The remarkable recovery demonstrates Romania's strong economic policies and investment environment that have delivered sustained growth and development.

Serbia experiences a series of oscillations in GDP growth, as shown by the restructuring and policy changes occurring most of the time. The growth rate declined from 0.73% in 2010 to 1.58% in 2014, then recovered to 4.49% in 2018. A repeating narrative of gradual upgrades in the

implementation records regarding Serbia's economy scales, primarily due to measures taken to improve business conditions and induce investment.

The Slovak Republic exhibited a consistent trend of moderate economic expansion but with occasional variations. The growth rate began at a peak of 6.71% in 2010, then declined to 0.63% in 2013, then climbed to 5.16% in 2015, eventually stabilizing at approximately 2.51% by 2019. This performance demonstrates the nation's ability to withstand and adjust to shifting economic circumstances.

Figure 1 shows that between 2010 and 2019, most countries' GDP increased their economic growth. The increase stood out in two countries, Bulgaria, and Czechia, while in others, Hungary and Poland, an upward trend continues. This reflects an increase in economic conditions throughout those countries during this time with a higher standard of living.

To summarize the plot, the GDP growth trends of these Eastern European countries in Table 2 and Figures 1 and 2 during the last decade compound prior reflections over their mixed economic performances primarily driven by internal policy dynamics interacting with external financial effects. For example, while some, such as Romania and Hungary, saw significant gyrations in growth, others, like Bulgaria or North Macedonia, have experienced more stable development paths. These trends highlight the need for domestic economic policies and reforms to support sustainable growth and build resilience in an ever-changing global economy.

Lastly, The GDP growth trends among the selected Eastern European countries from 2010 to 2019 reveal a landscape characterized by varied economic performance and resilience amidst global and regional challenges. This analysis interprets the GDP growth data for Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic, offering insights into their economic trajectories over the decade (Locatelli, 2017).

2.2 Foreign direct investment

A thorough examination has been conducted to assess the factors that affect FDI, focusing on national strategic considerations and academic research objectives (Chung, 2014; Kayalvizhi and Thenmozhi, 2018; Vu, 2019). FDI has experienced rapid growth and has become one of the most dynamic economic activities worldwide. Global FDI increased from an average of US$142 billion

between 1985 and 1990 to US$1.2 trillion in 2010, according to UNCTAD (2011). It does not stop but increase by approximately US$1.4 trillion in 2020. Different financial factors have primarily driven foreign investors' choices to engage in FDI. However, a favorable institutional environment has been progressively more crucial for FDI decisions in both established and emerging nations since the 1990s (Dunning, 1998). According to Daude and Stein (2007), governments that are considered credible and efficient are more willing to encourage FDI. The authors also found that an efficient institutional environment in a host country is more beneficial to attracting investors, as it can facilitate foreign direct investment by offering consistent governance, effectively implemented laws and regulations, reduced corruption, and market-oriented policies, among other factors. Globerman and Shapiro (2002) claim that a successful government and reduced regulatory burden positively influence a host country's investment environment. These factors, in turn, provide favorable conditions for attracting FDI and promoting economic growth.

Table 3: Systematic Review of Foreign Direct Investment

Authors	Methods	Context, Country, and Periods	Determining Variables
(Li *et al.*, 2023)	hierarchical linear modeling (HLM)	How cultural trade affects Chinese firms' outbound foreign direct investment Country: China Period: 2005-2016	cultural trade between China and its partners
(Benfratello, D'Ambrosio and Sangrigoli, 2023)	Regression Analysis	Are investors in Africa differ between Chinese and non-Chinese firms? Country: 43 African destinations Period: 2004-2017	GDP growth, FDI stock, and many more
(Lucke and Eichler, 2016)	Regression Analysis	The determinants of bilateral FDI stocks by focusing on institutional and cultural factors. Country: 65 countries Period: 1995-2009	Foreign direct investment
(Chung, 2014)	Regression Analysis	Environmental regulation affects the foreign direct investment Country: South Korea	Foreign direct investment

		Period: 2000-2007	
(Ngoc, Xuan and Huong, 2024)	the unrestricted fixed and random panel data method.	The association between carbon dioxide emissions, population dynamics, migration patterns, foreign direct investment, and gross domestic product. Country: Vietnam	Foreign direct investment

A country's gross domestic product (GDP) may reduce perceived risks when investing in that foreign nation. Robust GDP data show investors a favorable atmosphere for investment, creating opportunities to sustain and facilitate commercial activity. Bevan and Estrin (2004) also agree with this statement. They also stated that increasing GDP has more power to stabilize and appeal to foreign investment. A high GDP (Gross Domestic Product) might make investing in that country less risky. Investors have seen substantial GDP numbers as another indication of an economy able to withstand significant losses while remaining unfazed by financial turbulence. Chakrabarti (2001) provides evidence that higher GDP levels are perceived as less risky, suggesting an economic sector robust enough to survive financial instability.

FDI at the cross-border level has gradually grown in both scales and is ahead of its influence on financial operations. Most economies worldwide see FDI as necessary for development, a means to prosper their respective nations, whether already developed or not (Tiutiunyk *et al.*, 2022; Bozsik, Ngo and Vasa, 2023). Apart from financial attraction and institutional considerations, several other factors determine the trajectory of FDI flows. Where the host country's infrastructure ranks among other criteria. Businesses operate at optimal levels only with proper transportation, communication networks, and energy supply, so infrastructure becomes an integral part of business. As such, infrastructure-poor countries are less likely to attract foreign investors chasing a reliable and cost-effective way to produce and distribute their goods or services (Asiedu, 2002).

Additionally, market size and trade openness also play a role. A statistically significant role in the decision to implement FDI. From the viewpoint of a multinational corporation wishing to grow its market presence, countries that play fast and loose with trade restrictions and have large populations are good places to be. Trade openness and increased market size lead to increased foreign trade by reducing barriers and the potentially high returns offered by a large domestic market, creating an attractive environment for FDI (Balasubramanyam *et al.*, 1996). Its prime

target has been emerging market countries where capital inflows have skyrocketed in recent decades, spurred by rapid economic growth and expanding middle-class populations (which global real estate players are keen to become).

The political stability of the host country is also crucial. Manufacturing investors shy away from uncertain places because of the political risks, such as civil unrest or expropriation and sudden policy changes – this should be no surprise. A stable political scene secures the investment climate and enables businesses to run regularly without hiccups. Jensen (2003) suggests that countries with relatively political stability are more likely to attract longer-term FDI as they provide a safer environment to do business.

Investor-friendly human capital can increase the attractiveness of FDI. A skilled and educated workforce is valuable for foreign investors, especially in sectors involving specific knowledge or technical effort. Likewise, a dense country with a higher proportion of well-educated labor will attract more FDI in high-value sectors such as technology and finance or even manufacturing, highlighting the need to prioritize human capital development in a country that would make it more attractive for foreign investors (Noorbakhsh *et al*. 2001).

On the other hand, FDI also hinges on factors like macroeconomic stability (low inflation, stable exchange rates and prudent fiscal policies) to attract it. In short, investors will be keener to invest in countries that provide a sound return on investment and can replenish their spent finances without huge risk losses due to economic instability. Having a situation of macroeconomic stability means less risk is associated with currency availability and price volatility than it follows; this scenario leads to investment valuing the conditions for long-term investments (Frenkel *et al*., 2004).

Muhammad Mohsin (2022) claims that FDI countries promoting significantly enhancing the production level, modernizing the economy, and promoting developing countries' economic growth. The acquired data from the World Bank for FDI from 2010 to 2019 across several countries in this analysis, Table 2 and Figures 3 and 4, delve into the trends of FDI in the selected Eastern European countries, namely Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic, from 2010 to 2019.

Table 4: Foreign direct investment, net inflows (% of GDP) of seven Eastern European countries.

Foreign Direct Investment							
year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	3.630548	4.863365	-15.7142	3.204382	1.890107	4.048952	2.320938
2011	3.643779	1.824659	7.567138	4.839817	1.230493	10.00958	5.435795
2012	3.29374	4.516567	8.396529	3.467442	1.70129	2.944728	1.877506
2013	3.561261	3.47571	-2.64334	3.720368	2.031105	4.255253	1.014706
2014	1.9133	3.86354	9.260263	0.535808	1.937371	4.248716	-0.35777
2015	4.371783	0.904051	-4.20729	2.947028	2.427275	5.908671	1.710206
2016	2.758178	5.528353	54.18032	5.147555	3.374233	5.787812	5.272631
2017	3.384418	5.138725	-8.478	3.367266	2.832734	6.552007	4.417756
2018	2.726919	3.343233	-40.0863	5.114949	3.018116	8.040762	2.120685
2019	3.224764	4.257453	60.03121	4.358925	2.934231	8.286464	2.156631

Source: World Bank's data bank.

In Bulgaria, FDI has shown fluctuations but remained relatively stable. From 3.63% in 2010, FDI experienced a slight increase and decrease, reaching 3.22% in 2019. This stability suggests a consistent yet modest attraction of foreign investments, potentially due to favorable economic policies and a stable business environment.

Czechia displayed a more volatile trend in FDI. Starting at 4.86% in 2010, it saw significant dips and peaks, with a low of 0.90% in 2015 and a high of 5.52% in 2016. It concluded the decade at 4.25% in 2019. This volatility could be attributed to changes in economic policies, global economic conditions, and investor confidence.

Hungary's FDI trends were marked by extreme fluctuations, highlighting the country's dynamic but unpredictable investment climate. From a dramatic low of -15.71% in 2010 to a high of 60.03% in 2019, the country's FDI figures reflect significant economic reforms and shifts in investor sentiment over the decade.

North Macedonia, on the other hand, demonstrated a relatively stable increase in FDI. Starting at 3.20% in 2010, it rose to 4.35% in 2019. This steady growth suggests improving economic conditions and increasing investor confidence in the country's market potential.

Romania's FDI trends were relatively moderate, with minor fluctuations. Starting at 1.89% in 2010, FDI in Romania reached 2.93% in 2019. The consistency in these figures indicates a stable investment environment, although the growth rate suggests room for improvement in attracting higher levels of foreign investment.

Serbia experienced substantial growth in FDI over the decade. From 4.04% in 2010, FDI rose significantly, peaking at 10.00% in 2011, and continued to grow, reaching 8.28% in 2019. This growth reflects Serbia's efforts to create a favorable business climate and attract foreign investors through economic reforms and incentives.

FDI in the Slovak Republic followed a pattern of makes and breaks, improving modestly. After starting the decade at 2.32% in 2010, it ebbed and flowed regularly for the next nine years before finishing at just over two percentage points in August of last year (it fell to a reflective low of little more than one-half those rates near month's end). These fluctuations can also be ascribed to changing economic policies and altering trader decisions due to external influence.

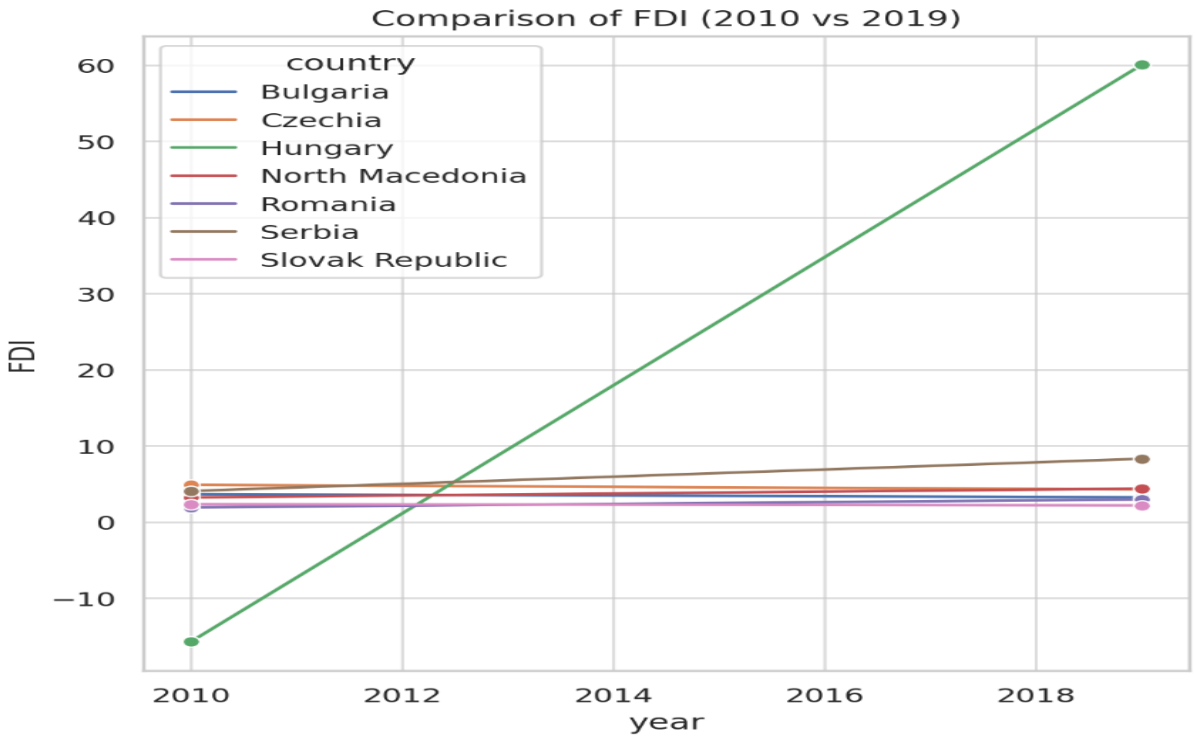


Figure 3: Comparison of FDI growth over the years among Eastern European countries.

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's data bank.

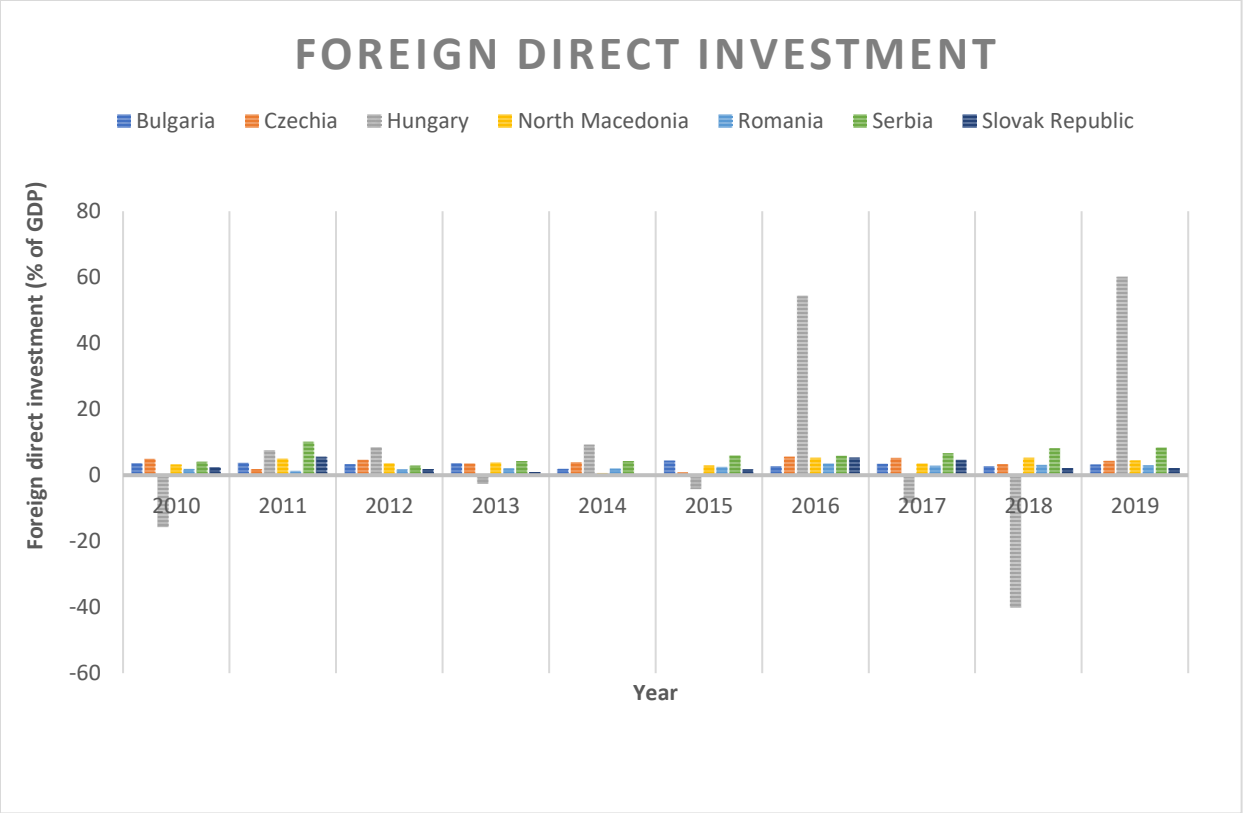


Figure 4: Foreign direct investment, net inflows (% of GDP) over the years among seven Eastern European countries.

Source: World Bank's data bank.

Figure 3 also summarizes that various foreign direct investment patterns for Bulgaria and Czechia indicate a marginal decrease in FDI until 2019. Hungary shows negative direct investment since the year is based on 24.7%, which indicates a net outflow of investments. Yet, FDI in Hungary strengthened throughout 2019. This means that the volatility of FDI is more significant than its trend would suggest, and it was not distributed evenly (positive) but around zero. This change can occur due to global investment patterns, shifts in investor confidence, or domestic political instability. However, other countries have recovered in FDI, meaning successful attractive investment climates may exist as it will improve capital, technology, and management.

The impact of GDP on FDI is an intricate process, depending on economic stability, market potential, risk reduction, infrastructural improvement, and institutional quality. Generally, a higher GDP per capita is positively related to an increase in FDI. Higher GDP means a robust, stable, and

desirable economy for foreign money. The relationship between GDP and FDI shows that economic growth or progress is crucial in creating an environment necessary for investment.

In conclusion, FDI can be influenced by a complex interaction of factors, ranging from financial incentives and institutional quality to infrastructure, trade openness, political stability, human capital, cultural ties, macroeconomic stability, and tax policies. Countries that adopt these areas gain a competitive advantage in attracting and maintaining foreign investment, which will automatically lead to economic growth, higher levels of production, and renewal of their economies.

2.3 Domestic General Health Expenditure

Healthcare expenditures have experienced significant growth compared to the increase in gross domestic product (GDP) in nearly all nations, regardless of their socioeconomic levels (Mladenović *et al.*, 2016; Zhuang *et al.*, 2020). Governments and policymakers have become more concerned about this increase in expenditures (Panopoulou and Pantelidis, 2012; Sun *et al.*, 2021).

Table 5: Systematic Review of Domestic health expenditure

Authors	Methods	Context, Country, and Periods	Determining Variables
(Rana, Alam and Gow, 2020)	Panel data (Unit root, cointegration, and causality test)	Health sector (Period: 1995–2014 Country: 161 countries)	Total expenditure on health of a country, national income (GDP)
(Mladenović *et al.*, 2016)	The method of ANFIS (adaptive neuro-fuzzy inference system)	Health economy (Period: 1974-2015 Country: 28 countries of European Union)	Health expenditure, GDP growth
(Sülkü and Caner, 2011)	the Johansen multivariate cointegration technique	Health care expenditure Country- Turkey Period: 1984–2006	Healthcare Expenditure, GDP Growth

(Kiymaz, Akbulut and Demir, 2006)	The tests of unit roots, the Phillips and Perron tests of stationarity, the Johansen multivariate cointegration test	Health care expenditure and GDP Country: Turkey	Healthcare expenditure, GDP, and population growth (Correlated)
(Jakovljevic, Timofeyev, *et al.*, 2020)	Panel regression analysis	GDP growth rates and healthcare Spending Country: G7 and EM7 (Emerging Markets Seven) countries Period: 2000–2016	current health expenditure (CHE)

Murthy and Ukpolo (1994) revealed evidence of cointegration. They determined that the income elasticity of health expenditure per capita, based on US data from the 1960-1987 period, was not substantially distinct from one. A subsequent study (Hansen and King, 1996) utilizing an identical technique analyzed data from 20 OECD nations from 1960 to 1987 and performed an individual analysis for each country. Surprisingly, the authors discovered no cointegration between monetary income and health expenditures in most countries. The researchers hypothesized that this discovery resulted from the shortness of the time series and was likely partly related to an incorrect model specification.

As data availability from more significant countries and for extended periods has increased, researchers have been able to conduct data analyses. Blomqvist and Carter (1997) analyzed the continuous correlation between nations' income and health expenditure across 19 OECD nations for 32 years, from 1960 to 1991. The authors used a cointegration model with nation dummies and a linear temporal trend to analyze the data. They concluded that earlier research underestimated income elasticity and that the genuine value should be closer to one. The authors suggested that the overestimation can be attributed to disregarding the variables' time series characteristics and omitting a time trend in the study. Gerdtham and Löthgren (2000) discovered a cointegration relationship between health expenditures and income (both per capita real) using time series and panel data analysis. Their study analyzed data from 21 OECD nations from 1960 to 1997. Jaunky and Khadaroo (2011) also undertook a cointegration analysis using data from 28 African countries

between 1991 and 2000. Their findings indicate a correlation between the income distribution of public health expenditure and the GDP of these nations. A recent study employed a panel threshold regression model to calculate country-specific and time-specific income elasticities for 17 OECD nations from 1975 to 2003 (Chakroun, 2010). The following research concludes that healthcare is an essential requirement rather than a luxurious indulgence, aligning with the outcome of my analysis. All this research has been designed to facilitate an analysis of seven countries from 2010 to 2019 by collecting panel data from the World Bank and conducting relevant analyses.

Second, more recent analyses (Bazzana, 2020; Xiaohui Chen *et al.*, 2020) have emphasized the determinant role of governmental policies in determining health expenditure. For example, some studies investigate whether the relative effects of income and public health insurance on personal expenses have changed over time or across different government subsidy levels against regulatory regimes. The income elasticity of health expenditure could be lower when the state covers a significant part of healthcare costs, as is typical for extensive public healthcare systems. Admittedly, this contribution limits private out-of-pocket burdens when dealing with expenses and thus saves money spent. On the other hand, countries where a more significant part of total health expenditures is covered by private spending (i.e., those who must pay something when they use services) have much higher income elasticities as their consumption depends more on people's ability to pay.

Moreover, further research proposals can be made to examine the effects of demographic changes, such as aging populations, on the income-health expenditure relationship. Aging populations drive up health expenditures, often increasing demand for healthcare services independent of income growth. This is particularly relevant to developed countries, where aging populations are one of the central issues faced by healthcare planning and financing. Including these demographic characteristics within econometric models has provided a more complete explanation for the growth in health expenditure.

Recent research also examines the effects of global economic integration. The development of healthcare markets and international trade in medical goods and services has made it clear that the relationship between income is not maintained just within country borders but can now vary depending on where you live. For instance, more affordable medical technologies and medicines from overseas are necessary for influencing health spending behavior within the country. There

are also ever-evolving relationships between income-health expenditure and new cross-border healthcare services (e.g., medical, tourism, etc.) because individuals can now utilize their disposable incomes for relatively cheaper healthcare options in other countries rather than exclusively through the health system they reside as citizens.

More recent (Jakovljević, 2017; Stepovic, 2019; Emam and Tashkandy, 2022) studies have also focused on equity of health expenditure distribution across countries. This one area researchers have investigated for health expenditure elasticity how income inequality within a country affects the overall. For higher-income groups with greater access to and demand for healthcare services, health spending is also likely more elastic in more unequal societies (Cong *et al.*, 2021). On the other hand, lower-income groups may have less inelastic expenditures since they cannot afford to spend much. Such a difference might result in divergent health outcomes and access to care with implicit implications on the nature of analyses that deserve to be included as part and parcel while analyzing health expenditure (Smith *et al*., 2009).

Table 6: Domestic general government health expenditure per capita (current US$) of seven Eastern European countries.

Domestic general health expenditure							
Year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	268	1281.233	655	183	377	332.6764	921
2011	301	1393.717	704	203	320	378.2751	975
2012	284	1277.4	623	192	309	347.7942	938
2013	310	1274.331	656	227	391	375.6413	1005
2014	352	1270.063	671	217	397	354.7067	1023
2015	291	1103.965	590	197	345	283.3776	873
2016	310	1161.874	619	206	372	280.0785	940
2017	343	1281.974	674	201	436	296.5018	940
2018	398	1482.133	748	225	548	366.3521	1030
2019	413	1526.634	720	254	592	374.0477	1058

Source: World Bank's data bank.

Table 3, figures 4 and 5 comprehensively examine the patterns in DGH expenditures from 2010 to 2019 in various Eastern European nations, namely Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic.

Bulgaria's DGH expenditures have a consistent upward trajectory, commencing at 268 in 2010 and 413 in 2019. This surge underscores a burgeoning commitment to healthcare throughout the past decade. Czechia's expenditures experienced swings but ultimately climbed from 1281.23 to 1526.63, suggesting significant healthcare spending.

Hungary's expenditure on DGH followed a variable but overall upward trend. It began at 655 in 2010, reached its highest point at 748 in 2018, and then slightly decreased to 720 in 2019. The healthcare investment in North Macedonia experienced a continual increase, steadily climbing from 183 to 254.

Romania's expenditure on DGH rose substantially from 377 in 2010 to 592 in 2019. Notably, the increases were more pronounced towards the end of the period. Serbia's expenditure fluctuated, beginning at 332.67, reaching a peak of 378.27 in 2011, and concluding at 374.04 in 2019, with intermittent variations in between.

From 2010 to 2019, the Slovak Republic experienced a consistent rise in DGH expenditure, increasing from 921 to 1058. It indicates a continual expansion in healthcare spending.

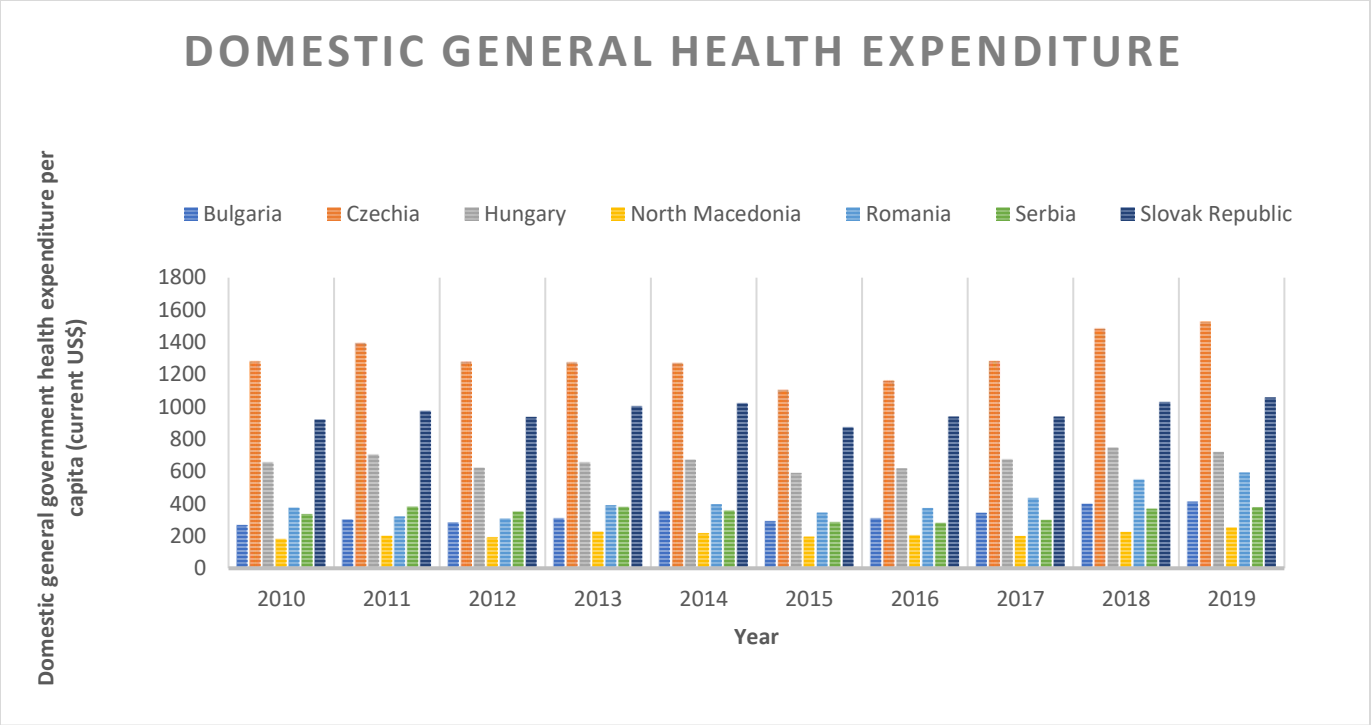


Figure 3:Visual representation of Domestic general government health expenditure per capita (current US$) among seven Eastern European countries.

Source: World Bank's data bank.

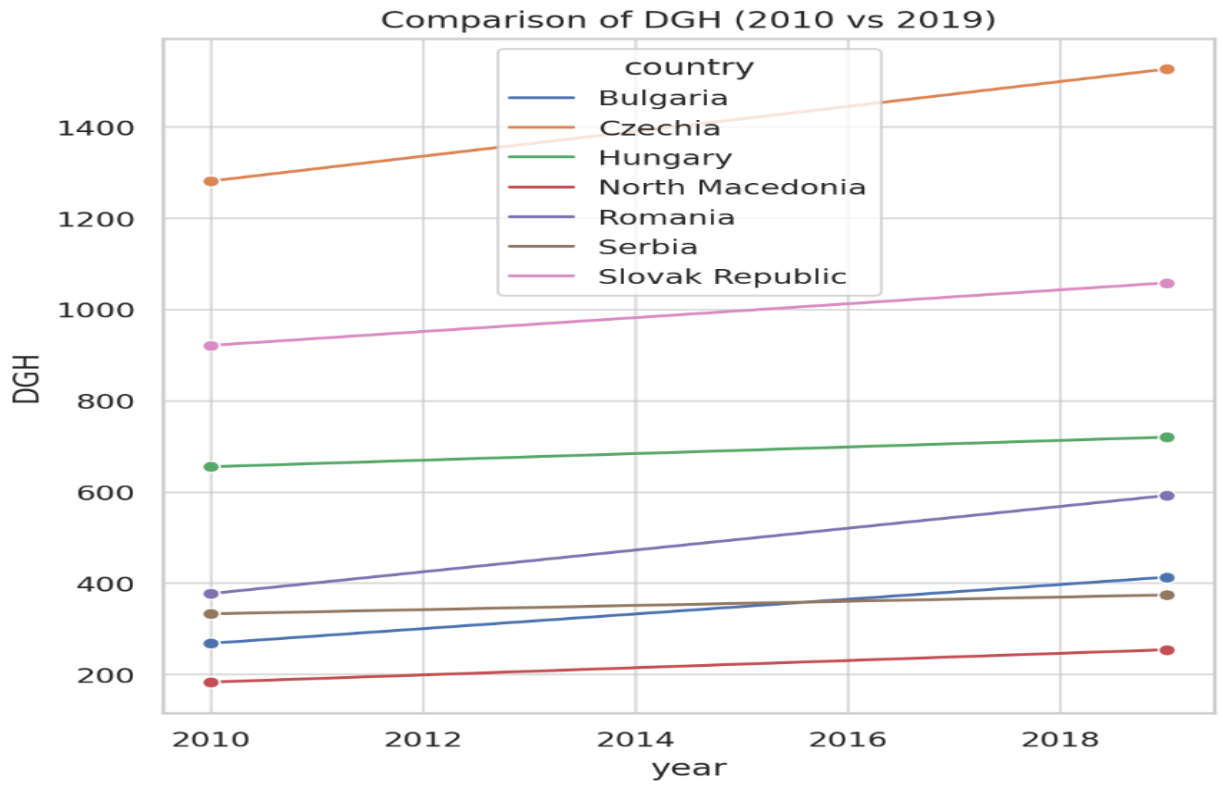


Figure 4: Comparison of DGH growth over the years among seven Eastern European countries.

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's data bank.

The data shows a consistent pattern of rising DGH expenditures in the Eastern European countries studied over the past ten years. This trend demonstrates a more extensive dedication to strengthening healthcare systems and improving public health results. Domestic government health expenditures increased in every country from 2010 to 2019, as shown in Figure 5. This points to increasing investment in public health spending, with substantial growth occurring in Bulgaria and Czechia, illustrative of a push to enhance national health environments.

The rising domestic government health expenditure indicates an increasing commitment to public health services across countries. Whether these may be expected due to the increasing demands in healthcare or demographic transitions where populations are aging, there is a stronger push for improved health outcomes. Increased government investments in health result in a sound

healthcare infrastructure, increased service delivery, and an improved population life experience, enhancing economic productivity and social stability.

More broadly, the research on income and health expenditure that has been evolving in recent years holds important lessons about what shapes these dynamics. Recent research that includes this information, in addition to broader economic, demographic, and technological factors, has shed new light on healthcare spending's response to changes in income, with significant consequences for developed and developing nations. Future research will almost certainly cast even more light on this central feature of economic and social development as data quality and availability steadily improve.

2.4 Renewable energy consumption

One of the critical infrastructure components for socioeconomic development is renewable energy, which is the most adaptable form of energy (Inglesi-Lotz and Dogan, 2018; Emam and Tashkandy, 2023). The debate surrounding the threshold effect of sectoral renewable energy consumption on economic growth has attracted significant interest, although there needs to be more empirical evidence to substantiate this matter (Dabboussi and Abid, 2022). Hansen (2002) found that the impact of renewable energy consumption in specific sectors on economic growth is both positive and statistically significant. Further research has demonstrated that using renewable energy leads to a rise in economic development. Bhattacharya *et al.* (2016), also provide evidence supporting the positive impact of renewable energy use on economic growth. Renewable energy sources have the potential to ensure energy stability, encourage social and economic progress, increase energy accessibility, mitigate climate change, and minimize environmental and health consequences (Asumadu-Sarkodie and Owusu, 2016).

All centimeters of Earth's landmass bear witness to the heavy price humans and nature currently pay for economic progress via hastened environmental despoliation. The overemphasis on economic growth, often without sufficient regard for environmental consequences, is a crucial factor in the widespread ecological disruption of our planet. However, the best option to control and minimize environmental degradation is renewable power, which provides a way for sustainable development. Climate scientists say it helps cut back to reduce GHG that drive global

warming. This is crucial because nature is threatened by the impacts of climate change all over. The more concerning part is that the inconsistent weather pattern results from global warming as we consume energy in an unsustainable manner, further igniting climate havoc like hurricanes, floods, and droughts.

Globally, energy consumption and the consequences of GHG are among the most severe environmental threats. Energy requirements spike with growing populations and expanding industries, putting a strain on precious resources as we continue to speed up climate change. The Global Footprint Network uses the concept of an Ecological Footprint to quantify a nation's impact on nature (Kumar *et al.*, 2022). It accounts for much of our natural heritage and what we are drawing on, essentially showing whether this balance (or rather imbalance) between humanity's demand and the planet's regeneration capacity is required to meet that has been met or not. It also compares this demand with the planet's biological capacity to regenerate those resources so that nations can monitor their path toward sustainability.

The GDP system is also based on the elementary idea that the demand and supply of nature can be quantified. The production of goods and services demanded by human activities inevitably requires resources and generates pollution or heat waste at each stage (beginning from raw material extraction). Hence, all the GDP figures are tightly associated with the process. As well documented elsewhere (in particular by earlier studies), the Ecological Footprint is a prized source for gauging humanity's impact on nature. It provides insight into how uneven or unsustainable consumption contributes to the depletion of natural capital due to previous economic practices. This underlines the pressing necessity for policies of transformation that will help forestall such industrial overreach and provide future generations with a habitable world. Incorporating the Ecological Footprint into national policy can be an effective tool in helping countries manage their ecology.

Table 7: Systematic Review of Renewable Energy Consumption

Authors	Methods	Context, Country, and Periods	Determining Variables
(Li *et al.*, 2023)	hierarchical linear modeling (HLM)	How cultural trade affects Chinese firms' outbound foreign direct investment Country: China Period: 2005-2016	cultural trade between China and its partners
(Benfratello, D'Ambrosio and Sangrigoli, 2023)	Regression Analysis	Are investors in Africa differ between Chinese and non-Chinese firms? Country: 43 African destinations Period: 2004-2017	GDP growth, FDI stock, and many more
(Lucke and Eichler, 2016)	Regression Analysis	The Determinants of FDI stocks are focused on institutional and cultural factors. Country: 65 countries Period: 1995-2009	Foreign direct investment
(Chung, 2014)	Regression Analysis	Environmental regulation affects the foreign direct investment (FDI) Country: South Korea Period: 2000-2007	Foreign direct investment (FDI)
(Ngoc, Xuan and Huong, 2024)	the unrestricted fixed and random panel data method.	The association between carbon dioxide emissions, population dynamics, migration patterns, foreign direct investment, and gross domestic product. Country: Vietnam	Foreign direct investment (FDI)

From this standpoint, the beneficial effects on the correlation between sector-specific use of renewable energy and economic advancement are of utmost importance. Undoubtedly, this might streamline the execution of suitable energy and economic expansion policy measures (European

Commission, 2010). This principle also applies to strategies promoting sustainable development and the stability of nations. It also applies to policies fostering sustainable growth and the strength of countries. Additional study and the development of novel econometric techniques are necessary to address the differences in empirical findings and enhance the analysis of the correlation between sector-specific renewable energy usage and economic growth (Emirmahmutoglu et al., 2021). Therefore, renewable energy sources are directly linked to sustainable development under their influence on economic productivity and human development.

A supply of renewable energy is an urgent line of action necessary to reduce environmental effects in compliance with the new "decarbonization" targets introduced by the EU. The target is ambitious, expected to ratchet up national efforts beyond those necessary merely for reducing reliance on fossil fuels and make significant progress in cutting the emissions that cause global warming. Of course, as semantics enthusiasts have noted in the past few years, the environmental victories for renewable energy are only an expected side effect. One of the most extensive social consequences is likely to be provocations for job creation, which are highly significant in times of economic crisis. Nevertheless, others can be created in industries like manufacturing, installation, and maintenance as the renewable sector grows, generating immediate economic stimulus and fostering long-term financial stability.

Moreover, the EU's decarbonization objectives during the last few years include electricity supplied from renewable sources and thermal energy and extensive energy-efficient retrofitting to structures. Energy retrofit works to improve the performance of a building so that it becomes economical and greener. Still, these initiatives have broad societal benefits that extend far beyond the apparent energy reductions and environmental impact. Users can receive enhanced indoor comfort at an individual building level, such as improved temperature regulation and air quality, which will significantly improve the overall ability to enjoy a comfortable life. Second, on a societal level, these measures can have co-benefits such as good health, which is only postulated in the fourth.

The social consequences of these must be far-reaching. As we fight climate change, renewable energy reduces environmental risk and makes communities more resilient to future shocks. The health benefits of cleaner air, fewer greenhouse gases, and better indoor environments can result in many savings regarding healthcare costs. In addition, employment in renewable energy and the

associated field of energy retrofitting are essential sources for new economy sectors with economic regeneration possibilities (particularly areas where traditional industry is declining). Finally, renewable energy sourcing enhances the security of supply, reducing reliance on volatile fossil fuel markets and enabling a cleaner, more sustainable manner to generate power within nations, improving their independence on the global stage concerning access.

Renewable energy is pivotal in fostering sustainable development by providing a reliable and clean energy source that supports long-term economic growth while minimizing environmental degradation (You and Lv, 2018). As the world grapples with the challenges of climate change and dwindling fossil fuel reserves, the transition to renewable energy is increasingly seen as an ecological necessity and an economic opportunity. The shift towards renewable energy can drive job creation, stimulate technological innovation, and enhance energy security, which is crucial for achieving sustainable development goals (Raggad, 2021).

Apart from its economic advantages, Renewable Energy also dramatically assists in curtailing the harmful effects caused by climate change. Reducing emissions of greenhouse gases by taking more significant advantage of renewable energy is needed to meet overall global climate targets, such as those in international agreements like the Paris Accord. Not only will a low-carbon economy help stop global temperatures, but it will also lower health and environmental costs from air pollution related to the burning of fossil fuels (Bracco *et al.*, 2018). In so doing, they can also help improve public health and reduce healthcare costs over time, which pay dividends to sustained economic growth (Ipcc, 2018).

However, to unlock the full potential of renewable power, I first have some hurdles associated with its adoption that must be overcome (Armeanu *et al.*, 2017). For the decentralization of energy to ensure a reliable and cost-effective grid, existing challenges must be met. Solar panels cannot store enough spare power for days without sunshine or wind; these renewable energies require storage solutions that have not been realized, yet minimal innovation has occurred in distributing domestic-sized production systems across neighborhoods or grid zones. Changes in energy supply, such as the move to renewable energy sources, need careful management to ensure a fair share of benefits, especially for vulnerable groups who may be hit hardest by changes linked to moving away from fossil fuels. Policy-makers, therefore, need to be especially careful when defining and

applying these strategies, always ensuring a balance between economic growth on the one hand and social equity or environmental protection on the other (Ben-Salha *et al.*, 2018).

A big plus of renewable energy is that it can offer us a pathway to decentralizing energy production and, with time, fewer consumers on larger power grids (Dell'Anna, 2021). In more remote or underserved areas lacking even the basic grid infrastructure, decentralized energy systems like solar panels and wind turbines can be deployed to provide access to electricity (Ullah *et al.*, 2021). Its ramifications can be world-changing in developing areas with significant energy poverty, which is a critical hurdle to the ongoing economic uplift of societies. Renewable energy can help alleviate poverty, improve education and healthcare services, and improve overall social well-being due to their potential to enhance access to energy (Maji *et al.*, 2019).

The growth of a country's GDP reflects its overall economic vigor, which directly influences its ability to invest in renewable energy infrastructure (Aldieri *et al.*, 2021). A higher GDP enables governments and private groups to allocate more excellent financial resources toward funding renewable energy initiatives (Adekoya *et al.*, 2021). An example is Romania's robust GDP development, which has facilitated significant investments in renewable energy. As a result, renewable energy consumption has seen a noteworthy surge between 2010 and 2019. Stern (2011) stated that a strong GDP enables increased investment in renewable energy, supporting the shift towards sustainable energy systems.

Table 8: Renewable energy consumption (% of total final energy consumption) of seven Eastern European countries.

Renewable energy consumption							
Year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	14.3	10.9	13.5	22.3	24.1	20.5	10.3
2011	13.2	12.2	14.7	18.6	21.1	17.4	10.4
2012	15.6	12.8	16.5	18.3	21.5	19.5	10.5
2013	18.2	13.9	17.2	21.2	23.1	20	10.7
2014	17.1	14.8	15.7	21.2	24.3	23.2	12.2
2015	17.9	14.8	15.6	23.9	23.7	21.2	13.4
2016	17.7	14.8	15.3	21.4	24.4	20.9	13.1
2017	17.1	14.5	14.6	19	23.4	20	12.4
2018	19.6	14.7	13.6	20.9	23	21	12.4
2019	19.3	15.9	13.6	17	23.5	21.4	17.6

Source: World Bank's data bank.

According to Table 4, Figures 6, and 7, Bulgaria experienced an increase in renewable energy consumption, which grew from 14.3% in 2010 to a peak of 19.6% in 2018 before slightly declining to 19.3% in 2019. This indicates a general increase with significant variations. The usage in Czechia steadily increased from 10.9% to 15.9%, demonstrating a persistent dedication to renewable energy.

Hungary's utilization of renewable energy increased from 13.5% in 2010 to a peak of 17.2% in 2013 but decreased to 13.6% by 2019. Consumption in North Macedonia exhibited substantial fluctuations, reaching a peak of 23.9% in 2015 and declining to 17% in 2019. It highlights the difficulties in sustaining consistent growth in the utilization of renewable energy.

Over the period, Romania consistently used renewable energy at a reasonably stable rate, with a bit of annual fluctuation, growing from 24.1% to 23.5%. The proportion of renewable energy consumed in Serbia increased steadily from 20.5% in 2010 to 21.4% in 2019, with occasional variations.

The adoption of renewable energy sources in the Slovak Republic increased significantly from 10.3% in 2010 to 17.6% in 2019, demonstrating noteworthy development.

This report emphasizes the different paths countries take in adopting renewable energy, showcasing the progress and obstacles faced in enhancing renewable energy usage. The patterns indicate a more comprehensive regional dedication to implementing sustainable energy practices, even though the rates of progress and stability vary.

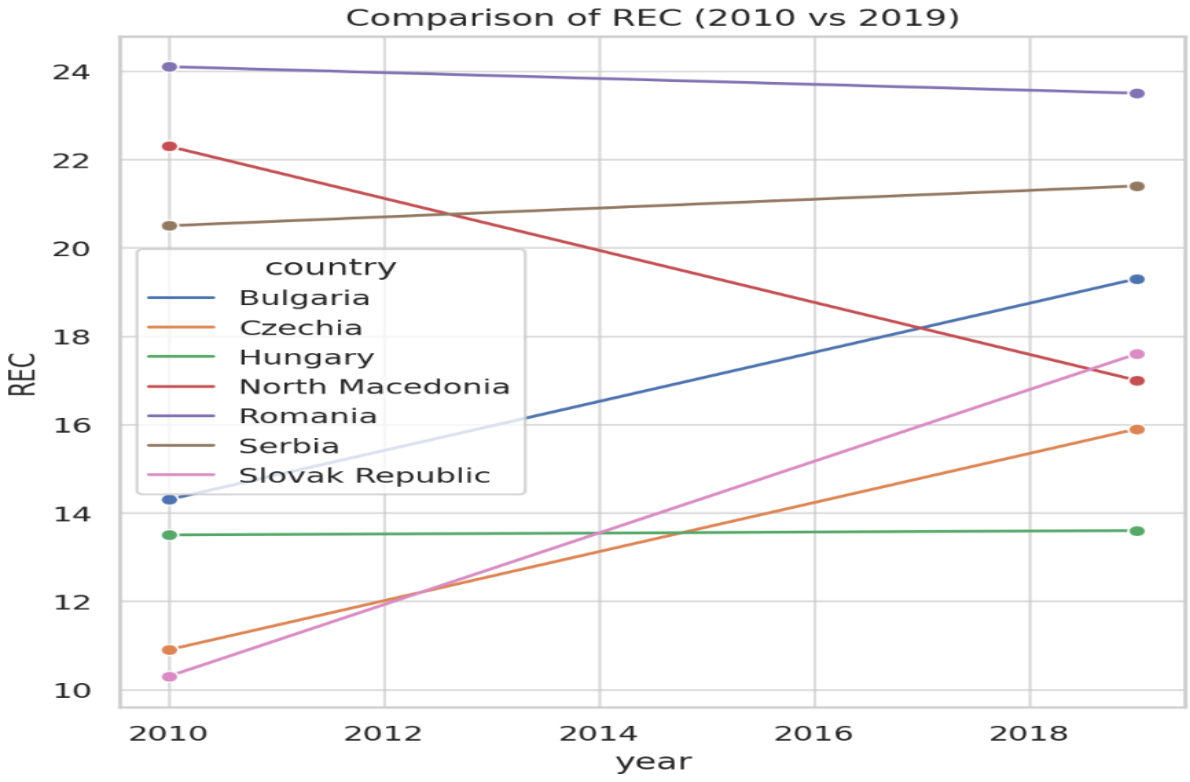


Figure 5: Comparison of REC growth over the years among seven Eastern European countries.

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's data bank.

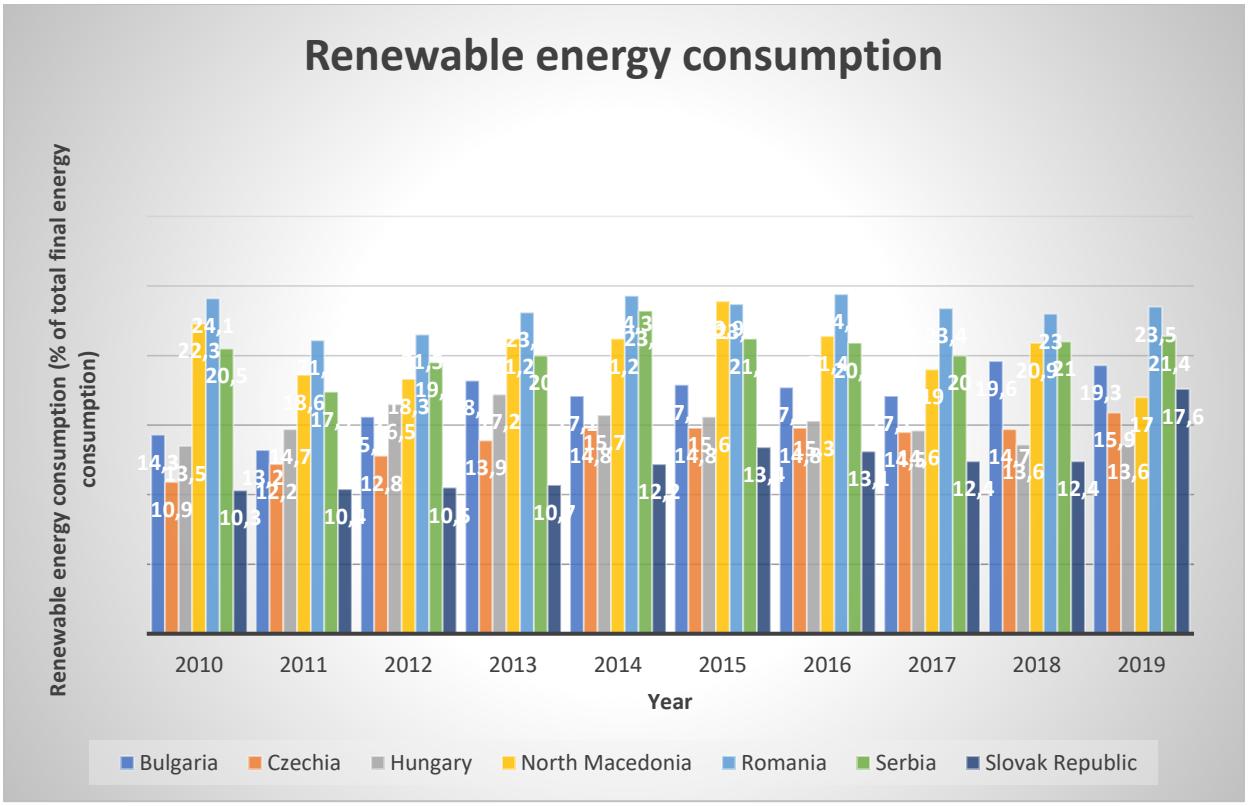


Figure 6: Visual representation of Renewable energy consumption in histogram among seven Eastern European countries.

Source: World Bank's data bank.

As shown in Figure 6, Energy use from renewable sources grew in almost all countries, continuing the upward trend seen since 2017. Yet, Bulgaria and Czechia stand out even more as a relative political change towards renewables in these countries.

The impact of GDP on renewable energy is complex, involving investment capacity, technology progress, policy formulation, infrastructure, and public awareness (Rahman and Velayutham, 2020). Higher GDP levels and the greater use and advancement of renewable energy are typically associated with a positive association (Vural, 2020). I also see this positive influence in my selected Eastern European countries. The selected seven countries have given us the true promise of renewable energy. Higher GDP levels generally correlate with increased adoption and development of renewable energy, highlighting the importance of economic growth in achieving

sustainable energy goals in the selected Eastern European countries. It emphasizes the significance of economic growth in attaining sustainable energy objectives.

2.5 Employment Ratio

The relationship between GDP and employment is fundamental in economic theory. A notable study by the St. Louis Federal Reserve investigates the correlation between GDP growth and employment rates, emphasizing that GDP and unemployment frequently exhibit inverse movements. Okun's Law summarizes the relationship between GDP and unemployment, stating that a 1% decline in GDP is often associated with a 2-percentage point increase in unemployment (Okun, 1963). Nevertheless, these factors' correlations might drastically differ during economic turmoil, such as the Great Recession, as evidenced by observed deviations from the usual pattern (Sanchez and Liborio, 2012).

Table 9: Systematic Review of Employment to Population Ratio

Authors	Methods	Context, Country, and Periods	Determining Variables
(Klinger and Weber, 2020)	Constant parameter, OLS regression, TVP regressions	Association between German output and employment growth. Country: Germany Period: 1993-2018	employment growth
(Demirgüç-Kunt, Lokshin and Torre, 2024)	OLS regression	The effectiveness of income protection and job protection policies. Country: 154 Country Period: 2020-2021	GDP, Income Protection GDP, employment Protection GDP
(Moghaddasi Kelishomi and Nisticò, 2022)	Regression analysis	The effect of economic sanctions on employment. Country: Iran Period: 2005-2012	annual change in import exposure, industry's export exposure
(Brancaccio, Garbellini and Giammetti, 2018)	OLS regressions	How to increase employment and income by using Employment Protection Legislation Index (EPL) Country: OECD countries Period: 1991-2013	employment protection

(Gallipoli and Makridis, 2022)	The method of Okun (1963)	Relationship between GDP and Employment Country: Canada Period: 2020	employment growth

This relationship highlights the importance of economic growth in promoting employment creation. Okun's Law, which also previously states that a direct correlation exists between GDP growth and a decrease in the unemployment rate, is observed in these nations. Specifically, a 1% decline in GDP has shown a 2-percentage point increase in unemployment. However, the Great Recession highlighted how these correlations may diverge dramatically during economic turmoil (Sanchez and Liborio, 2012).

GDP gives the broadest indication of recovery because it measures how much economic output and production countries have. Still, there is also no level other than employment where the direct reflection in the labor market's ability to absorb or not. A rising GDP is usually a sign of economic growth, as businesses have to produce more to meet growing demand, which means higher job creation and lower unemployment (Romer, 2012).

Furthermore, as educational attainment improves the chances of employment, a fundamental question is raised: should governments allocate resources to lift certain levels of education? The literature justifies public intervention in education on many counts regarding the provision and finance of education. First, much theoretical and empirical literature has focused on human capital as an archetype that accounts for cross-country differences in growth rates (Eklund and Pettersson, 2019). The central thesis of these works is that, on average, schooling (or education) matters a good deal in explaining productivity differences because more educated populations are more extraordinary pools from which to draw highly innovating or efficiency-enhancing workers and hence enjoy higher economic output. These differential levels of educational attainment between nations are part of the explanation for why their economic paths have splintered apart.

A second consideration is the intrinsic and instrumental value of education. Education: A private good where the end consumer benefits directly by having more knowledge, skills, and higher future income streams (Eklund and Pettersson, 2019). People who hit up education levels increase their chances of getting better job opportunities, higher pay, and a better overall quality of life.

However, education is an investment that benefits not just the individual but also society. Across the board, a more educated workforce augments human capital in the economy, resulting in higher productivity, innovation, and economic development. This results in a positive externality; the benefits of an educated population spill over to other sectors of the economy and society, even to those who did not directly invest in it.

Conversely, decreasing GDP can be an economic signal of a contracting economy and potential job losses, which lead to higher unemployment. This is the foundation of much economic policy designed to accelerate growth and, in turn, reduce unemployment (García-Vega et al., 2021). There are several types of unemployment, but the most common is structural unemployment, which supposes that people who have been laid off as assemblage workers will be unable to find jobs because they probably need training not only on how transfers among states and regions exchange these positions. Contrary to cyclical unemployment, this form of unemployment is relatively inelastic concerning changes in GDP.

One of the most efficient ways to decrease joblessness is widely recognized as human capital or mere abilities and capabilities available in a large mass. One of the primary themes in economics was that formal education raises individuals' labor-market opportunities by giving them valuable skills. Education enhances labor market access and job quality through better working conditions and higher wages. Theoretically, there is a positive relationship between educational levels and employment generation, where an increase in education level leads to increased employability and economic productivity.

However, empirical research into whether higher levels of education result in lower unemployment rates is mixed. Although education can provide people with the right skills to succeed in the labor market, they are unlikely to get a good job if it is only ensured through so-called general cognitive abilities. This support for the imperfect view of human capital is found in research (Hu *et al.*, 2020) that suggests education may have little effect on an individual's labor market status unless accompanied by measures to raise demand for those skills. Labor and non-labor policies (say to make those relevant sectors more employment-intensive) are needed for these educational investments to result in jobs. The lack of these complementary policies may have prevented the lessons learned through schooling from being put to good use and well-educated people from winding up in jobs beneath their training.

Further, high-quality education also significantly impacts what individuals eventually do in the labor market. The more extended schooling that acquiring basic skills takes, the less productive educational investments become as a potential strategy. Here, the system may not provide the desired labor market outcomes, as people spend years in education without acquiring skills that make them survive in a changing job market. This shortcoming is especially problematic in developing countries because the connection between educational provision and labour market needs tends to be weak; as a result, mismatches occur frequently between skills supplied (taught) and those required. Therefore, reforms to upgrade the quality and relevance of education and broader economic policies that can generate jobs are so critical.

As automation and artificial intelligence (AI) become more prominent, technological advancements change the linkages between GDP and employment (Elgin *et al.*, 2021). If applied effectively, these platforms and cities of the future could raise GDP through productivity but would also challenge employment. Automation can also cause job displacement, especially in repeatable tasks requiring fewer skills, resulting in a higher unemployment rate even though GDP increases. The result is a call for people with better policies to promote GDP growth, but there also needs to be structural interventions for the labor market in which technology creates winners and losers (Brynjolfsson and McAfee, 2014).

I observed the same signature when applying the MMQR. Furthermore, this study also investigates how education impacts economic growth and its indirect impact on employment. Education's effects on GDP and employment have also been significantly distinct between economic conditions (Chien, 2020). Second, economic growth may generate economy-wide structural changes that influence employment across many sectors of the economy. High GDP levels create economic neutrality in tech, manufacturing, and services, generating many job opportunities.

Table 10: Employment Ratio among seven Eastern European countries.

Employment Ratio							
Year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	47.902	54.186	44.761	35.969	51.051	40.153	50.518
2011	46.597	54.351	45.008	37.839	50.225	38.374	50.777
2012	46.567	54.547	45.715	37.847	50.902	38.196	50.938
2013	46.925	55.16	46.615	39.427	50.658	39.956	50.862
2014	47.957	55.686	49.283	39.921	51.139	41.9	52.811
2015	49.128	56.419	50.785	40.736	50.826	42.466	52.814
2016	49.293	57.553	52.606	41.741	50.551	45.227	54.264
2017	51.94	58.48	53.711	42.609	52.231	46.764	55.088
2018	52.438	59.197	54.417	43.19	52.676	47.653	55.898
2019	54.187	59.16	54.927	45.667	52.984	49.127	56.261

Source: World Bank's data bank.

The connection between jobs and GDP is the most essential labor market power measure, revealing economic health. The effects of GDP on employment in Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic have always been linked to a rise in job creation because more economic activity means demand for labor would increase. Growing businesses and emerging companies lead to employment opportunities. For example, GDP remained on a consistent growth path in Czechia and Hungary, with the employment-to-population ratios continuously increasing over the past decade. It is an essential relationship for promoting employment creation with the help of economic growth.

During the time under analysis, most countries showed a favorable employment-to-population ratio (EMP) trend. For example, Bulgaria experienced an increase in employment levels from 47.90% in 2010 to 54.18% in 2019, demonstrating consistent improvement. Comparably, Czechia's employment increased from 54.18% to 59.16% within the same time frame, indicating a steady and continuous expansion. Hungary's (EMP) substantially rose from 44.76% to 54.92%, indicating substantial progress in the labor sector.

According to Table 10, Figures 8 and 9, North Macedonia experienced a significant increase in its (EMP) from 35.96% in 2010 to 45.66% in 2019. This indicates substantial advancements in

incorporating a considerable portion of its working-age population into the workforce. Romania experienced a slight rise from 51.05% to 52.98%, while Serbia's EPR increased from 40.15% to 49.12%, suggesting gradual improvements in both employment situations.

The Slovak Republic exhibited a favorable trajectory. Its employment-to-population ratio (EMP) increased from 50.51% in 2010 to 56.26% in 2019, placing it among the countries with the highest employment rates by the decade's end.

The rising EMP trend in these countries indicates a general enhancement in economic circumstances and labor market integration (Giupponi, Landais and Lapeyre, 2022). This development occurred within the analyzed period. Based on the data, the job market is strengthening, which would enhance the economic stability and prosperity of the region (Giupponi and Landais, 2023).

Moreover, the increase in EMP indicates that enterprises are growing and generating additional employment prospects for individuals in these nations. It is promising for decreasing unemployment rates, boosting general consumer expenditure, and encouraging economic growth (Lokshin *et al.*, 2023). With the ongoing improvement in the labor market, wages will probably rise, enabling workers to have more disposable income. This, in turn, will contribute to the growth of local businesses and stimulate economic development. The EMP generally indicates a favorable path for the region's economy in the upcoming years.

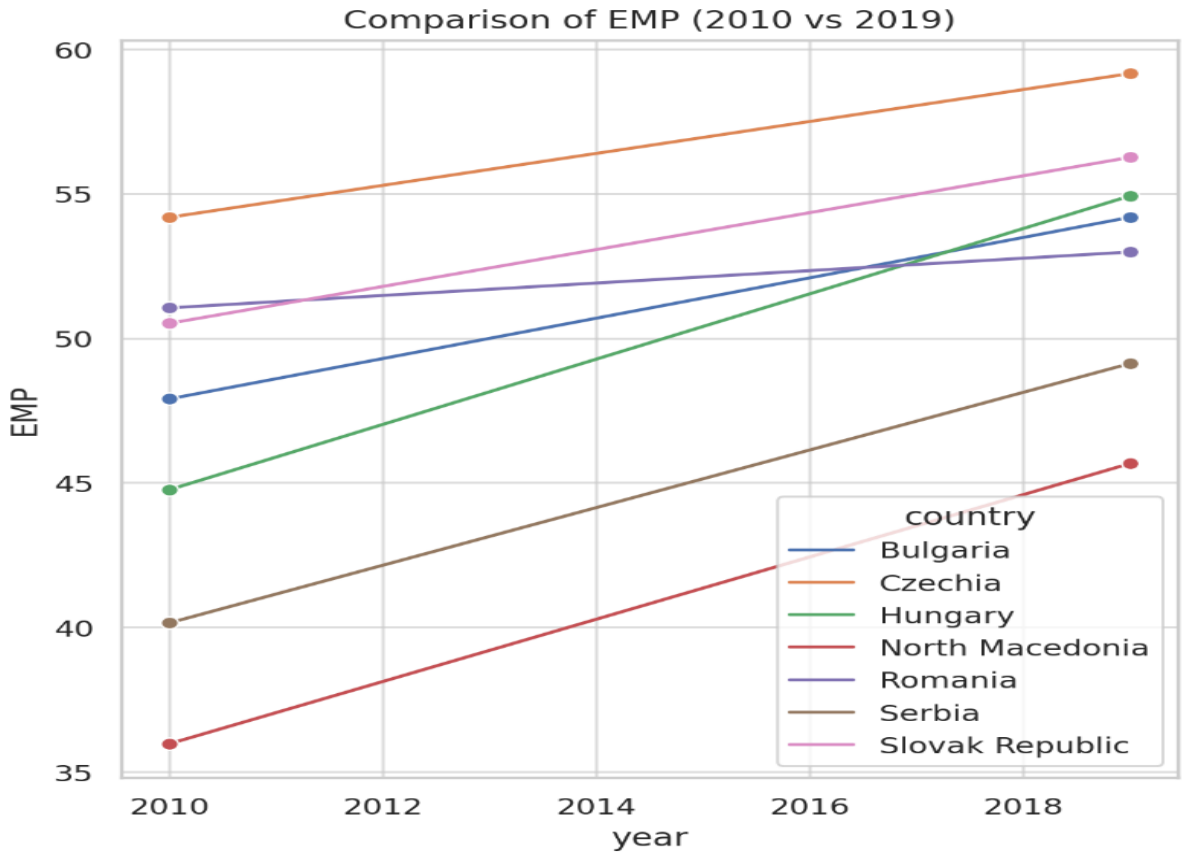


Figure 7: Comparison of EMP growth over the years among seven Eastern European countries.

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's [data bank](#).

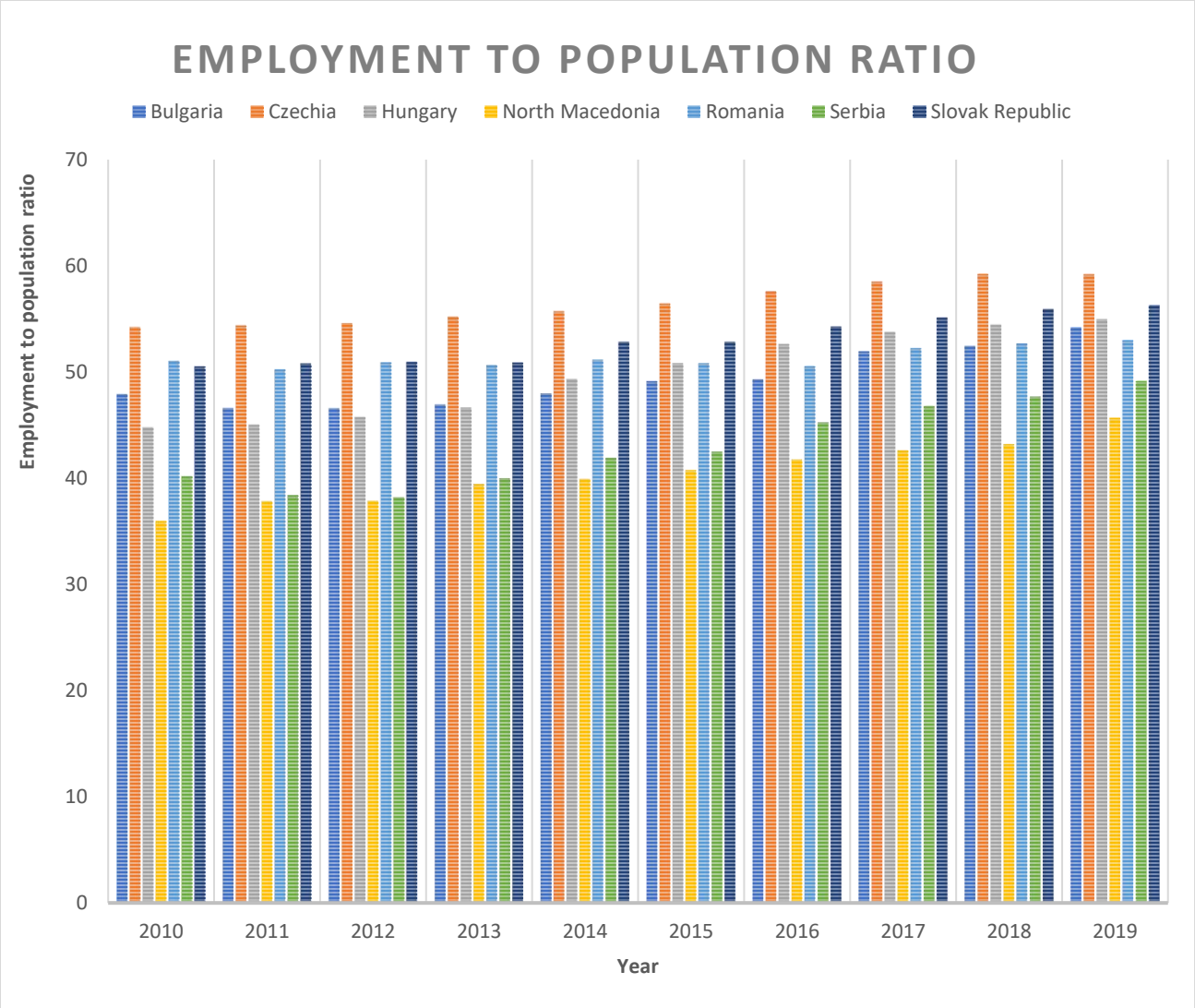


Figure 8: Visual representation of Employment to population ratio in histogram among seven Eastern European countries.

Source: World Bank's data bank.

As shown in Figure 8, Global employment rates are on the rise in all countries, indicating rising job opportunities and potentially an improved economic climate. Bulgaria and Hungary turned positive at high rates, reaching peaks in this indicator. This graph also highlights improved labor market conditions and financial health. Increasing participation in the workforce can significantly enhance economic recovery, job creation, and business activity. It also boosts the country's natural and economic growth.

Economic growth can drive structural changes, influencing employment patterns across different sectors (Bank, 2020). Higher GDP levels often lead to expanding industries such as technology, manufacturing, and services, creating diverse job opportunities (C. Onuoha and Agbede, 2019). In Romania and the Slovak Republic, economic growth has facilitated the development of these sectors, leading to higher employment levels in emerging industries.

2.6 Educational attainment

An empirical investigation of disparities in growth rates leads to a straightforward conclusion: the long-term growth of a nation's gross domestic product (GDP) is mainly influenced by the proficiency of its population (Ahec Sonje, Deskar-Skrbic and Sonje, 2018). Economists have invested a significant amount of time and effort in developing and comprehending alternative mechanisms that may contribute to the expansion of nations (Jones, 2002; Acemoglu, 2009). They have written entire volumes on the implications of economic growth models. Additionally, they emphasize the importance of human capital in enhancing the economy's ability to innovate by promoting the creation of groundbreaking concepts and technology. Within the model, technical evolution is influenced by economic pressures in these investigations. From this standpoint, a specific degree of education has the potential to generate a continuous flow of novel concepts, hence enabling education to impact long-term growth rates even in the absence of additional education being introduced into the economy. The conventional approach to estimating these models centers on the expansion of income and establishes a connection between variations in GDP per worker (or per capita) and the level of education (Haini, 2020).

Table 11: Systematic Review of Educational attainment

Authors	Methods	Context, Country, and Periods	Determining Variables
(Kirkcaldy, Furnham and Siefen, 2004)	Correlation, Correlation coefficients	relationship between educational performance in reading, mathematics, and scientific literacy. Country: 30 countries Period: 2000	Educational attainment, Subjective well-being, and happiness,
(Makkonen and Inkinen, 2013)	Granger causality tests	Relationship between innovative capacity and economic development. Country: European Union (EU) Period: 2007	Innovative capacity, educational attainment, and economic development
Ulubaşoğlu & Cardak (2007)	Durbin–Wu–Hausman (DWH) tests, General-to-specific modeling, Cross-country RATIO, and specific-to-general modeling.	Cross-country differences in rural and urban educational attainment. Country: 56 Countries Period: 1964-1999	Economical, demographical, infrastructural, political, geographic, and cultural variables.
(Singh and Shastri, 2020)	Autoregressive distributed lags (ARDL) method.	the relation among public expenditure allocated to education, educational attainment at the secondary level and unemployment rate Country: India Period: 1987–2017	public spending on education, output growth (GDP)
(Jordá and Alonso, 2017)	Parametric model	Estimates on educational attainment and inequality measures of education. Country: 142 Countries Period: 1970-2010	Educational attainment

Hanushek and Kimko (2000) introduced the inquiry into the correlation between growth and skills as measured in international examinations. Researchers discovered that the correlation between economic growth and cognitive skills is much more impactful than with years of schooling. This discovery dramatically strengthens the ability of growth models to account for differences in

economic development. Conventional measures of educational achievements, such as the number of years spent in school, may need to sufficiently reflect the caliber and efficacy of education in its contribution to economic progress (Zafar *et al.*, 2021). On the other hand, the cognitive abilities of the workforce, as indicated by international exam scores, have a more significant effect on driving financial advancement. This observation emphasizes the significance of prioritizing the excellence of education and the cultivation of talents that directly affect economic output. Table 12 and Figures 10 and 11 illustrate a histogram that shows the percentage of people who have attained at least a lower secondary education from 2010 to 2019. This visual illustration emphasizes notable differences and patterns throughout the area.

The long-run economic expansion in a country is directly connected to the skill set and adroitness of its human reserves. First, empirical research (Lucas, 1988; Romer, 1990) has conclusively demonstrated that economic growth over time is driven by human capital and the workforce's collective skills, knowledge, and abilities. This can be a slight improvement in the quality of goods and services, more workable innovations due to a skilled population, and creating conditions for them to adapt better to how an economy changes their fate, which means further GDP growth.

Alternative development mechanisms for the economy have transformed a great deal of time and effort into constructing theoretical models that explain how nations grow (Acemoglu, 2009). Economists have tried different models and theories to explain the determinants of economic growth. Groundbreaking works like those of Paul Romer and Robert Lucas have demonstrated that knowledge, innovation, and human capital drive economic growth. These models depart from conventional neoclassical growth models to include endogenous factors like technology and education as primary drivers of economic development, allowing for a more holistic understanding of how economies evolve.

Because of the externalities associated with education, unrestrained provision by private means can lead to market failure, unlike a standard private good; however, the benefits generated by education are not non-rivalrous; they extend beyond any consumer. Instead, benefits are shared socially through higher economic growth and employment rates, lower crime rates and better health outcomes. Market outcomes are said to lead to under-provision education when private and social benefits diverge. Accordingly, individuals may invest insufficiently in education, so the optimal level and composition of human capital for society are not reached. Hence, the state plays

a very important role in ensuring that all citizens have equilateral educational opportunities and should provide efficient regulation since market failures are often prevalent.

This state intervention is particularly crucial regarding its market invisibility in solving both the problem of poverty and inefficiency. Such barriers can severely limit the opportunity for education among those who are already socially deprived, a phenomenon that perpetuates cycles of poverty and social inequality. Moreover, education is both a means of consumption and capital so that it can lead to individual growth and an intergenerational investment in human capital. Credit markets, however, do not work well for education because low-income families often cannot borrow enough money at terms that enable them to afford the cost of educating their children. It also contributes to generational inequities, given the connection between education and familial income (and wealth). Without government intervention, these disparities will remain and impede social ladders for millions of individuals who cannot maximize their economic power.

In these countries, it is not only legitimate but necessary for the government to fund education to grow its economy equitably and without depleting all resources. Education helps break the cycle of poverty and reduce current disparities while investing in future productivity and economic growth. Ensuring everyone is equipped with the necessary quality education will mean everyone has access, whether poor or rich.

Schooling is an investment like any other and entails some risk. One of the significant risks for households is child mortality, which leads to a loss in investments in education before they can pay off. In the case of students, uncertainty may increase due to the changing demand for skilled workforce in local markets and, hence, future employment prospects. Thus, the returns to education are uncertain as some make their money back. In contrast, others do not, mainly concerning local economic conditions and the needs of the labor market. Demographic differences will largely determine the probability of children completing a schooling program. In contexts with high child mortality rates or poor health status, the risks attached to education become more pronounced as students can complete schooling and access the labor market. Moreover, politics are very much responsible for changing educational outcomes. Enforcement of contracts is a measure of the rule of law and security for property rights, underpinning the incentives that drive households to invest in schooling. Such institutions help lower uncertainty by making returns to

education more stable, and individuals are more likely to be absorbed into formal labor markets where their signals can be effectively rewarded and deployed (Majid and Behrman, 2021).

In contrast, a bad environment can magnify the risks of investing in education, weak institutions, or politically unstable environments. Corruption, nepotism, and discriminatory practices in the labor market can prevent these promising returns to schooling without complementary protection for workers or clear property rights. Second, differential across-the-board measures in the enforcement of laws, as well as the degree of political stability, can provide households and students with a stronger or weaker incentive to acquire education (Fjelde and Hegre, 2014). Together, these factors shape the likelihood that students will not only finish their schooling but also secure gainful employment where they can recoup and contribute (through taxes) to economic returns on the investment as human capital.

The vital role of formal labor markets in the economy is that the education choices made by households and students, depending on whether agriculture or non-farm production, are relatively more significant. In economies where agriculture is mainly subsistence, the skills and knowledge for such work can often be obtained by way of informal learning methods like a silent apprenticeship to a dad or mum who has completed it with their particular children. Here, there might be less incentive for families to pursue formal education if the perceived returns to schooling, especially in terms of eventual job prospects, are low (Michailidis and Lazaridou, 2020).

However, the benefits of schooling increase quite a bit when non-agricultural employment options are extensive. Over time, in economies with a mix of manufacturing-services-technology sectors, there is an expanding need for more and better education. The need arises for these industries to rely on a formal education system, as some aspects may only be acquired through the knowledge and hands-on training provided in schools. As a result, families are more likely to value education because they believe that higher educational attainment translates into better job opportunities and, therefore, higher wages with some flow-on effect on social mobility. The highly formal labour market associated with non-farm production motivates households to expend resources in their children's education because it is expected, though not guaranteed, that such investment would be likely to yield long-term economic benefits.

This contrast underlines the structure an economy is bound to have on education choices. That would undoubtedly be the wrong answer for many developing countries where agriculture predominates, especially in subsistence farming; completing an average education might not make sense as an investment, given how small the gains to skills are over agricultural work. Furthermore, when developing countries experience growth in their non-farm sectors, the opportunity costs shift so that education becomes a more attractive investment. Diversification and industrialization of economies bring the role of formal education into focus, as they make a key to economic participation and individual progress; this, in turn, incentivizes more people through more incredible sections of society to seek higher levels of educational attainment.

Not only because education produces a more capable labor force, providing immediate economic advantages, but also because it is conducive to long-term development by enabling innovation. Endogenous growth models posit that the knowledge and skills learned through schooling generate technical change, as each generation scores on top of what was discovered by past generations. This implies that, provided the level of education does not rise much further, there remains a stock of human capital that can drive growth in new ideas and technologies (Romer, 1990; Jones, 2002).

Table 12: Educational attainment, at least completed lower secondary, population 25+, total (%) (cumulative) of seven Eastern European countries.

Educational attainment							
Year	Bulgaria	Czechia	Hungary	North Macedonia	Romania	Serbia	Slovak Republic
2010	93.21961	99.82282	97.93047	57.68081	87.27738	85.63167	98.98125
2011	93.73533	99.81562	98.20566	58.95815	88.20022	84.58574	99.04719
2012	94.30368	99.81666	98.28557	60.22702	88.91441	65.63018	99.30277
2013	94.32664	99.79965	98.39374	61.10011	89.43608	85.7873	99.28269
2014	94.24516	99.81548	96.64062	61.80135	89.05052	86.72604	99.34426
2015	94.815	99.80766	96.76661	62.52736	89.48691	88.64245	99.27007

2016	95.14305	99.80446	97.1765	64.19839	90.00441	89.49024	99.30356
2017	95.38572	99.82792	97.42357	65.80919	90.52904	89.79982	99.2805
2018	95.40314	99.80927	97.70099	69.67716	91.08285	72.56218	99.26856
2019	95.55736	99.80963	97.90453	67.29685	91.16201	91.78774	99.01622

Source: World Bank's data bank.

The histogram shows that Czechia maintains an unusually high level of lower secondary educational attainment, with a near-perfect rate of roughly 99.8% during the decade. Similarly, the Slovak Republic demonstrates a consistent and high level of achievement, with minor fluctuations around 99%. Hungary's level of educational achievement stays consistently high, with very minimal volatility.

There was a little decrease around 2015, but a gradual improvement followed. In contrast, Bulgaria has experienced a consistent rise in educational engagement at the lower secondary level, increasing from 93.21% in 2010 to 95.55% in 2019. It indicates a continuous improvement in educational involvement. North Macedonia exhibits a noticeable and consistent increase, beginning at 57.68% in 2010 and reaching its highest point at 69.67% in 2018, with a minor decrease in 2019. This substantial increase highlights the nation's endeavors to improve educational opportunities and graduation rates.

Romania has experienced a favorable trend, with its percentage increasing from 87.27% in 2010 to 91.16% in 2019. Serbia exhibits distinct characteristics characterized by significant variations. The achievement rate experienced a substantial decline to 65.63% in 2012, after which it rebounded and reached its highest point at 91.78% in 2019. These fluctuations directly involved these countries' economic growth and indicate potential actions or policy modifications that could affect educational achievement over time.

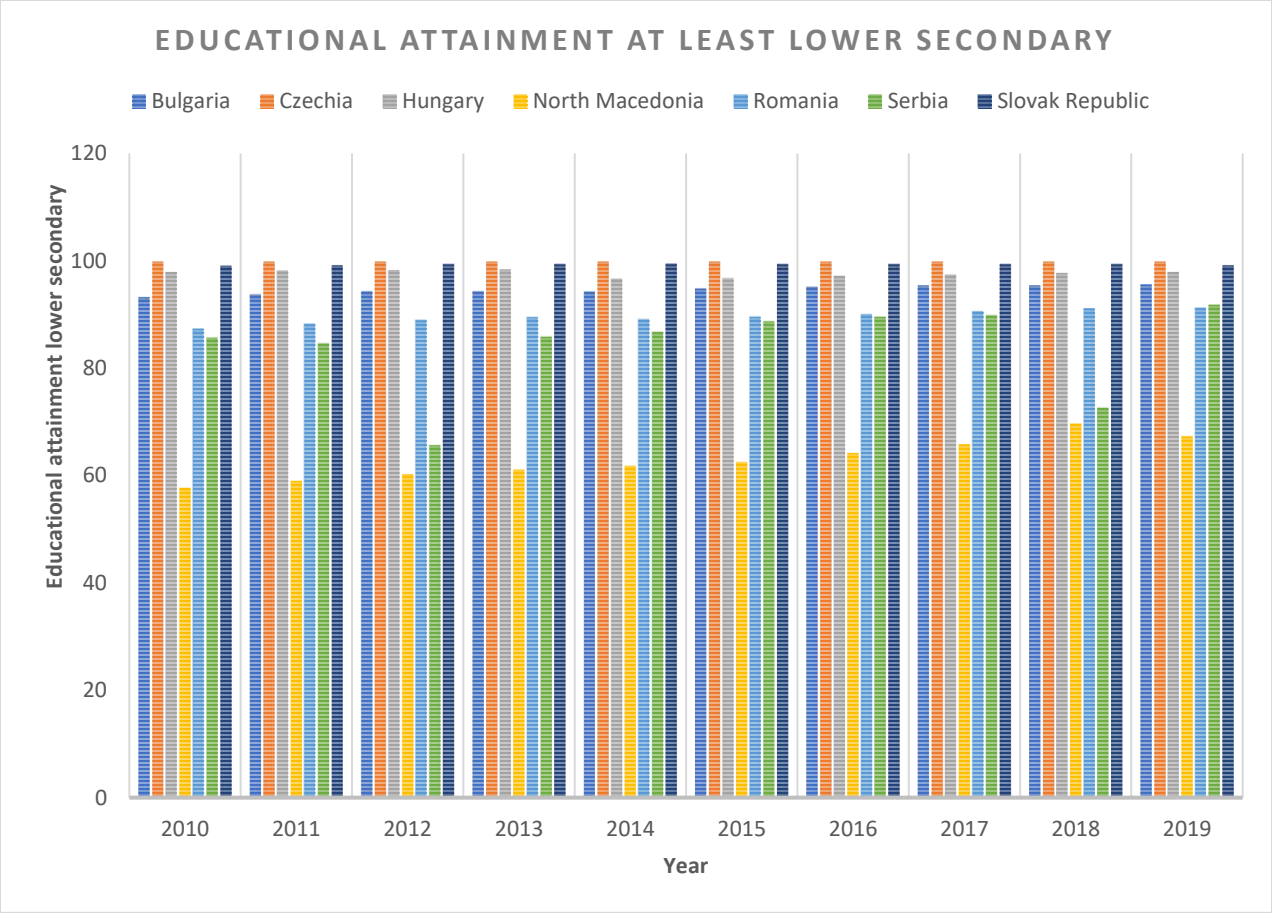


Figure 9:Visual representation of educational attainment at least lower secondary in histogram over the years among seven Eastern European countries.

Source: World Bank's data bank

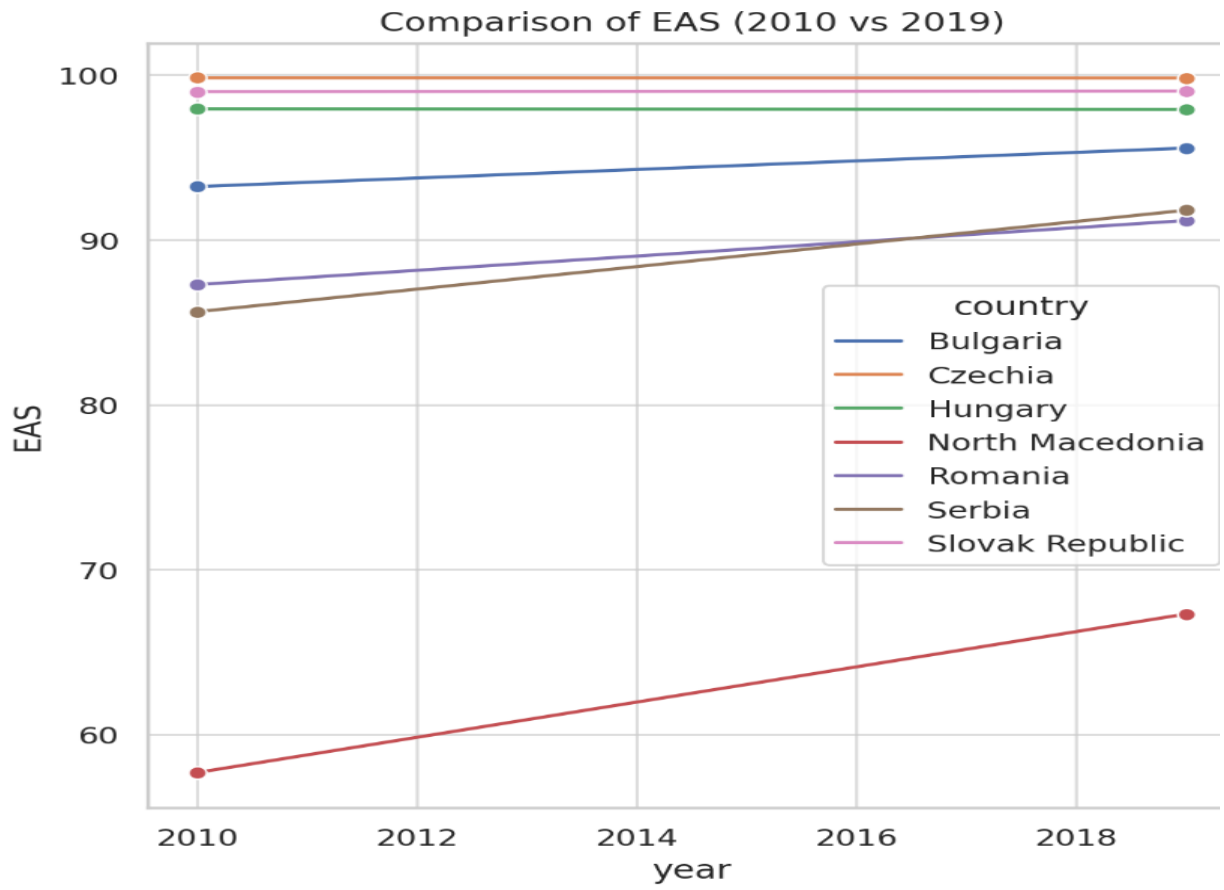


Figure 10: Comparison of EAS growth over the years among seven Eastern European countries

Source: Self-interpretation by applying Python's stat model using the same data from the World Bank's data bank.

Figure 11 also states that the Educational Attainment rate only slightly improves or stays constant, with minor variations between countries. This means the motivation to attend schools in these countries has been better or more neutral for 2010 and 2019. This stability is a positive indication for all countries, as education is the backbone of a nation. Also, the improvement of the Slovak Republic is more significant than that of any other country. However, the rate is still shallow compared to other countries.

The next portion will address the data source and methods adopted. The subsequent section will consist of the results and commentary. I employed advanced panel analysis methodology,

incorporating tests like the Unit root and Panel cointegration tests. Eventually, I utilized the most up-to-date MMQR approach to assess the stability and investigate the impact of GDP on several predetermined variables. The study will be concluded in the last phase, including policy recommendations. Finally, I employed the most recent MMQR approach to assess the stability and investigate the impact of GDP on several predetermined variables. In the final section, I summarize the study by offering policy recommendations.

3. MATERIALS AND METHODS

3.1 Hypothetical development

This dissertation examined how changes in GDP influence a variety of indicators by using data from seven Eastern European countries, namely Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic. This dissertation also has well-developed literature on these countries' economies and social interaction by taking GDP growth as an effect factor. The foremost variables are FDI, health expenditure, renewable energy utilization, employment status, and literacy rate. Furthermore, the outcomes are expected to yield valuable perspectives for policymakers who want to design interventions that foster sustainable economic growth and improve national welfare. An impactful and increasing GDP data show investors a favorable atmosphere for investment, creating opportunities to sustain and facilitate commercial activity. Bevan and Estrin (2004) also agree with this statement. They also stated that increasing GDP has more power to stabilize and appeal to foreign investment.

The dissertation emphasizes the substantial expansion in FDI as a vibrant global economic activity, rising from an average of US$142 billion from 1985 to 1990 to US$1.2 trillion in 2010. The literature analysis previously highlights those financial reasons are the main drivers of FDI decisions. However, it also underlines that a favorable institutional environment, particularly the role of governments, has grown increasingly crucial during the 1990s. Credible and efficient governments are more likely to attract FDI because it provides consistent governance, efficiently enforces rules and regulations, minimizes corruption, and adopts market-oriented policies. This understanding can help policymakers and researchers in shaping their strategies and recommendations.

The research also reveals some evidence-based suggestions concerning the role of institutions in FDI. Recent literature shows that governments have been more critical in attracting foreign investment since the early 1990s. The greater the transparency and accountability in countries, the more favorable the environment for investment. Because of the credibility and predictability, governments can provide primarily regarding regulations, reducing corruption or favoring market-friendly policies. This highlights the more general point about how economic development is

shaped by market mechanisms and, far more significantly, political, and institutional environments.

As mentioned earlier, numerous papers have supported the interaction of the selected variables with GDP. While investigating the factors that affect FDI, it is found that significant changes in FDI have happened to a country's economic growth (Awokuse and Yin, 2010; Daniele and Marani, 2011; Perez, Brada and Drabek, 2012; Gomes Neto and Veiga, 2013; Chung, 2014; Dreher, Mikosch and Voigt, 2015; Kayalvizhi and Thenmozhi, 2018). As microeconomic factors failed to examine the increasing growth of FDI related to a nation's emerging economies, researchers shifted their focus to the country's governance factor (Gani, 2007; Buchanan, Le and Rishi, 2012). They also predicted that increasing foreign investment would create a better economic environment to induce more economic growth in a country. Again, a country's culture can play a vital role in capturing more foreign investment. Hence, I can say that FDI might influence GDP. For further analysis, the following hypothesis is proposed:

H1: Gross Domestic Product (GDP) is influenced by Foreign Direct Investment (FDI)

Apart from foreign direct investment, other significant factors support economic growth with health expenditure. On the other hand, raising healthcare expenditure is essential, and if done correctly, it feeds into overall productivity, so naturally, GDP reflects increased spending on health. Workers in good health are likelier to be active in their communities and engage in full-time and overtime jobs, contributing to economic output and decreasing reliance on safety nets. Health expenditure not only adds to an individual's well-being but also contributes to building human capital and ensuring long-term financial return for a nation.

Domestic general health (DGH) expenditures show a significant correlation with Gross Domestic Product (GDP) growth (Mladenović *et al.*, 2016) in almost all countries, which also elevates irrespective of a nation's socioeconomic status. It is also evident that health expenditures increased by 10% in 2014 from 7.9% in 1997 (Self and Grabowski, 2003). This growth is even faster than the GDP growth in many countries (Rana, Alam and Gow, 2020). Previous studies didn't recognize the value of health expenditure across all citizens' income levels (Acemoglu and Johnson, 2007;

Amiri and Ventelou, 2012) and didn't announce the relation between economic growth and health expenditure. However, many studies determine that healthcare is a fundamental necessity rather than a luxury (Halıcı-Tülüce, Doğan and Dumrul, 2016; Baltagi *et al.*, 2017), with the income elasticity of healthcare expenditure being approximately equal to or slightly higher than one. They also draw causal relationships with various income levels. That is why it is necessary to investigate whether GDP has an influence over health expenditure or not. For further insights, the following hypothesis is proposed:

H2: Gross Domestic Product (GDP) is influenced by Domestic general health expenditure (DGH)

The current study examined a third dimension of sustainable development: the increasing importance of renewable energy consumption. Nations emphasizing renewable energy have a better chance of long-term economic growth through reduced reliance on unstable fossil fuel markets and fewer externalities. By adopting renewable energy, the country also paves the way for new industries and job opportunities that help increase GDP while simultaneously providing immediate solutions to climate change.

Again, renewable energy consumption is a crucial infrastructure element for promoting socioeconomic growth. The following studies (Marques and Fuinhas, 2012; Menegaki and Tugcu, 2017) emphasize the capacity of renewable energy sources to guarantee energy stability, promote social and economic advancement, enhance energy accessibility, alleviate climate change, and reduce environmental and health impacts. The report cites other research that offers data showing the favorable influence of renewable energy utilization on economic growth by highlighting the significance of examining the threshold impact of renewable energy consumption in different sectors on economic growth despite the scarcity of empirical information in this area. Most of the energy sources are dying. Now, it is high time to shift to never-ending renewable energy sources. Rafindadi and Ozturk (2017) also state that renewable energy can reduce the ongoing climate change and global warming. Securing long-term availability and uses will substantially develop rural and urban areas. Chien and Hu (2007) also showed that increasing renewable energy

consumption can improve a nation's technical efficiency. They analyzed this experiment in 45 countries and found that renewable energy positively influences the economic sector. So, it is evident that renewable energy consumption can affect a nation's GDP. Thus, I proposed the following hypothesis:

H3: Gross Domestic Product (GDP) is influenced by Renewable Energy Consumption (REC)

The Employment Ratio and Gross Domestic Product (GDP) relationship is criticized. Klinger and Weber, (2020) examined their study by applying OLS regression between GDP and employment growth. However, they found a fragile relationship with an inferior R^2 value. Then, they declared these variables to have a strong negative correlation. After the Covid-19 scenario, there has been a change in this relationship. Demirgüç-Kunt, Lokshin and Torre, (2024) stated in their study that unemployment has skyrocketed in many developing and developed countries by mid-2020. The governments of affected countries were forced to invest GDP in various sectors to reduce job retention and labor costs. However, only a 0.4 percent increase in employment appeared, which is not an expected scenario. Nonetheless, Gallipoli and Makridis, (2022) have shown results from the pre and post covid era. I have seen a moderate increase in employment by investing GDP with a satisfied R^2 value. Considering the scenario from the pre-covid era, I am assuming the following hypothesis, which also matches the pattern of my selected years:

H4: Gross Domestic Product (GDP) is influenced by Employment to population ratio (EMP)

Moreover, using the employment-to-population ratio in rich social data provides strong evidence supporting our claim that minimum wage increases influence economic outcomes. Full employment leads to a stable and growing economy, as employed persons earn money for all kinds of demand that they stimulate and the national product in which they participate. Policy recommendations and implications conclude that finally addressing the relationship between employment and GDP also points to policies that lift aggregate economic output at a

macroeconomic level but ensure it can filter through into mass job creation, rising living standards, etc.

Finally, literacy and, thus, education are crucial long-term sources of economic growth. High literacy and education levels enable countries to leverage new technologies that support economic prosperity. Building human capital is a prerequisite to creating high-value-added sectors, promoting innovation, and securing competitiveness in an economically integrated world. Therefore, long-term GDP growth is directly dependent on investments in education, as it will create a more dynamic and productive economy in the future.

Educational attainment is identified as a vital element in promoting economic growth and societal development. The research analysis highlights the significance of cognitive abilities and the quality of education, rather than the mere duration of schooling, in promoting economic growth. Studies like Ulubaşoğlu and Cardak, (2007) showed us that among many variables, GDP plays a significant role in creating cross-country differences in educational attainment. More developing countries have attracted more educational attainment to the population because of their overall economic growth. However, they found bias in urban areas, too. That made the relationship slightly unclear. However, attraction in educational attainment certainly can change in rural areas if enough GDP is allocated there. Kirkcaldy, Furnham and Siefen, (2004) found that economic growth is very weakly related to educational attainment. Again, recent studies like (Lin, 2015; Jordá and Alonso, 2017) have found a significant relationship between economic growth and educational attainment. That is why I need to investigate whether a relationship between GDP and educational attainment exists. Hence, I proposed the following hypothesis:

H5: Gross Domestic Product (GDP) is influenced by Educational Attainment at least lower secondary (EAS)

My research provides an overall understanding of the determinants of GDP growth in the selected Eastern European countries. To this result, the research provides valuable information for policymakers who wish to drive sustainable economic development by concentrating on added factors like FDI, health expenditure, renewable energy, employment, and education. The results

illustrate the combined features of long-run economic growth so that institutional quality, social investments, and environmental sustainability constitute a triangular nature that will determine its course in the mid-term.

Table 13: Descriptions of the variables

Variable	Description	Type
GDP	Per capita GDP (current US$)	Dependent
FDI	Foreign direct investment	Independent
DGH	Domestic general health expenditure	Independent
REC	Renewable energy consumption	Independent
EMP	Employment to population ratio	Independent
EAS	Educational attainment at least lower secondary	Independent

This expansive research of the Eastern European countries from 2010 to 2019 against various economic and social factors nevertheless gives some beneficial observations about their growth path. The research analyzes the economic and social development of these countries based on indicators like GDP growth, FDI inflows, healthcare spending, and renewable energy consumption rate as a percentage of total final energy consumption use being proportionally linked to employment rates at the national level. Employment is usually highest in developed nations that boast transparent labor laws. It highlights the complex interplay of these and other factors and underlines the importance of holistic approaches tailored to individual states' conditions.

Table 14: Summary Statistics

Statistic	Mean	Median	Maximum	Minimum	Std_Dev	Skewness	Kurtosis
GDP	2.59	2.72	8.20	-3.90	2.02	-0.32	1.09
FDI	4.07	3.38	60.03	-40.09	11.12	2.17	16.33

DGH	603.83	397.50	1526.63	183.00	381.08	0.83	-0.56
REC	17.48	17.30	24.40	10.30	4.08	0.03	-1.14
EMP	49.05	50.60	59.20	35.97	5.88	-0.44	-0.70
EAS	89.68	94.57	99.83	57.68	12.66	-1.41	0.62

Source: Self-interpretation using Python's describe function

3.2 Data Source

This study uses panel data from the World Bank, including data from seven Eastern European countries dating from 2010 to 2019. I extracted GDP growth (annual %) for the GDP variable, Foreign direct investment, net inflows (% of GDP) for the FDI variable, Domestic general government health expenditure per capita (current US$) for the DGH variable, Renewable energy consumption (% of total final energy consumption) for the REC variable, Employment to population ratio, 15+, total (%) (modeled ILO estimate) for the EMP variable, Educational attainment, at least completed lower secondary, population 25+, total (%) (cumulative) for the EAS variable from the world development indicator section for each country and a panel was developed to indicate the countries that are utilized. Table 7 provides details regarding the variables that were implemented.

The GDP growth rate is the annual percentage increase in a country's economic output. It is the primary indicator of financial health and vitality. This variable was chosen because it significantly impacts domestic and international investment decisions. GDP growth is widely acknowledged as a critical driver of FDI, as higher growth rates usually indicate a favorable investment environment that attracts foreign capital. This makes the variable the foundation of the study. Hence, it directly affects a country's economic performance.

FDI is an important indicator as it shows how much financial investment is directed from the home country concerning its GDP. The investment data is then expressed as a ratio normalized by GDP, such as FDI: GDP (Foreign Direct Investment units to Gross Domestic Product) studied perspectives. It makes the investment environment comparable across countries and is consistent

with the scale of the economy. FDI is crucial as it expounds on international investments according to domestic economic conditions, such as GDP growth.

Health expenditures are critical to a country's human capital development and are closely linked to economic productivity and growth. By selecting this variable, the study acknowledges the importance of government investment in health as a determinant of long-term financial stability and growth. Higher health expenditures can enhance labor productivity, reduce economic vulnerabilities, and create a more conducive environment for sustained GDP growth.

Including renewable energy consumption as a variable signifies the growing importance of sustainable energy practices in contemporary economies. This variable was chosen to measure the degree to which a country is shifting towards renewable energy, which has consequences for long-term economic viability and expansion. The transition to renewable energy is frequently linked with innovation, enhanced energy security, and decreased environmental hazards, all of which can favor GDP development and attract FDI. So, it has shown an interchangeable impact.

Human capital assets are vital to economic development and growth, impossible without education. To gauge the educational achievement of a region's workforce, this study looks at what share of its population ages 25 and over has completed at least lower secondary education. Education is associated with higher productivity, innovation, and economic diversity, which boost the GDP growth rate and hence affect FDI.

Tables 13 and 14 comprehensively explain the variables and their respective data-driven outlines. They offer a well-organized and easily understandable summary of the aspects addressed in this analysis. Combining these variables, the study seeks a broader understanding of the relationship between GDP growth and other critical economic indicators. Ultimately, it hopes to provide significant insights into the elements contributing to financial success in the selected Eastern European countries.

Figure 12 (A)

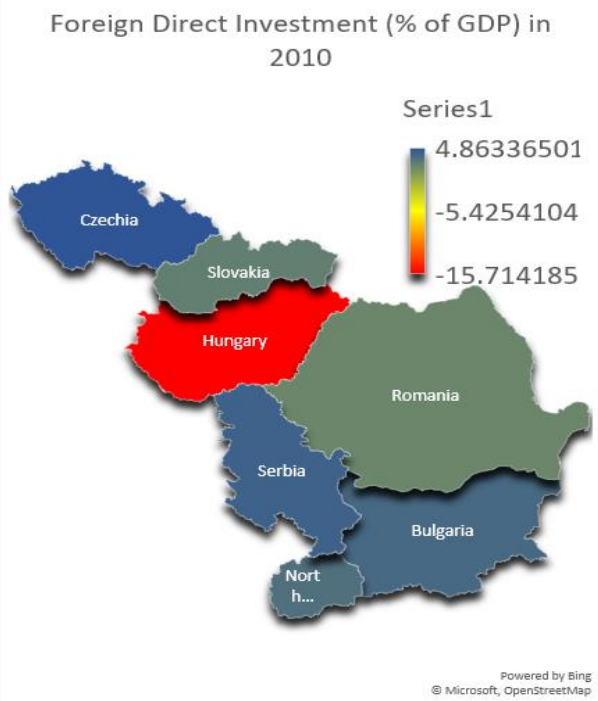


Figure 12 (B)

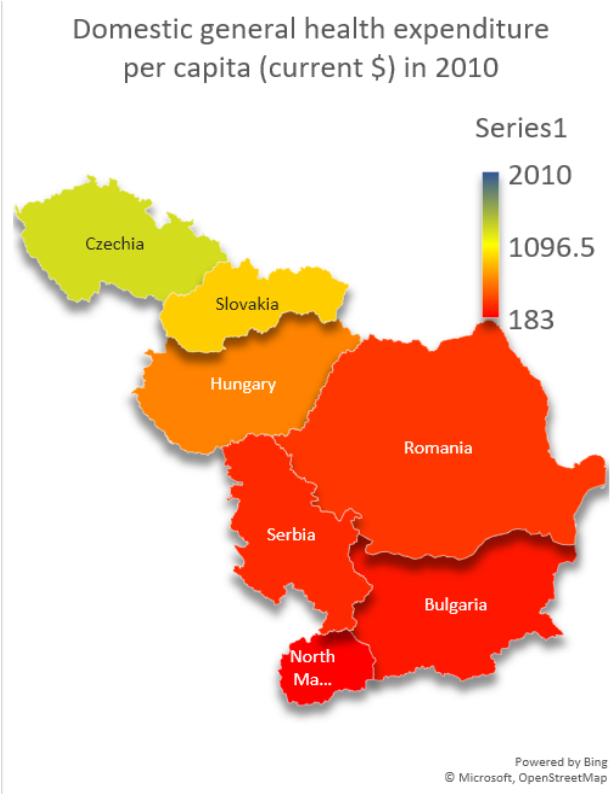


Figure 12 (C)

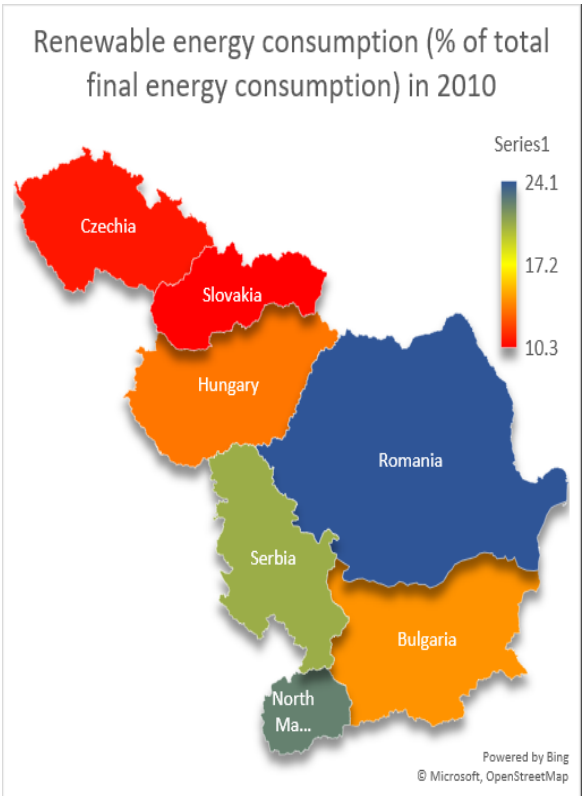


Figure 12 (D)

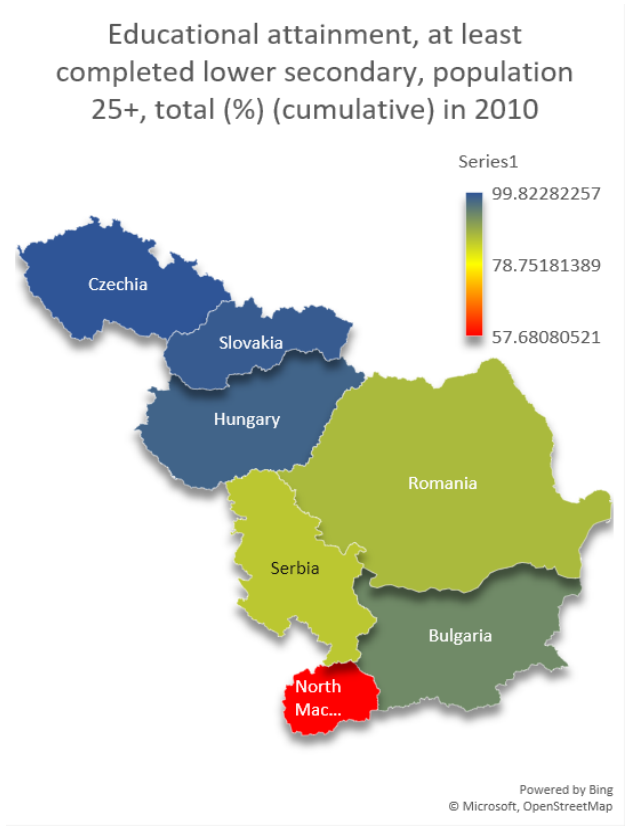


Figure 12 (E)

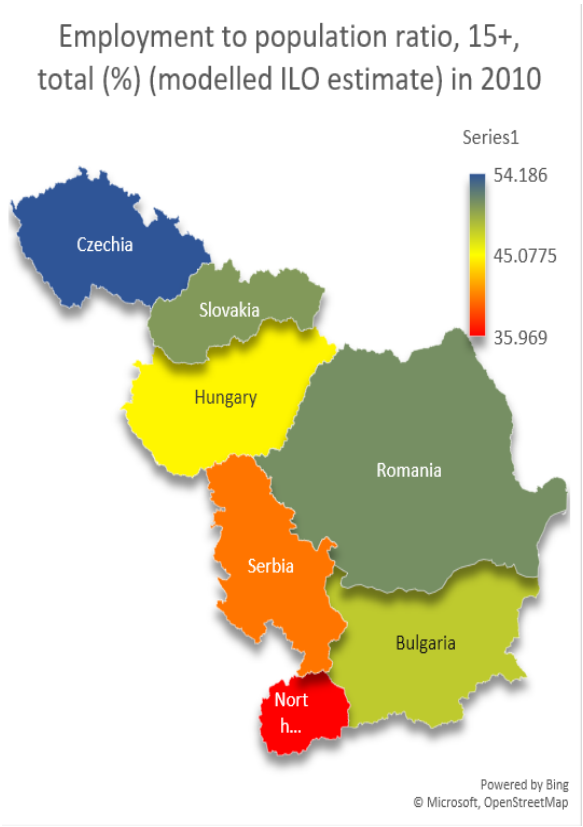


Figure 12 (F)

Source: Self-interpretation using World Bank's data bank.

Figure 11: A) GDP Growth, B) Foreign Direct Investment, C) Domestic general health expenditure, D) Renewable energy consumption, E) Educational attainment, F) Employment Ratio of seven Eastern European countries in 2010.

A demographic map was also generated based on data obtained from the World Bank. The graphic illustrates notable disparities in multiple characteristics among the seven countries. I will observe substantial variations among the countries as I collect data from 2010 to 2019.

3.3 Summary Statistics

The summary statistics for the variables under study reveal several essential insights into the economic and social landscapes of the seven analyses of Eastern European countries.

The mean per capita GDP is 2.59 (current US$), but the median is 2.72, suggesting a slight positive skewness. The GDP values span from -3.90 to 8.20, with a standard deviation of 2.02. This dispersion emphasizes the moderate variation in economic performance among the countries. The negative skewness of -0.32 and positive kurtosis of 1.09 indicate a distribution that is quite close to a normal distribution, with only little departures from the mean.

The average FDI is 4.07, with a middle value of 3.38, indicating a positive imbalance and that many nations have much greater FDI levels. The range of values is vast, from -40.09 to 60.03, which means significant differences in the foreign investment coming into the country. The crucial standard deviation of 11.12 confirms the presence of this variability. The skewness value of 2.17 and kurtosis value of 16.33 indicate the existence of extreme outliers, suggesting that there are uneven investment conditions among the countries.

The average health expenditure is 603.83, with a median of 397.50, indicating that most countries spend less than the average amount. The spending varies significantly, with a minimum of 183.00 and a maximum of 1526.63. The standard deviation of 381.08 indicates a considerable amount of fluctuation. The skewness value of 0.83 indicates a considerable rightward skew, while the kurtosis value of -0.56 suggests a flatter distribution than the standard curve.

The average renewable energy consumption is 17.48, with a median value of 17.30, suggesting a symmetrical distribution. The range of values varies from 10.30 to 24.40, with a standard deviation of 4.08, indicating consistent consumption patterns among the countries. The skewness value of 0.03 and kurtosis value of -1.14 suggest that the distribution is almost expected, with a minor tendency toward platykurtic characteristics.

Educational attainment is, on average, 89.68, with a middle value of 94.57, indicating a sizable portion of the study, at least in lower secondary. The range of attainment is between 57.68 and 99.83, with an average standard deviation of ~12.66; significant differences in educational performances are present (Table A1). The distribution is significantly leftward skewed (skewness

= -1.41) and positively kurtotic (kurtosis = 0.62), meaning that the bulk of the data are more concentrated toward higher educational attainment than expected if I assume a normal distribution.

The average employment rate is 49.05, with a median of 50.60, suggesting a slight leftward skew. The ratio varies between 35.97 and 59.20, with a standard deviation of 5.88, indicating significant fluctuations in employment levels. The skewness value of -0.44 indicates a slight leftward skew, while the kurtosis value of -0.70 suggests a flatter distribution compared to the standard curve.

This summary data provides a basic understanding of the economic and social variables under study, providing insight into commonalities and differences across Eastern European countries. These insights are critical for designing tailored country-centric policies to stimulate region-wide growth and stability.

3.4 Empirical Methods

To investigate this influence of GDP, I collected secondary panel data on relevant variables from the World Bank. One of the most attractive features of panel data analysis is that it can consider the temporal nature of economic relationships. Cross-sectional data provides a snapshot of one point in time, whereas panel data examines how these relationships change over the years. It adds a temporal dimension previously unavailable through static analysis to indicators such as GDP, health expenditure, and educational attainment, which are of interest in natural scientific studies on the economy and social sciences (Hsiao, 2022).

After that, I filtered out the data from seven Eastern European countries I had chosen from 2010 to 2019. Then, I have to make sure that the data is stationary. If it isn't stationary, I must take necessary precautions, like using differencing or log differencing. The nonstationary existence of panel data analysis makes it impossible to infer statistical models due to the spurious regression problem and may cause biased estimation and invalid conclusions. To address these concerns, researchers must screen for stationarity and employ corresponding techniques when required, like differencing and cointegration proposals, so that the results are sound.

Then, I used the unit root test to confirm stationarity. Since these are panel variables, I need to confirm cointegration. I have considered the Pedroni and Kao tests (Kao, 1999; Pedroni, 2001) for

the panel cointegration tests to determine the relationship among the panel variables. I also checked robustness using the latest MMQR. Finally, I used the Ordinary Least Squares (OLS) regression method (Deloof, de Jong and Legierse, 2020) to counter and test our hypotheses. This allows us to determine the significant influence of GDP over our selected variables.

3.4.1 Panel Analysis Technique

These data are panel data in nature and provide units over time. The advantage of panel data is the more significant number of countries in the sample, multiple observations on each country, and a fixed effect to provide additional control for other time-specific country-level factors or assume a typical relationship across all countries (Glied and Smith, 2013).

In addition, panel data considers any unobserved differences and consists of an assessment of diverse causal effects (Chen et al., 2014). Several empirical studies have been conducted to study the long-term cointegration connection between health expenditure, educational attainment, and GDP, employing diverse statistical assumptions and approaches (Hall et al., 2012; Tamakoshi and Hamori, 2016). The following model has been developed to examine the Foreign direct investments, Domestic general health expenditure, Renewable energy consumption, Employment to population ratio, and educational attainment of GDP influence:

$$GDP = f(FDI, DGH, REC, EMP, EAS) \qquad (1)$$

To assess the relationship between GDP and the variables mentioned earlier, unit root, cointegration, and method of moment quantile regression tests were employed.

3.4.2 Unit root test

The cross-sectional augmented IPS (CIPS) unit root test, which Pesaran (2007) introduced, is helpful for dynamic panels with serial correlation and cross-sectional dependence, along with Im–Pesaran–Shin (IPS) (Im, Pesaran, and Shin, 2003) unit root tests. This test handles two critical

problems for panel data: serial correlation and cross-sectional dependence. Ambiguities in the form that generates unit roots would affect those standard tests, and unit root tests may yield distorted outcomes that are misleading about the presence or absence of a fundamental unit root. A CIPS unit root test is applied since it provides a non-standard approach for testing the presence of unit roots in dynamic panels, specifically when accounting for serial correlation and cross-sectional dependence issues. The capacity to deal with these issues in conjunction with the allowance for heterogeneity across units distinguishes it. It makes such methods a favorite among researchers who work with panel data.

The problem of non-stationarity in panel data analysis is severe because it will negatively impact the clarity and accuracy obtained. The dataset is non-stationary if the statistical properties like mean, variance, and autocorrelation are not constant over the time axis. In this way, bias in the calibration prediction distorts relationships between variables and can lead to an overfit model that does or does not have a proper pattern (trends). In many econometric models, the variables are assumed to be stationary for consistency and efficiency. For non-stationary data, the estimators may be inconsistent. As I sample more and more data randomly from our freeloaders' community, these estimates will likely not match their actual parameter values. This inconsistency is especially troubling for forecasting and policy analysis, where accurate long-range predictions are essential.

Unlike other tests that fail to recognize cross-section dependence, the CIPS unit root test yields reliable conclusions (Baltagi and Moscone, 2010). To ascertain stationarity, which refers to the property of selected variables remaining constant throughout time, it is necessary to investigate the presence or absence of a unit root in the given panel data.

Table 15: CIPS, CADF unit root test result

Panel unit root test: Summary		
Null Hypothesis: Unit root (individual unit root process)		
Test	Statistic	Prob.
Levin, Lin & Chu t*	-10.0153	0
ADF - Fisher Chi-square	48.9027	0
Im, Pesaran and Shin W-stat	-4.37240	0
ADF - Choi Z-stat	-4.68096	0

Source: Self-interpretation using E-views

The result of the unit root test provided the p-values of the given test, i.e., Levin, Lin & Chu t, ADF—Fisher Chi-square, ADF—Fisher Chi-square, are all results of zero-determining stationarity. The presence of unit roots can exploit many statistical analyses. Checking for unit roots before conducting a cointegration test is essential when dealing with panel data. Many econometric models, such as OLS, assume that the time series data are stationary.

Therefore, panel data analysis combines the implementation of both CIPS and IPS tests simultaneously with understanding multiple testing methodologies, providing a comprehensive empirical research methodology using rich datasets to discriminate financial innovations better. Methodological triangulation is a widely utilized strategy and serves several important functions in econometric analysis.

For one, it enables researchers to establish the validity of their results by cross-checking them with a few other testing frameworks. Every test is distinct in its assumptions; likewise, its technical qualities offer a differing point of view on panel data stationarity. Because these multiple avenues provide converging results, they greatly enhance the confidence and consistency of those findings. Conversely, inconsistent results may provide an opportunity to discover issues in the data or model description that force reexamination and improvement with analytical points.

Furthermore, this multi-test technique allows a detailed evaluation of the results' sensitivity to different model specifications and underlying assumptions. The CIPS test explicitly considers

cross-sectional dependence, although the IPS test provides other methods for addressing this problem when used with the demean option. By comparing outcomes from these tests, researchers can assess the influence of cross-sectional dependence on their findings and the reliability of their conclusions under various modeling assumptions.

A multi-test method is consistent with the prevalent movement for increasing reproducibility and robustness in empirical research. In subsequent experimental processes, researchers introduce the results to allow examination of their analysis from a more transparent and comprehensive perspective. By doing so, I ideally increase the study's reliability and offer relevant data for meta-analyses and systematic reviews in this field.

Moreover, this all-encompassing methodology is especially beneficial in practical econometric studies, where the intricacy of real-life occurrences frequently conceals the underlying mechanism that produces the data. Economic and financial time series sometimes display traits that depart from statistical assumptions, such as non-normality, heteroscedasticity, or complicated forms of cross-sectional and temporal dependency. When dealing with these situations, depending solely on one testing method can result in accurate conclusions or more complex explanations of the findings.

3.4.3 Panel Cointegration Test

Pedroni (2001) introduced seven test statistics to test the null hypothesis of finding cointegration in nonstationary panels. The seven Pedroni tests can be classified into two main groups: four-panel statistics and three-group statistics. The panel statistics are calculated by aggregating the residuals within each dimension of the panel, whereas the group statistics are obtained by aggregating across the dimensions. This dual methodology offers researchers a comprehensive and detailed understanding of the cointegration linkages present in the panel. In addition to these tests, I have also performed the Kao (1999) test, specifically designed to analyze cointegration in panel data. The Kao test provides an alternative viewpoint on panel cointegration, though it is less adaptable regarding heterogeneity assumptions. These eight tests, consisting of seven Pedroni tests and one Kao test, comprehensively analyze potential cointegrating correlations in panel data.

I will make our decisions based on the majority of the results of these tests. I will see whether the p-values of more than half the number of tests (which has to be more than four in this scenario) are more than 0.05. If the p-values of more than half of these tests are less than 0.05, I can say that the null hypothesis based on this panel cointegration test is rejected.

Null hypothesis (H_o): No cointegration exists among these panel variables.

Researchers often have to rely on additional testing methodologies to mitigate this uncertainty. The best tool in this case is the Kao Residual Cointegration Test. It was devised by Kao and Chen (1995b) based on a broader range of assumptions under which it is valid compared with the Pedroni tests. The Kao residual cointegration test assumes that the cointegrating vectors are identical across panel units, which can have appealing features, especially in applied empirical work.

The Kao test depends on the Engle-Granger two-step process for time series data, which has been extended to estimate panel cointegration. Another approach uses residuals. This procedure involves estimating the presumed cointegrating relationship and testing whether our residuals display stationarity. The test statistic follows a normal distribution asymptotically under the null hypothesis of no cointegration.

However, bivalent results can rarely be obtained using these tests; e.g., in the symmetric conclusion reported here, four p-values are below 05 and four over 05. The difference in results makes it problematic to grasp and underscores the complexity of panel cointegration analysis. Thus, we do not argue for its cointegration. That is why I moved to the Augmented Dickey-Fuller ADF test. Importantly, these results highlight the importance of different test methodologies and that variation in test requirements may affect the sensitivity of findings.

Also, using different testing techniques aligns with what has been considered a general trend in econometric research to perform tests called robustness checks and sensitivity analyses. Publishing results from multiple tests allows the researchers to give a broader description of how various cointegration properties their data followed, disentangling, and inspecting if specific findings were altered while also pointing towards areas where further investigation is needed.

Table 16: Kao Residual Cointegration Test

Pedroni Residual Cointegration Test				
Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.58903	0.944	-2.42788	0.9924
Panel rho-Statistic	2.880148	0.998	2.727772	0.9968
Panel PP-Statistic	-7.70893	0	-8.79712	0
Panel ADF-Statistic	-2.45327	0.0071	-2.94823	0.0016

Source: Self-interpretation using E-views

The findings of our cointegration study, as displayed in Table 6, provide detailed insights into the nature of the interactions among the variables. The modified Phillips-Perron t-statistic is particularly noteworthy since it offers robust and reliable evidence supporting the presence of cointegration. This revised metric, designed to overcome specific constraints of the conventional Phillips-Perron test, provides improved dependability in panel data analysis, especially when confronted with possible interdependence and variability within panels.

Table 17: Panel Cointegration Test using Pedroni test.

	t-Statistic	Prob.
ADF	-2.88365	0.002
Residual variance	5.192757	
HAC variance	4.089919	

Source: Self-interpretation using E-views

Expanding on this basis, I develop an alternative hypothesis to question the null hypothesis of no cointegration. Our alternate hypothesis suggests a consistent and long-lasting connection between the variables based on the cointegration of all panels in the dataset. This hypothesis is based on

economic theory, which indicates the possibility of stable correlations among the variables being studied in the long term.

To thoroughly investigate the possible existence of cross-sectional dependence among the variables in our dataset, which has panel variables. I also utilize the (ADF) test. Conducting this initial stage is very important in panel data analysis since the existence of cross-sectional dependence can significantly impact the accuracy of later econometric estimations and inferences.

Table 18: ADF test for cointegration

Ho: No cointegration Ha: All panels are cointegrated.		
	Statistic	p-value
Modified Phillips-Perron t	4.1382	0
Phillips-Perron t	-5.9667	0
Augmented Dickey-Fuller t	-5.1626	0

Source: Self-interpretation using E-views

In contrast to this new statistic, the standard Phillips-Perron t-statistic and ADF-t-statistics indicate statistically significant support for cointegration. The robust consistency in these test data, taken from such different testing environments, suggests good reliability of our observations.

It is essential to mention that these tests run based on slightly distinct assumptions and procedures, which adds to the strength of their collective agreement. Both the Phillips-Perron test and the enhanced Dickey-Fuller test confirm the presence of cointegrating relationships by providing a minimal p-value of less than 0.05. The Phillips-Perron test uses a non-parametric method to adjust for serial correlation. In contrast, the augmented Dickey-Fuller test considers higher-order autoregressive processes parametrically. The consistency observed across different approaches enhances our trust in the validity of the outcomes.

When analyzing these results, it is crucial to consider their economic ramifications. Cointegration indicates that although the individual variables may display non-stationary behavior

independently, there is a stationary linear combination of these variables. This statistical quality is frequently regarded as indicative of a stable and balanced relationship over a long period between the variables. This concept holds great importance in economic theory and policy analysis.

3.4.4 Method of moments quantile regression outcomes

This study employed the Method of Moments Quantile Regression (MMQR) (Machado and Santos Silva, 2019). This analysis of the approach is a more recent method compared to older techniques, such as Quartile regression, and it involves the application of several types of OLS.

Table 19: Outcomes of MMQR

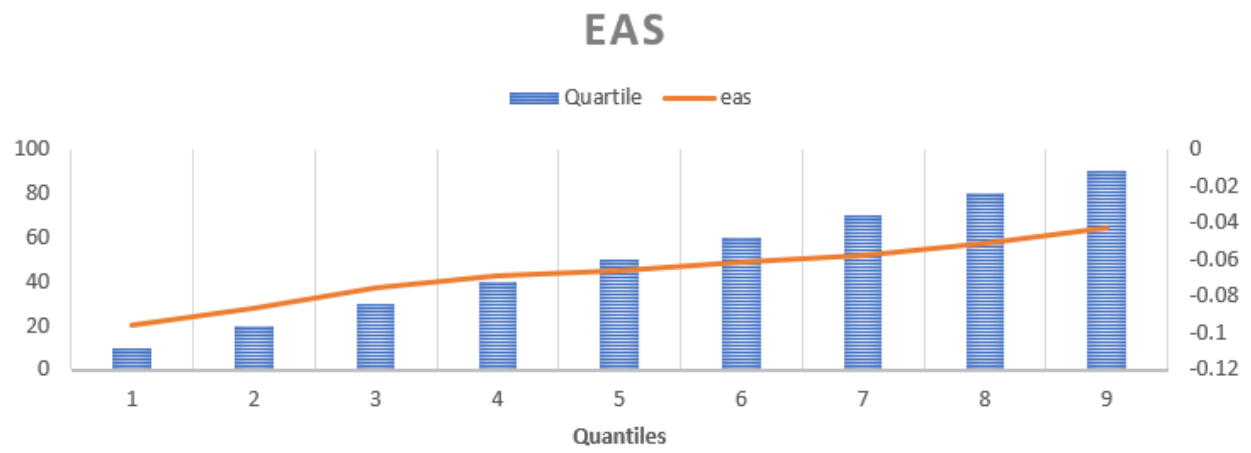
MM-qreg Estimator		
Number of obs = 70		
gdp	Coef.	P>|z|
location		
fdi	-0.00695	0.666
rec	-0.06363	0.451
dgh	-0.00179	0.091
emp	0.279279	0
eas	-0.06726	0.029
_cons	-2.85383	0.333
scale		
fdi	2.59E-05	0.998
rec	0.085549	0.135
dgh	0.000414	0.565
emp	-0.02833	0.6
eas	0.016555	0.429
_cons	-0.52431	0.793
qtile__1		

fdi	-0.007	0.788
rec	-0.20899	0.128
dgh	-0.0025	0.145
emp	0.327422	0.011
eas	-0.09539	0.056
_cons	-1.96295	0.68
qtile__2		
fdi	-0.00698	0.749
rec	-0.16466	0.152
dgh	-0.00228	0.113
emp	0.312739	0.004
eas	-0.08681	0.038
_cons	-2.23466	0.576
qtile__3		
fdi	-0.00697	0.69
rec	-0.10343	0.27
dgh	-0.00199	0.085
emp	0.29246	0.001
eas	-0.07496	0.026
_cons	-2.60992	0.415
qtile__4		
fdi	-0.00696	0.669
rec	-0.07225	0.403
dgh	-0.00184	0.088
emp	0.282133	0
eas	-0.06893	0.028
_cons	-2.80102	0.348
qtile__5		
fdi	-0.00695	0.664
rec	-0.05636	0.501

dgh	-0.00176	0.096
emp	0.27687	0
eas	-0.06585	0.032
_cons	-2.89841	0.323
qtile__6		
fdi	-0.00695	0.666
rec	-0.03513	0.675
dgh	-0.00166	0.118
emp	0.269842	0.001
eas	-0.06175	0.045
_cons	-3.02847	0.304
qtile__7		
fdi	-0.00694	0.676
rec	-0.01332	0.879
dgh	-0.00155	0.157
emp	0.262617	0.001
eas	-0.05752	0.071
_cons	-3.16217	0.299
qtile__8		
fdi	-0.00693	0.703
rec	0.01932	0.839
dgh	-0.00139	0.245
emp	0.251807	0.005
eas	-0.05121	0.142
_cons	-3.3622	0.313
qtile__9		
fdi	-0.00692	0.747
rec	0.063311	0.587
dgh	-0.00118	0.406
emp	0.237238	0.026

eas	-0.0427	0.304
_cons	-3.63182	0.356

Source: Self-interpretation using STATA-17



Source: Self-interpretation from the result of STATA-17

Figure 12: Graphical outcomes of MMQR

The primary identification of MMQR seeks to estimate either conditional median or other quantiles of response variables conditioned on some levels of exogenous variable. By contrast, regular least-squares regressions provide estimates of the conditional mean of the endogenous variable based on specific values of the exogenous variables. Quantile regressions are less sensitive to the presence of outliers during the estimate process. Furthermore, this is particularly relevant when the correlation between the average values of two variables is weak or absent (Binder and Coad, 2011).

3.4.5 OLS Regression Outcomes

OLS regression is best suited for linear regression models as it minimizes the sum of the squared differences between observed and predicted values of the dependent variable. This method ensures the best linear unbiased estimator (BLUE) properties by indicating homoscedasticity, absence of multicollinearity, and normally distributed errors (Wooldridge, 2016). Its simplicity and embracing nature led it to become a popular choice. OLS has assumptions that need to be seriously taken into account. Failure to meet the assumptions can result in inefficient estimates due to, for example, heteroscedasticity or autocorrelation; multicollinearity among the independent variables may not

significantly inflate the variance of coefficient estimates and, therefore, make them unreliable (Gujarati, 2009).

From Table 21, the resulting value of R-squared is 0.177, which indicates a 17.7% variation in GDP influenced by the independent variables. The relatively low R-square value suggests that a significant portion of GDP may be manipulated by other factors that I did not include. However, the resulting value of the p-value of the F-statistic is 0.0259, which indicates that the selected model is statistically significant at the 5% level, meaning the independent variables collectively have a substantial relationship with GDP.

Table 21: Summary of OLS Regression

Dep. Variable:	GDP	R-squared:	0.177
Model:	OLS	Adj. R-squared:	0.113
Method:	Least Squares	F-statistic:	2.75
No. Observations:	70	Prob (F-statistic):	0.0259

Source: Self-interpretation using Python's Statmodel

The results from Table 20 help us make final decisions. The detailed results for each variable and the p-value significantly support the choice of hypotheses.

Table 22: Outcome of OLS Regression

	Co-efficient	Standard Error	T statistic	P-value	Hypothesis	Path
const	-2.8538	2.993	0.953	0.344		
FDI	-0.007	0.021	0.337	0.737	H1	FDI → GDP

DGH	-0.0018	0.001	1.558	0.124	H2	DGH→ GDP
REC	-0.0636	0.085	0.748	0.457	H3	REC → GDP
EMP	0.2793	0.078	3.576	0.001	H4	EMP → GDP
EAS	-0.0673	0.032	-2.1	0.04	H5	EAS → GDP

Source: Self-interpretation using Python's Statmodel

The result of OLS regression shows that FDI positively influences GDP (T = 0.337, p-value = 0.737). Thus, H1 is statistically insignificant, and we can accept the null hypothesis. Therefore, I see a relation between GDP and FDI. Similarly, DGH positively influences GDP as the p-value is greater than 0.05 and is statistically insignificant (T = 1.558, p-value = 0.124). Thus, H2 is accepted. Again, the p-value REC is way greater than 0.05, which indicates the acceptance of hypothesis 3 (T = 0.748, p-value = 0.457). Thus, H3 is statistically not significant. However, EMP does not positively influence GDP because the p-value is less than 0.05. Thus, H4 is statistically significant (T = 3.576, p-value = 0.001). Similarly, EAS does not positively influence GDP for the same cause of p-value (T = - 2.1, p-value = 0.04). Thus, H5 is statistically significant.

4. RESULTS AND DISCUSSION

4.1 Result Interpretation

In many cases, panel data analysis is vulnerable to heterogeneity and cross-sectional dependence, resulting in inaccurate findings (Vasudeva Murthy and Ukpolo, 1994; McCoskey and Selden, 1998; Gengenbach, Palm and Urbain, 2006). Nonetheless, most prior research did not consider these factors. Hence, this study employed suitable estimate methods to mitigate cross-section dependence and unobserved heterogeneity, yielding reliable findings about the correlation between various factors and GDP. In this context, serial correlation is when the error terms in a time series are correlated across time; this usually happens especially in dynamic panels since past values influence current ones. Cross-sectional dependence, however, arises when there is a correlation across a panel's different cross-section units (e.g., countries or regions). Standard shocks or spillover effects that affect all units simultaneously can lead to this happening. Because such traditional unit root tests, e.g., the CIPS test, fail to consider these interdependencies, it may induce bias in test results.

Table 15 presents the findings of second-generation panel unit root tests, specifically the cross-sectionally augmented IPS (CIPS) test proposed by Pesaran (2007) and the Cross-sectionally Augmented Dickey-Fuller (CADF) test, which is particularly useful for handling issues of cross-sectional dependence. The Levin, Lin, and Chu t statistic produced a result of -10.0153, accompanied by a p-value of 0. The outcome of this analysis provides significant evidence against the null hypothesis of a unit root, suggesting that the panel data series are stationary under the assumption of a common unit root process throughout the cross-sections. The CIPS result shows a statistic of -4.37240, with a p-value of 0. The ADF - Fisher Chi-square test also yielded a statistic of 48.9027 and a p-value of 0. Similar to the other tests, this outcome refutes the null hypothesis of a unit root, suggesting that the panel data series exhibits stationarity. All these results indicate the stationarity of the panel data series. It is an important finding as the dataset doesn’t contain any unit roots, and any time trends within the data are deterministic rather than stochastic, under the assumption of a common unit root process across the panel.

The Pedroni Residual Cointegration Test result, shown in Table 16, thoroughly analyses the possible cointegration relationships in a panel data set. The alternate hypothesis of this test suggests that there are common autoregressive coefficients (AR coefficients) among the different dimensions of the panel. It indicates a situation in which there may be long-term equilibrium relationships among the variables in the panel, even if they differ in the short term. The Pedroni Residual Cointegration test provides four statistics, their corresponding p-values, and an additional set of four weighted statistics and their respective p-values. The Panel v-Statistic is reported as -1.58903 with a probability value (Prob.) of 0.944 for the unweighted statistic and -2.42788 with a probability value of 0.9924 for the weighted statistic. The findings suggest that the null hypothesis of no cointegration for the panel variables cannot be rejected based on the v-statistic criterion. The Panel rho-Statistic follows the same principle. The unweighted statistic is presented with a value of 2.880148, with a probability of 0.998. On the other hand, the weighted statistic has a value of 2.727772, with a probability of 0.9968. The rho-statistic values, like the v-statistic, indicate a significant inclination to support the null hypothesis without cointegration. In sum, the p-value of 4 statistics of the Pedroni test supports the null hypothesis, but the other half does not. Thus, it creates confusion as we cannot make a decision.

The Panel ADF-Statistic provides more evidence of cointegration, as indicated by the values of -2.45327 (Prob. 0.0071) and -2.94823 (Prob. 0.0016) for the unweighted and weighted statistics, respectively. The presence of negative and low probability values indicates a rejection of the null hypothesis, therefore implying the existence of cointegration. The Panel PP-Statistic presents a contrasting perspective to the previous statistics, displaying values of -7.70893 (Prob. 0) and -8.79712 (Prob. 0) for the unweighted and weighted statistics. These substantial negative values and their corresponding probability values of zero provide a strong argument against the null hypothesis that there is no cointegration. Hence, the PP-statistic presents compelling evidence of cointegration among the panel variables. It also omits the confusion from the Pedroni test. Now, I can say that cointegration exists.

In general, the Pedroni Residual Cointegration Test provides us with inconclusive findings. Although the v-statistic and rho-statistic do not offer evidence of cointegration, the PP-statistic and ADF-statistic strongly suggest the existence of cointegration relationships in the panel data. This distinction implies that the proof of cointegration is more robust according to specific statistical

criteria, emphasizing the significance of examining numerous statistics in panel cointegration testing. To provide a more comprehensive answer, the outcome of the Kao Residual Cointegration Test can be found in Table 17. In contrast to the Pedroni test, the Kao test specifically examines residuals derived from estimated long-run relationships. The ADF t-statistic is reported as -2.88365, with a probability value of 0.002. This highly negative result signifies a robust rejection of the null hypothesis that no cointegration exists. The low probability value provides additional evidence for cointegration, indicating that the panel variables have a shared long-term equilibrium relationship. The residual variance is reported as 5.192757, while the heteroskedasticity and autocorrelation-consistent (HAC) variance is calculated as 4.089919. These values offer supplementary details regarding the residuals' dispersion and the cointegration relationship's long-term sustainability. Compared to the residual variance, the reduced HAC variance suggests that incorporating adjustments for heteroskedasticity and autocorrelation results in a more reliable assessment of the variance.

The Kao Residual Cointegration Test provides robust evidence of strong cointegration in panel data (as supported by the Pedroni test). The ADF t-statistic and variance measures indicate that the panel variables are cointegrated. It suggests that there are stable long-term correlations between the variables, even though there may be fluctuations in the short term. Based on the findings of both the Pedroni and Kao Residual Cointegration Tests, there is strong evidence of cointegration among the panel variables.

ADF test was also used to confirm the variables were co-integrated. Table 6 provides the last evidence of cointegration. The cointegration test was performed using the ADF and Modified Phillips-Perron (PP) and Phillips-Perron (PP) tests to ensure reliable and robust outcomes. The null hypothesis (Ho) claims no cointegration among the panel variables, while the alternative hypothesis (Ha) proposes that all panels are cointegrated. The Modified Phillips-Perron t-test statistic of 4.1382 shows a p-value of 0 that corresponds to the rejection of the null hypothesis as it suggests evidence against the unit root cause and concludes in favor of stationarity (regression). This proves the null hypothesis of no cointegration in panels can be rejected.

Furthermore, the Phillips-Perron t-test reports a test statistic -5.9667 and a 0 p-value, confirming further evidence against this null hypothesis. This also confirms that the panel variables are cointegrated. Furthermore, the ADF test `statistic of -5.1626, coupled with a p-value of 0, provides

strong evidence to support the rejection of the null hypothesis of no cointegration. The negative ADF test statistic indicates a consistent long-term association between the panel variables.

Lastly, the Method of Moments Quantile Regression (MMQR) analysis provides a more detailed view of how different independent variables influence GDP at various points in its distribution, from the 10th to the 90th percentile. This approach is particularly illuminating because it enables us to understand how the impact of each type changes with different growth levels. It also provides an insightful look into the effects of various independent variables on the influence of GDP across several different quantiles (0.1–0.9). Table 19 and Figure 13 help us understand how these relationships may vary as I move across the distribution of influence of GDP. From Table 19, The coefficients for FDI show an increasing trend as we move across higher quantiles of GDP, suggesting that FDI has a progressively more substantial impact on GDP at higher levels of economic output with GDP across different quantiles (0.1–0.9), which is particularly noteworthy. Hence, it is certain that FDI directly affects the countries' GDP, which can play a crucial role.

Moreover, the effect of DGH on GDP is positive across all quantiles (0.1–0.9), as shown in Table 19 and Figure 13, with an uplifting positive trend as we move into the higher quantiles. It indicates that as countries spend relatively more money on health, the benefits to GDP increase, and this association is more potent at higher GDP levels. It also indicates that health expenditures contribute to the population's well-being and enhance economic progress, especially in wealthier nations in the European continent.

Conversely, the EMP has shown a negative trend in countries' GDPs, which indicates that the Employment of the population is unrelated to the countries' GDPs. This surprising trend demonstrates that increasing employment is not necessarily a critical factor in turning around GDP for these countries. The negative coefficients might signify that more jobs do not buy growth without improving labor productivity and employment quality. It also illustrates the role of skills and education in determining that employment is productive for GDP. GDP growth enables the creation of more jobs, but these occupations' types and skill levels are essential to their effect on the economy.

Lastly, there is an upward trend in Educational Attainment (EAS), as shown in Table 19 and Figure 13, in the coefficients across different quantiles (0.1–0.9). Education is a crucial driver of economic

development. Populations with higher levels of education are more apt to make gains in innovation, productivity, and overall connection performance.

Hence, the MMQR model concludes that FDI, health expenditure, and education positively impact GDP, i.e., if countries allocate more resources into these sectors, their GDP will increase (irrespective of other factors). However, in the case of employment-related activities that could be more complex, the influence on GDP may depend not just on the level but also on the quality or productivity effectiveness made by the workforce. Our analysis shows that priority should be given to investments in education, health, and initiatives that improve the productivity of employment-driven economic growth strategies.

Finally, our core analysis is in Tables 21 and 22. Table 21 provides an overall summary of our OLS interpretation. Its R-squared value is about 0.177, meaning that 7.7% of the variance in GDP per capita exists. However, its adjusted r-squared value is overly low, at 0.113. Combining its F-statistic of 2.75 and a p-value of 0.0259 indicates that the model is statistically significant at the 5% level. When the independent variables are taken together, they have a meaningful relationship with GDP.

Table 22 provides the outcomes of the p-values for each hypothesis, as our selected null hypothesis for FDI concerns influencing GDP. The resulting p-value of our first hypothesis is 0.737, more significant than 0.05 (as we selected a 5% significance level), indicating acceptance of the null hypothesis. In other words, there is a 73.7% probability that the observed data would occur if the null hypothesis were true. That is why I fail to reject our first hypothesis.

Our second hypothesis regarding DGH also supports the null hypothesis with a p-value of 0.124, more significant than 0.05. However, the negative coefficient indicates a potential inverse relationship that we can ignore as the score is too low. Thus, DGH influences the GDP.

The following result also shows the p-value for our proposed third hypothesis, which concerns economic growth and the consumption of renewable Energy. The resulting p-value of 0.457 indicates a statistically significant relationship between renewable energy consumption and GDP in this model. However, the negative coefficient also shows a potential inverse relationship associated with lower GDP growth.

In contrast, we witnessed a different result in the p-value of the employment-to-population ratio. The resulting p-value is 0.001, indicating rejection of the selected null hypothesis for EMP. Also, it has a positive coefficient of 0.2793, associated with a high level of GDP growth. The result was expected because we had seen the same scenario in my previous section. Even with an excellent GDP investment, the employment rate has slightly increased. Thus, it does not support our hypothesis, meaning there is no relationship between GDP and employment rate.

Finally, our last hypothesis is also rejected with a poor p-value score. Our fifth and previous hypothesis posits that GDP is influenced by Educational Attainment, at least lower secondary (EAS). However, the resulting p-value of 0.040, less than the 5% significance level, indicates the rejection of our selected null hypothesis. Although the relationship is not statistically significant, the negative coefficient suggests that higher levels of educational attainment are unexpectedly associated with lower GDP growth.

In summary, the panel data support the maximum number of my hypotheses accepted related to foreign direct investment (FDI), Domestic General Government Health Expenditure (DGH), and Renewable Energy Consumption (REC). However, my hypothesis did not satisfy the Employment to Population Ratio (EMP) and Educational Attainment (EAS). Thus, they do not influence a nation’s GDP growth.

4.2 Discussion

Based on the thorough analysis given above, some factors can influence GDP. Many studies (Tai, Chao and Hu, 2015; Vu, 2019; Jakovljevic, Timofeyev, *et al.*, 2020) have previously forecast the existence or upcoming possible factors that affect a nation's economic growth. Tai, Chao and Hu, (2015); Jakovljevic, Timofeyev, *et al.*, (2020) have also mentioned that health issues can play an important role in influencing GDP. According to Islam (2015), allocating more funds to healthcare can cause social safety, security, and tranquility growth, which will also impact employment. That is why I included the hypothesis based on health expenditure. The concept of foreign investment is ancient. Over the years, the concept has evolved and contributed to many sectors worldwide. Consistent evolution has increased upper and middle-class citizens' market size and human capital (Lederman *et al.*, 2013; Cleeve *et al.*, 2015). Hence, it is crucial to analyze the influence of foreign

direct investment on GDP. I have selected our first and foremost hypothesis based on this concept. As mentioned earlier, my first hypothesis is:

H1: Gross Domestic Product (GDP) is influenced by Foreign Direct Investment (FDI)

The core analysis of this hypothesis, which is the OLS regression's outcome, supported this claim. The resulting p-value of this hypothesis is 0.737, which indicates the acceptance of our selected null hypothesis. The robustness of this claim, which I analyzed using MMQR, also supports this claim. The same happens for our second variable chosen, Domestic General Government Health Expenditure (DGH), where my null hypothesis says:

H2: Gross Domestic Product (GDP) is influenced by Domestic general health expenditure (DGH)

I got our result of a p-value of 0.124, which indicates the acceptance of the selected null hypothesis. More budget should be allocated to this sector to increase public health security as it is increasing substantially, raising concerns with GDP (Mladenović *et al.*, 2016).

Enormous studies (Stern, 2011; Inglesi-Lotz and Dogan, 2018; Vasylieva *et al.*, 2019; Chica-Olmo, Salaheddine and Moya-Fernández, 2020; Emirmahmutoglu, Denaux and Topcu, 2021) have assumed and proven the relationship between GDP and renewable energy. The whole economy stands on energy. However, not all the energy sources are renewable. Non-renewable energy sources are gradually decreasing and often harming the environment. Nevertheless, renewable energy has a more sustainable future and is accessible to all. Anyone can produce renewable energy and consume it with the right equipment. This advantage has a significant impact on GDP and the overall expenditure of a nation. It is also seen in my analysis too. The resulting p-value of our core analysis, OLS, is 0.457, supporting the selected null hypothesis:

H3: Gross Domestic Product (GDP) is influenced by Renewable Energy Consumption (REC)

The resulting p-value has declared there exists an influence as accepting the null hypothesis. Further robustness analysis (MMQR) also supports this claim in different quantiles.

The relationship between employment and GDP is a noticeable attraction. However, human and natural disasters have always occurred, so this relationship is inconsistent. Klinger and Weber (2020) mentioned the linkage between employment and GDP during and after the German Great Recession. They noted that during the Great Recession, the productivity rate dropped and hardly recovered during these years. However, it is noticeable that despite the tight GDP, employment kept on rising. So, there is no relationship between these two variables. If there, it would be very weak. Gallipoli and Makridis (2022) draw attention to the COVID-19 scenario. They used employment and GDP-related public data of Canada, but they found less extreme GDP responses towards unemployment. They also forecast a shrink in the GDP budget. But this shrink will not affect employment. The layoffs will be controlled totally by the government or private firms not to be affected by GDP. The same scenario has been witnessed in our data, too. The data was taken before COVID-19 and during the Great German Recession, but the relationship between GDP and employment does not exist. Results from Table 22 also support this statement. We see the resulting p-value of OLS regression for EMP (employment ratio) is 0.001, which is greater than the 5% level of significance, indicating the rejection of my selected fourth null hypothesis, which is:

H4: Gross Domestic Product (GDP) is influenced by Employment to population ratio (EMP)

These led us to conclude that employment does not influence GDP growth (Brancaccio *et al.*, 2018).

While examining the relationship between educational attainment and various factors, Kirkcaldy, Furnham, and Siefen (2004) found that GDP is weakly related to educational performance. However, they found a relationship between happiness and health-related variables. Again, Makkonen and Inkinen (2013) examine the relationship between educational attainment and

economic development among the countries of the European Union. However, they found conflicted results about educational attainment, innovative capacity, and economic growth. They found that increased educational attainment leads to increased innovative capacity and economic development, but the results are bidirectional and conflicted with various variations of degrees. This type of relation highly occurs with the most innovative countries and regions but not too much witnessed in lower innovative countries. So, I can say that some conditions need to relate GDP with educational attainment. I have selected my last hypothesis as:

H5: Gross Domestic Product (GDP) is influenced by Educational Attainment at least lower secondary (EAS)

However, the resulting p-value of my OLS analysis rejects this hypothesis. The OLS result was 0.04, which is less than the threshold value for acceptance. So, a relationship between GDP and educational attainment does not exist.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Recommendation

This dissertation shows the impact of factors such as Foreign Direct Investment (FDI), Domestic General Government Health Expenditure (DGH), Renewable Energy Consumption (REC), Employment to Population Ratio (EMP), and Educational Attainment (EAS) on GDP growth. This has essential practical implications for the selected Eastern European countries' policymakers, economists, and regional development agencies. Gaining insight into the relationship between these characteristics and GDP growth lays the groundwork for devising specific policies to uphold financial development and improve overall welfare in these countries.

The research underlines the importance of a favorable FDI environment as it is discovered that there exists a significant correlation between GDP growth and FDI. Policymakers working to boost foreign direct investment (FDI) inflow in Eastern Europe can capitalize on this understanding. Among the measures that might find their way to a list of investor-friendly policies are those intended to reduce red tape for company operations, provide tax holidays, and offer stable political-economic environments. It illustrates how the homogeneity of DGH emphasizes the critical importance of sufficient public health spending in producing an efficient workforce. While improved allocation of resources in the health sector can lead to better health outcomes and fewer absences, lower labor productivity growth may occur through reduced worker/working hours due to illness or premature death, which encourages economic development.

The integration of REC as a variable reflects the potential of renewable energy consumption to drive economic growth on a sustainable basis. Eastern European nations, several of which are shifting away from conventional energy sources, can use these discoveries to justify augmenting their investments in renewable energy infrastructure. This transition decreases reliance on imported non-renewable energy sources. It establishes these nations as pioneers in sustainable progress, drawing in environmentally friendly investments and generating employment opportunities in the growing renewable energy industry.

The positive influence of EAS on GDP expansion indicates that endeavors to enhance educational achievement are crucial for economic advancement. Policymakers should prioritize job creation

measures, explicitly target the working-age population, and allocate resources towards enhancing education systems to guarantee that individuals obtain the necessary expertise. In addition, improving vocational training and providing lifelong learning opportunities can contribute to sustaining high levels of employment and enabling the workforce to respond to the evolving needs of the economy effectively.

The research upholds that regional cooperation pays off based on collective characteristics: all Eastern European countries have similar economic structures and developmental problems. Together, these nations could be more economically resilient and robust, sharing strategies that work for obtaining foreign direct investment (FDI), encouraging renewable energy generation, or improving public health and education. Properly functioning regional groupings and alliances can signify encouragement and facilitation of cooperation, thus paving the way for better health and effective economic development.

Finally, this dissertation's findings might serve as a foundation for prolonged economic growth in Eastern Europe. By comprehending the primary factors influencing GDP growth, governments may develop strategic plans prioritizing spending in crucial sectors such as healthcare, education, and renewable energy. This planned approach guarantees that economic expansion is solid but equitable and enduring, benefiting all sectors of society.

5.2 Conclusion

My overview of trends in the selected seven Eastern European countries, calculated as part of their GDP growth and the influence they have, leads to a complicated image that goes far beyond the economic domain. While GDP is still an overall measure of financial performance, this broad research reveals that its impact stretches to employment, education levels achieved by children's parents, international direct investment, and health spending use; it also incorporates renewable energy utilized.

I have taken five hypotheses based on my five selected variables. However, three of them significantly influence GDP, as shown in the figures included in the literature review. I have seen that Foreign Direct Investment, Domestic General Government Health Expenditure, and Renewable Energy Consumption significantly influenced GDP. Employment-to-population ratio

and Educational Attainment do not satisfy the hypotheses, but they are somehow affected by low or higher GDP growth.

The Czech Republic and Hungary witness the highest GDP growth. These countries also exhibit favorable patterns in employment and investments in renewable energy production. Given this association, economic stability is essential in supporting sustainable development. The growth here proves the trickle-down economics that can occur when economies do well, especially regarding job markets and green energy initiatives.

Romania and North Macedonia highlight the difficulties encountered by transforming economies. These countries' GDP growth variations highlight the complex dynamics of economic advancement and the importance of successfully employing focused tactics to navigate the transitional stages. The findings indicate that although GDP growth can catalyze developments in various socio-economic sectors, policymakers must adopt holistic methods that consider the broader consequences of economic development.

The findings of the core analysis suggest that policymakers should prioritize innovation-driven sectors that will increase renewable energy consumption, as they are a sustainable system. Increasing health and foreign direct investment investments will also make GDP more effective. So, it must be aligned with specific, well-targeted strategies in the specific regional context. Though employment and educational attainment are not linked with GDP growth, they play a vital role indirectly. They shape the labor market dynamics that lead to increased production and higher income levels and create demand for products and services.

Nevertheless, outside factors can disrupt this relationship during economic depression or crises, such as the Great Recession (Klinger and Weber, 2020) and the COVID-19 (Giupponi and Landais, 2023) pandemic. Again, educational attainment usually enhances a population's innovative capacity and productivity, positively impacting different contexts.

However, to ensure continued progress and improve the quality of life for their citizens, Eastern European governments in the selected countries should be instructed to maximize their economic potential by creating a conducive and sustainable environment. Formulating policies that stimulate financial expansion and guarantee that the potential advantages are divided fairly is necessary. If

they take this action, these countries can establish a robust structure that supports continual improvement in economic and social domains.

5.3. Limitations and Future Research

This dissertation focuses on a distinct group of independent variables: Foreign Direct Investment (FDI), Domestic General Government Health Expenditure (DGH), Renewable Energy Consumption (REC), employment-to-population ratio (EMP), and Educational Attainment (EAS). While they are essential for growth, these variables cannot encapsulate the complexity of factors contributing to GDP. Scientific advancements, infrastructure development, political stability, and the quality of institutions can significantly influence financial growth. However, it is crucial to note that these factors should have been considered in the present analysis. Subsequent studies could integrate these additional factors to offer a more exhaustive comprehension of the factors influencing GDP growth.

The findings of this dissertation may be helpful in future policymaking as they relate to the influence of FDI and health expenditures on GDP growth from different industries and their competitiveness among the selected seven Eastern European economies. That said, it is also crucial to be cautious in inferring more general statements from this research. Although the chosen variables are pertinent in identifying economic growth, they do not fully capture GDP determinants. Future research may benefit from including other variables like technological innovation, infrastructure development, political stability, and institutional quality, which could be crucial in determining a nation's economic course. Including these factors would provide a more holistic appreciation of what drives GDP growth. However, this research should also be taken cautiously when making generalizations or policy conclusions. These limitations also allow future work to improve and extend the results presented in this thesis.

The dissertation included only seven Eastern European countries characterized by certain historical, economic, and political factors. Consequently, the conclusions may not be directly relevant to other areas with distinct economic frameworks or levels of advancement. For instance, the influence of FDI or REC on GDP growth may vary in emerging markets in Asia or Africa due to substantial differences in economic conditions compared to Eastern Europe. A subsequent study

has the potential to broaden the scope of this analysis to encompass additional geographical areas, allowing comparative investigations into the variations in the connections between these factors and the rise of GDP in different economic environments.

There is a potential endogeneity issue between this study's dependent and independent variables. FDI is commonly regarded as an independent variable that influences GDP growth. However, it is logical that more excellent GDP growth rates can attract more FDI, resulting in a reciprocal connection. Likewise, improved health outcomes and increased employment rates can be both a contributing factor and a result of economic expansion. While the current research addresses these concerns, future research should utilize more advanced econometric methods. Additionally, it is crucial to consider that this study period may only partially encompass the long-term patterns or the influence of current geopolitical events on the chosen nations' economies. For example, events like the COVID-19 pandemic, the Russia-Ukraine conflict, or changes in the European Union's economic policy could have substantial consequences on GDP growth, FDI, and other factors that may not be accounted for in the present approach. Subsequent investigations could enhance the analysis by using more current data and examining the impact of exceptional occurrences on the examined correlations in this thesis.

6. NEW SCIENTIFIC RESULTS

This dissertation emphasizes the crucial significance of Gross Domestic Product (GDP), a comprehensive concern of economic performance indicators and its diverse influence on different variables in Eastern European countries. The study examines seven countries, including Bulgaria, Czechia, Hungary, North Macedonia, Romania, Serbia, and the Slovak Republic, that have experienced substantial economic transformations from centrally optimal planned to market-oriented economies.

1. *I have investigated seven Eastern European countries that have not been explored. This study is exclusively based on seven emerging countries. These countries are neither overdeveloped nor underdeveloped, which is perfect for conducting studies. These countries share similar historical backgrounds, such as post-communism, and the same economic structures. These countries also shared a mix of EU and non-EU members. That is why different types of GDP within the same region will give us a comprehensive overview.*

Many studies have accumulated in 161 countries (Rana *et al*., 2020) or 154 countries (Demirgüç-Kunt, Lokshin and Torre, 2024) for their investigation. Concentrating on fewer countries allows for a more comprehensive discussion of each country's development outcomes, institutional structures, and economic policies.

2. *I have used MMQR (method of moment quantile regression) to search for robustness after using OLS regression, which can be the latest touch in research. One of the limitations of OLS regression is that it assumes that errors are normally distributed and that relationships between variables are constant across all levels of the dependent variable. This assumption can be a critical violation of real-world data, mainly when applied in socio-economic studies where outliers and skewed distributions are common.*

A unit root test was conducted to determine stationarity in the selected dataset. The p-values of the given tests, Levin, Lin & Chu t, ADF—Fisher Chi-square, and ADF—Fisher Chi-square, all result

in zero stationarity. Expanding on this basis, I develop an alternative hypothesis to question the null hypothesis of no cointegration.

These hypotheses are based on economic theory, which indicates the possibility of stable correlations among the variables that are being studied in the long term. Both the Phillips-Perron test and the enhanced Dickey-Fuller test confirm the presence of cointegrating relationships by providing a minimal p-value of less than 0.05.

Finally, the MMQR analysis provides an insightful look into the effects of various independent variables on the influence of GDP across different quantiles (0.1–0.9). Besides employment, all the variables like Foreign direct investment, Domestic healthcare expenditure, Renewable Energy Consumption, Employment Ratio, and Educational Attainment positively affect GDP.

Identifying robustness in different quantiles can reveal significant heterogeneities that OLS might miss during the process. It can also create opportunities to explore other variables' socio-economic development and provide more effective policy recommendations to policymakers. Aside from OLS, MMQR is not influenced by outliers because it focuses on different quantiles and provides robust results.

The selected countries have unique economic development and policies. So, it is not enough to limit them to some hypothesis; they also need different layers of methodologies. In that case, MMQR is suitable for checking robustness as it analyzes different quantiles.

3. *I have seen a positive relationship between foreign development investment and GDP. This dissertation revealed some more exciting sectors and factors that might help everyone. As can be seen in the analysis, I also found the necessity of adopting renewable energy. As they are developed countries, it is necessary to invest in sustainable energy. The relationship between healthcare expenditure and GDP has also been found to indicate the importance of healthcare systems in increasing socio-economic development that improves health outcomes and reduces the economic burden of illness on families and the state. However, the relationship between education attainment and GDP has not been found for now, but further investigation is needed. Similarly, the relationship between employment and GDP has not been seen as expected.*

Investing in sustainable energy can lower energy costs for households and businesses, reduce environmental degradation, and improve public health by minimizing carbon footprint. Fostering economic growth can also create new industries and jobs. This sustainable growth from adopting clean energy can attract both domestic and foreign investments. It also leads to technological advancements and increased energy security for a better future.

The relationship between healthcare expenditures and GDP is an important finding. Good-quality healthcare services are critical for reducing health-related problems. Adequate policy coverage can ensure that all citizens' health-related issues lessen the economic burden of illness on families.

However, I did not find the relationship between education attainment and GDP. Education is essential for economic growth, permitting individuals to obtain the knowledge and skills required to participate in a modern economy. In the selected Eastern European countries, assisting educational institutions (from primary schools to universities) will encourage innovation, improve workforce productivity, and contribute to economic growth. Excellent education drives social mobility so that people from every background can participate in a rising tide.

It is crucial to support the education of science, technology, engineering, and mathematics (STEM) institutions in a knowledge-based economy. Gaining talents in these fields will help Eastern European countries become more competitive with global development, attract high-tech industries, and drive technological progress. Workers need to engage in lifelong learning and vocational training that can teach them how to switch careers as economic conditions change so they, too, can benefit from the expansion of GDP.

The negative relationship between GDP and employment clearly shows this. Toward this end, targeted job creation programs would be helpful to support broad-based socio-economic development. Eastern Europe can reduce unemployment (especially in areas devastated by economic transitions) and work to decrease underemployment; the EU should be more active here by promoting entrepreneurship and helping small and medium-sized enterprises work hand-in-hand in labor-intensive industries.

Targeted employment programs for vulnerable groups, such as youth, women, and rural areas, can help ensure that economic development benefits everyone. Public work programs, vocational

training, or incentives for employing socially marginalized groups are one way of reducing poverty and social inequality and integrating these people into the work process. Therefore, the key to a more cohesive, prosperous society in Eastern European countries lies in the responsible application of viable employment policies and ensuring that they reflect this broader objective: a higher GDP-aligned growth-focused strategy.

Indeed, I have found that FDI and GDP positively relate to developments. It is invested in capital technology and expert people, so it is highly sought for economic growth. Through strategies to facilitate FDI flow, the countries can hasten their industrialization processes, develop infrastructure, and amplify global trade competitiveness. But, fundamentally, the FDI matches with national development goals, and several society sectors have an advantage of this instead of just a few.

The capital accounts policy and the use of foreign exchange reserves are inextricably linked to adequate supervision so that FDI can effectively promote sustainable development; FDI standards in terms of labor and suitable environments are a vital way to ensure that foreign investors adhere to local laws so there is little or no harmful spill over from FDI into society. Similarly, by promoting joint ventures and public-private partnerships between foreign firms and their local counterparts, we can enhance knowledge and development capacity in recipient countries so that the broader parts of the economy would push toward sustainable growth.

These five sectors are sustainable energy, health care, education, employment, and foreign investment - all vital domains where policymakers can leverage GDP growth to bring about more holistic economic development. If the selected Eastern European countries carefully invest in these domains, economic growth will become more inclusive and sustainable. It is one way to become economically resilient and promote social equity and environmental sustainability, supporting the overall well-being of where you live. By implementing the right kind of policies, Eastern Europe can leverage GDP growth as an effective means to facilitate inclusive and sustainable development across the region.

7. SUMMARY

This study examines the effect of GDP in selected seven Eastern European countries on various other socio-economic factors and variables such as Foreign Direct Investment, health expenditure, renewable energy consumption, employment, and educational attainment. The analysis underscores the utility of GDP in fostering growth and its causal links to other important variables that truly measure economic development. The global economy hinges on a measure like the GDP for economic evolution. This has also been observed in the selected Eastern European countries like Bulgaria, Czechia, and Hungary. GDP has been a big reason for the shift from centrally planned to market-oriented systems, improved living standards, better investment prospects, etc. The findings also give researchers, and policymakers hope, which claim to be influential leverage for better GDP growth besides economic development options in shaping sustainable socio-economic advancements for selected seven Eastern European nations.

I have pre-defined five hypotheses to examine five independent variables with GDP as our dependent variable. Based on the results from the hypotheses, foreign investments have been identified as an important factor stimulating economic growth. Over time, the changing landscape of FDI came to benefit the burgeoning middle and upper classes and nurture human resources, for example. The p-value from OLS regression and the robustness check using MMQR confirm our hypothesis that FDI influences GDP.

Another quality factor that massively affects GDP is energy consumption, especially renewables. With non-renewable energy gradually coming to run out and being incredibly harmful to our planet, renewable energy can be considered a durable solution. The p-value from OLS regression confirms that renewable energy consumption substantially affects GDP, which has also been validated across different quantiles by MMQR.

There is also a debate on the link between educational attainment and GDP. The relationship between GDP and academic performance is notoriously tricky. However, some studies have found an association of lending weight to the former, and others have demonstrated that innovation capacity depends critically on education development. Yet our results fail to support its secondary claim that GDP is affected by the percentage of the population with a college degree, indicating perhaps some complexity in this relationship.

The link between employment and GDP is nuanced and even erratic. The weak relationship between these variables became readily apparent during historical events, like the German Great Recession and the COVID-19 pandemic, when employment continued to grow despite an even more constricted GDP. According to our analysis, GDP has nothing to do with the EMP, so employment does not affect the GDP growth rate

The research poses a series of tips for policy-making in Eastern Europe, recommending action to boost or adjust the economy. Indeed, the long-run economic growth of these countries requires their policymakers to stimulate foreign investment inflows and better direct public health resources while promoting renewable energy resource utilization over fossil fuels and improving education systems. The study finds that the GDP growth of seven countries exhibits intricate patterns, with some, like Czechia and Hungary, taking big leads while others do not. Being one radical to this general assertion, specifically Romania and North Macedonia. These results support the call for coordinated, place-based economic policy to promote long-term sustainable growth and illustrate how that is an indispensable task for policymakers.

In addition, this study examines the potential results based on GDP growth. Utilizing GDP growth, policymakers can bring about a holistic development of society, which could benefit everyone over long-lasting periods. It also identifies limitations, e.g., a narrow set of variables and countries studied, possible endogeneity concerns, and the influence of recent geopolitical events. Future research considering additional variables and alternative dimensions or geographical regions will use more advanced econometric techniques to enhance this finding.

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