Energy consumption in the Balkans – an empirical analysis on the main drivers

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Abstract. *The planet on which we are living is currently under an imminent threat. Population growth, massive digitalization, environmental pollution, increased scarcity of resources, and the greenhouse effect are putting our future and the future of generations to come at risk. As more and more governmental reforms are aiming to diversify the sources of energy production and many international players are working on market coupling to enhance cross-border cooperation, the question that arises is what developing countries can do in light of an energy crisis. Such so-called transition economies are working hard to promote growth, sustainable development and increase competitiveness in the European arena. Said that, it becomes important to know how market dynamics shape the energy demand, and thus the energy consumption in these countries. To answer this question, this paper employs secondary data from 2007-2021. The empirical analysis builds on unbalanced panel data and studies the main statistically significant determinants steering energy consumption across Balkan region, by examining the case of Albania, Serbia, Bulgaria, Republic of North Macedonia, and Bosnia & Herzegovina through a Fixed Effects model. A wide pool of variables related to innovation, political climate, economy, and finance were chosen to explain the energy consumption in the region. Using a general-to-specific approach, we were able to obtain a model with three regressors, all of them critical in capturing the variability in energy consumption. The results showed that in developing countries the main drivers of energy consumption are HDI, FDI and Innovation Index. This research provides an up-to-date picture on the dynamics of the energy markets in the region by providing a comprehensive analysis, which accounts for a variety of factors and adequate methodology. It is especially useful for policy makers to have a forward-looking approach and embed the results of such a study in their projections, analysis, and future decisions.*

Keywords*: energy demand, innovation, panel data regression, FEM, Balkans.*
JEL classification*: C23; O13; Q43.*

1. Introduction

The planet on which we are living is currently under a regime of increased uncertainty also referred to as the "new Normal''. Population growth, massive digitalization, environmental pollution, increased scarcity of resources (Popescu et al., 2022b), greenhouse effect and many other dynamics are putting an increased pressure on efficient resource management, affecting global cooperation dynamics.

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Starting from existing geopolitical tensions and times of crisis especially during the global pandemic (Morina et al., 2022), the political, legal and economical dynamics have significantly changed. Such happenings have been especially evident in the energy industry, causing an energy crisis, which brought a domino effect in other industries in the world especially in Europe, for it having a higher dependency on imported gas which has been so far, crucial for the energy production.

Especially during the last decade, both the private and the public sector with its governmental reforms, have been trying to diversify the sources of energy production and specially to boost renewable energy. In addition, steps have been taken to move forward with market coupling which could ensure a more homogenous pricing beneficial both for countries which are short and the ones which are in energy surplus. This has been helping to enhance cross-border cooperation, nevertheless, with a non-uniform legal framework which takes time to be agreed, the increased dynamics of the market were not possible to be followed. That is why, the arising energy crisis affected all involved actors and the response to it was quite slow and is still in continuum.

As the tensions between Ukraine and Russia heated further, the energy transition and crisis aversion became the main concern in Europe and beyond. Even the most developed economies were unprepared for what happened. The number one goal for policymakers in the global arena became effective crisis management which could consequently minimize further spillover effects on the economic reality and global stability. Energy certainly turned into the centre of many high-level discussions, both in the political arena in the developed world and the so-called economies in transition, which are considerably more vulnerable to such external shocks and periods of increased volatility. While the so-called "developed'' countries have been working on ameliorating their position in the event of a possible crisis, developing countries are in even worse conditions. Especially, if we refer to Western Balkan countries, they have been in the position of an ongoing crisis.

While scarcity of resources increases and quantity demanded of energy increases as well, a question that arises is what developing countries can do in light of an energy crisis and rapidly changing regional dynamics. The war between Ukraine and Russia brought about significant volatility in energy prices, a slower growth rate at a global scale, ever-increasing uncertainty, and inflationary pressures. These effects combined with inadequate ageing infrastructure, outdated power plants, overdependence on imported energy and especially lack of energy-related investments caused a very impactful crisis in the Balkans. With little access to cutting-edge technology and limited resources, these countries' stability and development could be easily jeopardized due to such a serious supply shock. Nevertheless, with a sharp decline of supply, it becomes important to understand the whole dynamics even from the other side of the medal, focusing especially on a demand perspective. What are the main drivers of energy demand and how can governments be adequately prepared to address changes in demand by investigating the current trends and developments in several fields of economic reality?

As such, the purpose of this study is to analyze the main macroeconomic, financial, political, and innovation-related factors which drive the energy consumption across some randomly selected Balkan countries. The empirical analysis employs secondary, annual data, and it covers the period between 2007 and 2021. The multiple regression equation builds on an unbalanced panel dataset that allows to account for cross-entity heterogeneity. Using REM/FEM we aim to bring to light the main statistically significant determinants steering energy consumption across Balkan region, by examining the case of Albania, Serbia, Bulgaria, Republic of North Macedonia, and Bosnia & Herzegovina. Such a selection of the sample entities, even though random in its essence is undertaken while considering that all such countries, and the respective energy sectors across them all have been subject to the same historical context, similar limitations with respect to financial resources and access to cutting-edge technology as well as similar reforms aiming further "Europeanisation" of the region (Popescu et al., 2022b). Moreover, all these countries, grosso modo, face similar challenges in terms of energy-related problems. In fact, they have similar infrastructural problems with outdated connection and transmission lines, dependency on imports with over 35% reliance, and they remain considered as a transitory part of Europe with less economic power or influential position in the energy markets (Jovanović and Vujanović, 2023).

As for investments, despite the region having significant potential for renewable energy production in terms of solar, wind and hydropower, not much investment has been done up to 2019,

with many international companies facing challenges with the bureaucratic system and tardy responses from the governmental agencies.

Given the limited research on this sensitive matter targeting such a highly-dynamic region at the moment, it was considered that there was a growing need to elaborate such an empirical analysis which allows to forecast, understand, and adequately prepare for the future impact that cross-sectoral developments have on energy demand. In this regard, a wide pool of explanatory variables such as: corruption index, financial development, GDP per capita, global innovation index, HDI, FDI and trade openness were used to understand the relationships, size, and direction of impact of each factor on the explained variable – i.e., energy consumption per capita.

This spectrum was chosen, considering that despite the rich existing literature on the topic there is little research in the case of Balkan countries. Especially in light of the current ever-increasing dynamics that these countries are undergoing and in face of a still not-so-stable energy market, it becomes important to recognize the drivers behind the demand for energy and how these drivers can be used to formulate policies, conduct analysis and prevent any shocks or shortages in the future.

Considering that pricing and economic outcomes are dependent both on the movement of supply and demand, identifying what drives energy demand in a region and in this case, in the Balkans, can contribute to addressing problems more efficiently and designing policies "tailored" to problems of the region.

2. Literature review

Energy Supply and energy demand have always been on the spot of research considering energy is key to ensure a healthy cycle of PESTEL factors. This literature review aims to explore and analyze existing research on the main drivers of energy consumption in order to identify key factors that influence energy use. By synthesizing the findings from previous studies, this review seeks to contribute to the understanding of energy consumption drivers and highlight areas for further consideration.

In this paper, the focus is placed on energy consumption and demand to dive deeper in what has already been addressed and what literature gap this paper aims to fill. As mentioned, energy demand has been on the focus of many researchers. The reasons behind this relate to several factors. Initially, a thorough understanding of energy demand aids to plan and build appropriate strategies on better resource allocation and infrastructure development (Belke et al., 2011). Secondly, it helps to understand economic impacts of expected energy prices, which affect all production processes and consumption cycles. Thirdly, it aids to identify inefficiencies and capabilities of storing the energy for further use. Especially in the last two decades, with the depletion of available resources and increase in demand, it has become even more important to study energy consumption and how it can be exploited for developing sustainable energy systems that minimize environmental impact and mitigate climate change. In addition, research on the matter is crucial for developing energy-saving technologies and for promoting energy-efficient practices. To influence at its best the energy consumption, it is essential to understand the main drivers which affect it. These drivers belong to different spheres. There are economic factors, technological factors, behavioral factors, policy-related factors, seasonal patterns and other geopolitical or demographic factors (Dokas et al., 2022). The findings on the effects of such factors on energy consumption are generally mixed across researchers (Sharma, 2010).

Economic Factors

Economic factors play a crucial role in energy consumption especially if we consider the price changes. Numerous studies have examined the relationship between energy consumption and variables such as the price of energy, economic growth, GDP per capita, financial development, national lending, or investment. For instance, Dokas et al. (2022) found that the main drivers of energy consumption in developing countries are economic growth and investment. Khanna and Rao (2009) found out in their study that electricity demand especially in developing countries is driven by GDP, price, and income level. Similarly, Lee and Chang (2008) in their analysis based on Asian countries found that there is a unidirectional causality between energy consumption and real economic growth when real GDP was used as a proxy. In terms of economic factors, in the majority of the studies, financial development is found to have a positive effect on energy consumption (Anton and Nucu, 2020).

Besides, it is worth highlighting that energy consumption, economic growth, and overall financial development, increase even energy efficiency (Sineviciene et al., 2017). Along the same lines go Hysa et al. (2023). Furthermore, this viewpoint is supported by Shahbaz et al. (2013) who found out that there is a long run relationship between energy consumption and economic growth. Same results were reached with respect to the relationship between financial development and international trade. Similarly, Belke et al. (2011) confirm that there exists a bi-directional causal relationship between energy consumption and economic growth.

An important economic factor which affects not only energy consumption, but the overall economic condition of a country is the FDI (Foreign Direct Investment) (Shaari et al., 2022). In their study, it is concluded that an increase in FDI inflows cushions against the adverse impact of increased consumption or environmental degradation due to resource depletion, which is very important for sustainability. Zubedi et al. (2022) also studied the cointegration between energy consumption, economic growth, and foreign direct investment (FDI). The final results did support the view that FDIs can significantly improve trade, enhance investments and economic growth, hence mitigating any possible problems that might arise if energy consumption increases beyond estimations. Further, in an empirical analysis, Azam et al. (2015) proved that in the case of Malaysia, Thailand and Indonesia FDI inflows, economic growth, and trade openness have positive and statistically significant impact on energy consumption.

However, there is still a need for further research to explore the specific mechanisms and nuances of these economic drivers, particularly in relation to different sectors and regions.

Technological Factors

Technological factors account to some extent for the past, the present, and the future reality, considering that they capture the state of the existing infrastructure, ongoing technological advancements as well as expected innovations which shape energy consumption patterns to a considerable degree. As such, a key factor that has been overseen in other studies is innovation, especially in the form of technological innovation (TINO) (Safi et al., 2021). In addition, there are other factors such as smart grids, energy-saving appliances, or infrastructure focusing specifically on network losses or possibility for energy theft.

Hysa et al. (2020) in a study which targeted the dynamics of environmental effects and economic growth emphasize the necessary role of innovation and education towards sustainable practices as a key to promote development. Moreover, it is suggested that governmental bodies as well, need to support as in the case of additional funding for waste-free activities. This is also supported by Morina et al. (2022) who examined the effects of Covid-19 pandemics and found out the importance of governmental policies to lower the burden of crisis.

Solarin et al. (2022) demonstrated the positive impact of technological advancements on energy efficiency in the industrial sector especially in terms of renewable energy production. However, barriers to technology adoption and rebound effects must be considered to fully understand the dynamics between technology and energy consumption. Moreover, their findings suggest that countries with lower renewable energy production per capita are more influenced by renewable energy technological innovation, compared to countries which have higher renewable energy production per capita.

According to Liu et al. (2022) technological advancements, mostly impact energy production and reduction of emissions rather than directly energy consumption. Generally, technological factors pose difficulty when it comes to studying them, since it's difficult to find proxies to represent them or to efficiently measure their impact (Safi et al., 2021). More time is needed to properly assess the influence of technological factors on energy consumption (Liu et al., 2022), thus the impact remains more on a hypothetical phase.

Policy-related Factors

Even in the most open countries with a leading private sector, governmental policies and regulations have a significant impact on energy consumption. Studies have investigated the effectiveness of policy interventions, such as energy efficiency standards, subsidies, and carbon pricing, in influencing energy consumption behavior. In their in-depth study of 94 countries for more than 45 years, Llanos et al. (2022) came to the conclusion that when extreme policies are followed deliberately, such as a drastic increase or decrease of energy consumption, economic growth is jeopardized. A

contrasting view is represented by Topcu and Payne (2017) who studied 32 countries. In the end, authors claim that energy conserving policies do not affect economic growth.

Despite policies which intend to shape energy consumption behavior, an important factor in this cluster of policy-related factors is trade openness which positively affects consumption and overall energy efficiency. According to Sekrafi and Sghaier (2016) increased energy consumption goes in line with corruption, and both negatively affect emissions.

Apart from policymaking, a very important political factor is corruption. Boamah et al. (2021) found out that corruption and energy injustice can also lead to increased electricity consumption.

Demographic factors

In every consumption-related analysis, demographic factors are expected to have a significant influence. Different authors have studied the impact of population growth on energy consumption in general as well as on energy consumption patterns. Besides general growth, some studies have been conducted to understand the impact of urban expansion as well.

According to Muzayanah et al. (2022) population density is key when analyzing influencing factors in energy consumption. As such it is crucial to incorporate population growth actual figures or forecasts in national energy plans. This is especially important due to the impact that this population growth and increased energy consumption has on greenhouse gases and depletion of fossil fuels (OECD, 2013) which directly impacts a sustainable energy future. This is supported also by recent studies. As Zarco-Periñán et al. (2021) claim, an increased population density leads to higher energy consumption per inhabitant and per household.

Geopolitical Factors

Geopolitical factors also comprise an important subset in the factors influencing energy consumption. Just to illustrate it, the geopolitical tensions between Russia and Ukraine, brought a severe electricity and energy crisis in general. In addition, corruption, which is usually classified as a political factor, can influence consumption indirectly since it impacts the realized investment projects as well as the velocity of their operations. Other influencing factors are behavioral factors and seasonality (Khanna & Rao, 2009). A factor with increased importance over the years is HDI (Human development Index). Individual and collective behavior also contribute to energy consumption patterns (Popescu et al., 2022b). Research has shown that consumer behavior, such as energy-saving practices and energy-conscious decision-making, can result in substantial energy savings. Smith and Johnson (2018) found that providing feedback on energy consumption to households led to reduced energy use. Nevertheless, understanding the complexities of human behavior, social norms, and barriers to behavioral change remains an ongoing challenge in this field. Yet, evidence from Indonesia, Malaysia, and Thailand showed that HDI positively influences energy consumption (Azam et al., 2015). Given the technical aspects behind the computation of HDI, it would make sense to expect that higher income, life expectancy and education would lead to higher consumption of energy as the number of activities requiring its use would rise with these three factors which present the three components of HDI. Another reference, using data from an earlier period is Pasternak (2000). The author also uncovered a positive correlation between HDI and energy consumption; such a result was derived once secondary data from 1997 was employed for the analysis. As for seasonality, temperature, and weather, studies show that they usually affect both, the energy supply and consumption.

In short, it can be stated that by comparing the findings across economic, technological, behavioral, and policy-related drivers, several commonalities and discrepancies emerge. While economic factors consistently influence energy consumption, the specific relationships and interactions are still subject to controversy. Technological advancements show promise in reducing energy demand, but challenges related to adoption and rebound effects should be addressed. Behavioral factors demonstrate the potential for energy-saving behavior, but a comprehensive understanding and effective strategies for behavior change are still in progress. Policy-related factors highlight the importance of targeted interventions, but further evaluation and cross-country comparisons are necessary to identify successful policies.

3. Data & Methodology

In this paper, secondary data of an annual frequency are used to build an unbalanced panel data set for the period 2007-2021. We use a random sample of Balkan countries since they are all growing economies, quite dynamic with respect to the policies and reforms undertaken to check how energy demand in such countries can respond to changes in the political, economic, financial climate or technological innovation. This is not only a "hot topic" at the moment, but one that could bring serious further repercussions to the economic environment and stability in the region unless properly addressed. Said that, we aim to fill the existing gap in the regional literature on the matter by estimating a comprehensive model which provides useful insights to policymakers and regulators, thus allowing for a proactive behavior (from now onwards) rather than a reactive one. Given the trajectory of the matter, and the prolonged responses, it would be useful to carry out a research which investigates the energy market from a demand perspective, allowing in such a way the policymakers to evaluate how the progress in numerous related areas is translated into the future energy demand and consumption that the countries and the region as a whole can be expected to face.

The data is retrieved from the following sources: energy consumption per capita (measured in terawatt-hour TWh) is retrieved from Our World in Data; Innovation index from the World Intellectual Property Organization (WIPO); Corruption Index from Trading Economics; while the rest of the variables are taken from World Development Indicators.

Our goal was to build a comprehensive model, which accounts for a wide range of multi-dimensional factors; thus, allowing to fully account for the interrelationships between the variables and contributing to the regional literature. The initial model is presented below:

$$\text{Energy Consumption per capita}_{it} = \beta_0 + \beta_1 * \text{Corruption Index}_{it} + \beta_2 * \text{FDI}_{it} + \beta_3 * \text{Financial Development}_{it} + \beta_4 * \text{GDP per capita}_{it} + \beta_5 * \text{Trade Openness}_{it} + \beta_6 * \text{Global Innovation Index}_{it} + \beta_7 * \text{HDI}_{it} + u_{it}$$

Where:
i – stands for the entity, countries under study
t – stands for time, years under study
u – stands for the serially uncorrelated error term

3.1 Preliminary Tests

In advance of estimating the regression model presented above, the necessary preliminary checks are conducted to see whether that model satisfies all the pertinent panel data assumptions. Then the model is narrowed down to regressors which prove statistically significant. This general-to-specific approach is employed to allow the focus to be laid only on those factors worth working on to figure out future tendencies in energy demand and consumption. In line with this approach, we see that the initial model with seven explanatory variables has to be narrowed down to up to three regressors. The final regression equation is tested for robustness, and all necessary statistical tests are presented next, thus guaranteeing the reliability of our inferences. Knowing that panel data are a hybrid form between time series and cross-sectional data, they possess characteristics of both. Consequently, the focus is laid on the following checks conducted in E-Views 10: Philips Perron test for stationarity of the data, correlation matrix, LM serial correlation test, Breusch Pagan heteroscedasticity test, Wald Test for joint significance and Hausman test.

The most suitable model to be estimated given our sample of data depends on the characteristics and patterns of the data themselves. Said that, we rely on the Hausman Test to choose between the Fixed (FEM) and Random Effects model (REM). Hausman test results are interpreted using a 95% confidence level. The results from the Hausman test suggest the suitability of a Fixed Effects model given that the probability value was below the 5% significance level. In this regard, we can infer that the data heterogeneity was considerable, thus the test concluded on the rejection of the null hypothesis. As a result, we proceed with a three-regressor FEM for the rest of the empirical analysis. As shown in the paragraphs that follow, the final model (shown below) proves to be robust and hence helpful for the effective decision-making process related to energy consumption and demand predictions.

$$\text{Energy Consumption per capita}_{it} = \beta_0 + \beta_1 * \log(\text{FDI})_{it} + \beta_2 * \text{Global Innovation Index}_{it} + \beta_3 * \text{HDI}_{it} + u_{it}$$

Stationarity of the series is checked using Philips Perron (PP) Test. As Table 1 suggests, we reject the null hypothesis in favor of a unit root with 95 % confidence level. Consequently, we state that the regression variables are stationary in level form, and hence no data transformation is needed. It is important to underline that these results allow us to conclude that spurious regression problems cannot be considered as a concern regarding the reliability and accuracy of estimation results.

Table 1. Philips Perron Test

PP Unit Root Test		
Energy Consumption	39.0819	0.0000
Log (FDI)	66.4902	0.0000
Global Innovation Index	27.1450	0.0025
HDI	21.2322	0.0195

Secondly, the correlation matrix is presented to indicate that regression variables are free from any multicollinearity issue. In none of the cases, coefficients below suggest traces of perfect correlation between the regressors. As it can be seen, all values are well below 0.8, which is the threshold indicated in the literature. Results as appear on Table 2 below demonstrate that we can proceed with a ceteris paribus analysis, as there is no trace of perfect correlations between the three explanatory variables.

Table 2. Correlation Table

	FDI	Global innovation index	HDI
FDI	1.0000		
Global innovation index	0.2111	1.0000	
HDI	0.5018	0.0773	1.0000

Thirdly, there are below the results from the Hausman test. They indicate the rejection of the null hypothesis at a 5% significance level; thus, a fixed effects model (FEM) is then estimated to detect the magnitude and direction of impact of the selected key drivers on energy consumption.

Table 3. Hausman Test

Correlated Random Effects			
	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	706.15	3	0.0000

Finally, we run the serial correlation LM test and the heteroscedasticity test. Breusch Pagan test suggests that residuals have an equal variance; we fail to reject the null hypothesis in favor of homoscedasticity at any conventional significance level (p-value = 0.6659). Related to serial correlation, we employ HAC (autocorrelation consistent standard errors) to ensure that hypothesis testing procedures will generate reliable results.

Table 4. Heteroscedasticity Test

Breusch Pagan Heteroscedasticity Test	
H0: Residuals are homoscedastic	
Ha: Residuals are heteroscedastic	
R-squared	0.0261
F-statistic	0.5263
Prob(F-statistic)	0.6659

In Section 4, it is presented the final model which contains only three regressors: HDI, FDI and Global innovation index. Their impact on energy consumption is commented on in the next section.

4. Research Results

Following a General-to-Specific approach, we conclude that there are three regressors which prove statistically significant in explaining energy consumption per capita (at 5% significance level). These regressors are FDI, HDI and Innovation index. On the other hand, financial development (as captured by domestic credit to the private sector as a percentage of GDP), corruption index, GDP per capita, and trade openness result to have no impact in the case of Balkan countries. For these four regressors there was no sufficient evidence to reject the null hypothesis of each individual t-test. That said, the main equation was built on the three aforementioned variables which proved significant statistics-wise. The marginal impact of such variables is shown below using FEM (as suggested by Hausman test). For the specific estimation outputs, please refer to Table 5. The final model is estimated using heteroscedasticity autocorrelation standard errors. By using HAC standard errors, we can guarantee that the results from hypothesis testing will be reliable and accurate.

Table 5. Final Estimation Output

Fixed Effects Model		
Variable	Coefficient	Probability
LFDI	29.5424	0.0044*
Global innovation index	9.0674	0.0000*
HDI	1120.9020	0.0211*
R-squared	0.8155	
Adjusted R-squared	0.7513	
F-statistic	12.7070	
Prob(F-statistic)	0.0000*	

** Significant with a 95% confidence level*

As the results above indicate, the final estimation output explains 81.55% of the total variability in energy consumption per capita. Each of the variables seems to have a positive impact on energy consumption that can be proven with a 95 % confidence level.

If foreign direct investments increase by 1%, it would be expected an increase in energy consumption per capita by 0.30 TWh ceteris paribus. For each change of the innovation index, the energy consumption is expected to rise by 9 TWh ceteris paribus. For each change in HDI, energy consumption would be expected to rise by 1121 TWh ceteris paribus.

The results are mainly in line with the literature; thus, suggesting that investment, development of human capital and technological innovation are important factors steering energy demand and consequently consumption.

Our findings regarding technological innovation do not align with all the examined papers, as in the case of Hysa et al. (2023) and Safi et al. (2021). Nevertheless, the variables used to measure innovation in their case were different as they were mainly based on patents and trademarks or on an efficiency-based perspective rather than on an index form which aggregates information from seven pillars. As for FDI, the results are in line with the analyses of Zubedi et al. (2022) and Azam et al. (2015) which conclude that FDI increases energy consumption either in a direct or indirect manner. Lastly, the results for HDI align with the findings of published research in other countries (Azam et al., 2015); yet they seem to conflict with the findings of Smith and Johnson (2018) which expect HDI to lead to reduced energy use, thus lower consumption.

5. Conclusions

Energy crisis as triggered by the Ukraine-Russia war took a toll on the global economy, as uncertainty rose together with inflationary pressures, strikes and riots, which were soon spread across several countries. In line with this phenomenon, and the very dynamic market realities that characterize the growing Balkan economies, it becomes important to understand what drives the energy demand in the region. The literature on the matter suggests ambiguous results for some of the factors hence a comprehensive model that accounts for a variety of drivers might better control for the nature of interrelationships and provide a complete picture on the critical factors behind changes in demand and consumption of energy.

This paper employs a comprehensive empirical analysis covering a 15-year period (2007-2021) for a randomly selected sample of Balkan countries. The regression equation accounts for a plethora of factors namely economic, political, technological, and financial. Using secondary annual data and a fixed effects model, this study aims to bring to light the main determinants of demand for energy in the region. The estimation results were in line with our expectations and suggested that HDI, FDI and innovation push up the energy demand. All these regressors appeared to have a positive, significant impact on the dependent variable which was proven at the chosen significance level (5%). It would be useful to evaluate how policies that are undertaken in the majority of Balkan countries which aim to increase the attractiveness and competitiveness of the region, quality of workforce, and human capital in general might lead to a higher demand for energy in the future which has to be accounted for in policy projections and decisions. In addition, since we are living in a century when technological breakthroughs, AI, and continuous innovation are reshaping all areas of life, it can be equally important to understand that innovation has also to be taken into account once evaluating the future demand that such countries can face. Energy is thought to be also critical for growth and development, especially in the developing economies, so understanding the true dynamics of the matter can have a considerable impact on economic reality in the region. This research adds to the regional literature on the matter, and it provides an up-to-date picture as well as guidance to policymakers and other interested parties. The one important limitation this study faced was the data availability; given that the nature of research calls for secondary data the obstacles in this respect were many. It would be noteworthy to suggest extending the analysis in the future to developed economies to be able to examine how growth dynamics shape the consumption for energy across developing and developed economies; and recognizing current market orientation it would be interesting to consider also the demand for renewable energy alone. Further research is suggested especially in terms of comparing the figures pre- / post- pandemics and pre vs. post the Ukrainian-Russian war, which will take some time to be fully manifested.

What is to be underlined is the inclusive nature of the multiple linear regression model in this study, which by accounting for diverse factors enabled the reflection of respective sectoral dynamics on the energy market and more specifically on the energy consumption. This study fills a gap on a general overview of key energy consumption factors in the Balkans, thus allowing to narrow down the analysis and policy making to three critical drivers: FDI, HDI and innovation to address energy crises from the demand perspective.

***Authors' contribution**: Introduction & Literature review - V. Xhafa; Methodology and Data; Research results and comments; Conclusion - E. Zaimaj*

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