SOUTHEAST EUROPEAN REVIEW OF BUSINESS AND ECONOMICS

CONTENTS

Open access policy

Since our intention is to popularise the work of academic researchers, we are committed to promote the dissemination of research outputs and greater global exchange of knowledge. In order to support dissemination, the Faculty of Economics - Prilep provides an unrestricted on-line access to all issues published in SERBE.

The international journal SERBE is available internationally in *EBSCO* and *CROSSREF* database.

EDITORIAL

Southeast European Review of Business and Economics (SERBE) is a peer reviewed academic journal published by the Faculty of Economics-Prilep, University "St. Kliment Ohridski"-Bitola, Macedonia. It has been founded on the rich academic and publishing heritage, including the Yearbook of the Faculty of Economics-Prilep and Proceedings from a number of international conferences. Based on this tradition, our intention is to publish original papers, which have not been previously published or submitted for reviewing to other journals.

The world we live today is facesing with enormous challenges. Economic, environmental, sociological and health circumstances are putting significant pressure on governments, countries, communities, businesses, ecosystems, and even individuals to rethink their roles and responsibilities, and rebuild their competitiveness. We encourage experienced scholars, business practitioners as well as young researchers to submit their original work on various problems in the areas of business and economics.

In the tenth number of Southeast European Review of Business and Economics (SERBE) are presented selected papers from the XIII International Conference "**Economy, Business & Society in Digitalized Environment (EBSiDE 2024)**" held on September 20-22, 2024 at the Faculty of Economics-Prilep.

TWIN TRANSITION AN OPPORTUNITY FOR ACCELERATED GROWTH IN WESTERN BALKAN

Gligor Bishev

1. Intrioduction

Global economy is facing economic slowdown, pessimism, uncertainty, fragmentation of economic flows, high indebtedness of private and public sector. High interest rates are prevailing characteristics of current economic life. Many people are not sharing benefits and believe the economies are not working for them. Simultaneously, rapid technological changes and innovations are becoming part of our every-days life. Green economy and AI are becoming embedded in everybody's life. Vision, courage and optimism are becoming key for future development and sharing better life and higher living standard. Society is on cross-road as it was a Century ago, in a dark days of a Great Depression. Pessimism is unjustified, wrote Keynes that days… "I believe that this is a wildly mistaken interpretation of what is happening to us. We are suffering not from the rheumatics of old age, but from the growing pains of over-rapid changes, from the painfulness of readjustment between one economic period and another. The increase of technical efficiency has been taking faster, than we can deal with the problem of labor absorption; the improvement of standard of life has been a little too quick,…the enormous anomaly of unemployment in a world, full of wants, the disastrous mistakes we have made, blind us to what is going under the surface to the true interpretation of the trend of things (Keynes, 1930)."
For Keynes under the surface was unnoticed rapid technological change that was taking place and rapid capital accumulation. In order to predict future, he advocated to disregard short-term, and take a long-term view of a Century: "I would predict that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is to-day…Three hours a shift or a fifteen hours week will be working time in progressive countries (Keynes, 1930).

From today's perspective, it is surprisingly how much Keynes was right. GDP per capita in the most developed countries for less than a Century increased by 8 times, while population increased by 4 times and life expectancy from 40 to 75 years. Keynes miss the prediction for working

time, although the trend is in line with his forecast.What the world can expect for next hundred years? In accordance with IMF calculations, pessimistic scenario predicts increase of GDP per capita by three times, while optimistic scenario predicts GDP per capita increase by 9 times (Kristalina Georgieva, King's College, 2024). How these developments will be reflected on six Balkan countries: Albania, Bosnia and Hercegovina, Kosovo, Montenegro, North Macedonia and Serbia? What is their economic position today? What can we expect in next a Century? and how to exploit twin transition – green transformation and AI transformation to accelerate growth, to increase living standard and create better possibilities for our grand-children? These topics are in focus of this research and presentation.

2. Economic position of Western Balkan countries

The Western Balkans (WB) have made considerable progress in terms of economic reforms since transition to a market economy. In the period 1990 – 2024, GDP per capita at a constant USD prices, have grown at average rate of 202 percent, in comparison to rate of growth in EU of 57 percent, and world economy by 70 percent. Growth per country was very evenly distributed, with growth in Bosnia and Hercegovina by 511 percent, Albania 235 percent, Serbia 178 percent, North Macedonia 111 percent, Kosovo 91 percent and Montenegro 86 percent. While these reforms have delivered economic growth, the gap in living standards between the WB and the EU remains persistent, with the WB GDP per capita ranging from 25% to 52% (Albania 35%, Bosnia and Hercegovina 38%, Kosovo 25%, Montenegro 52%, North Macedonia 42%, and Serbia 45%) of the EU average (calculations based on World Bank data, open data 2024).

Graph 1

GDP per capita (constant 2015 US$ - WB6)
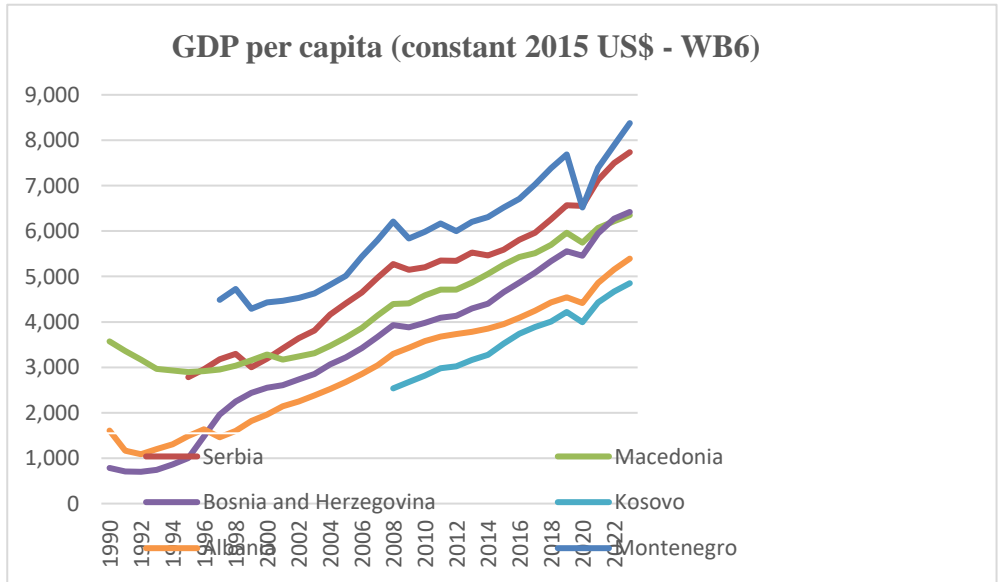
Source: World Bank open data

Graph 2
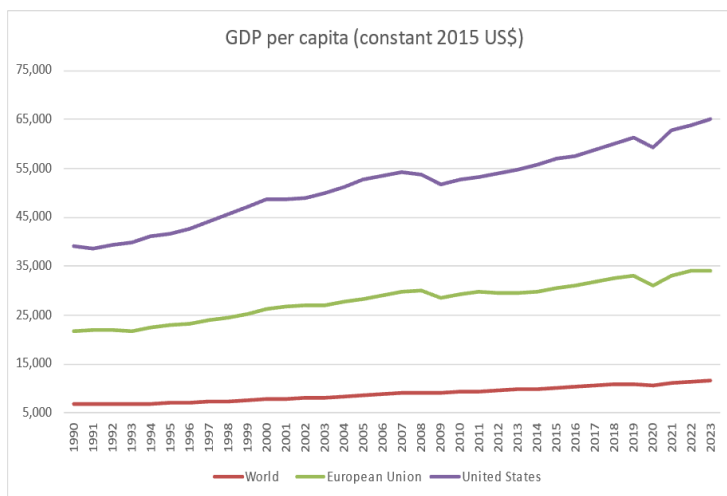
Source: World Bank open data

The OECD forecasts that at the current growth rates of the EU and the WB economies, income per capita convergence may only be achieved in the period 2065-2077 (OECD, Economic convergence Scoreboard for the Western Balkans, 2023). It is clear that a decisive action is needed to propel

the WB economies towards accelerated, sustainable, inclusive and shared development. Bold and comprehensive reforms, investments in infrastructure, education, health, green economy, new technology, digitalization, and economic integration are prerequisite to shorten the period of income convergence and WB to join living standard and happiness of EU average.

The large-scale emigration, labor shortages, and skill gaps have emerged as substantial impediments of the region's productivity and competitiveness, its capability to attract innovative and high value-added investments, as well as to lead, implement but also adapt to green and digital transformation. Extensive outmigration trends (actual, but also anticipatory trends such as those reflected in intention of WB citizens to emigrate) and brain-drain are profoundly hindering the Western Balkans growth potential by (risking) reducing skilled labor supply and depleting its human capital. Serbia, Bosnia and Hercegovina and Albania are among the top ten countries in the World that have the fastest declining population.

In a decade (2012 – 2021), WB outflow 1.6 million citizens, which represents 10,2% of total population. The highest outflow, above 10% had Albania (16.1%, North Macedonia 12,6% and Bosnia and Hercegovina 11,0%). Situation is worse if we have in mind that mainly emigrants are young, working age, highly skilled workers. If the outflow is compared to number of working population, the figures are extremely harmful (15.6%, the highest Albania 23.4%, North Macedonia 21.0% and Bosnia and Hercegovina 17%). The region lost the most valuable potential for development.

Graph 3

Share of Outlaws to Total Population and Working Population, in %
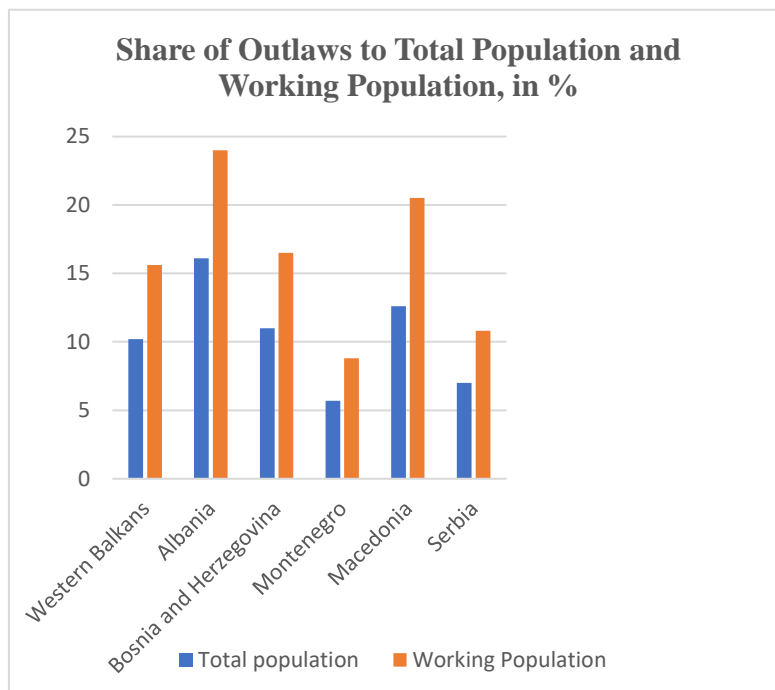
Source: OECD open data, OECD, Economic convergence Scoreboard for the Western Balkans, 2022 and own calculations.

High outmigration trends in WB are influenced by relatively high (youth) unemployment rate, though this is changing rapidly, low wages, inadequate public services, including poor education and health care, limited opportunities and weak institutions governed by political parties that promote their instead state interest, also perception of political instability, quality of life, pessimism, and low influence on political processes. Study of the Vienna International Institute for Economic Studies, confirms high share of those that have an intent to migrate from the region: 58.1% in Albania, 42.1% in North Macedonia, and 47.6% in Serbia. Thus, every second citizen of WB is considering leaving and working abroad, while for youth this is even more pronounced, with more 2/3 of youth (71%), considering leaving the region. Outmigration from the region is influenced by strong demand for high qualified, young labor force internationally, especially EU countries. Mobility of the labor force becomes very high and wage setting is becoming regional and international. Thus, based on Labor Agency of Germany, shortage of labor only in this country until 2030 will be 5 million or 400 thousand per year. For Europe this figure is estimate to 12 million.

hus, human capital becomes key factor for growth potential and development in WB. It also plays a catalytic role in driving progress in other key reform areas, such as private sector development, green and digital transition. Key question for WB region becomes how to phase out pessimism of citizens in the region, how to bring back trust, predictability and certainty, in order to preserve the most precious factor: labor force. As Keynes would say, we need to dive below surface, to discover potential and competitiveness of the region, to create optimism.

3. Green transition and economic possibilities

Governments and companies are increasingly committing to climate action. Green transition has to become part of behavior of each economic agent. Each sector of the economy has to become less carbon intensive in order achieving net-zero green house gas emission until 2050. Transformation will be comprehensive, and each part of economy will encounter changes. According to McKinsey Global Institute (Road to Net Zero Emission, 2024) seven sectors will be the most significantly transformed: **i) Power (energy)**, consisting of power and heat production, transmission and distribution, storage; **ii) Industry**, consisting various industrial processis emitting CO2, especially production of steel, cement and chemicals, extracting and refining oil, gas and coal; **iii) Mobility**, consisting of road, aviation, rail, maritime and other forms of transportation; **iv) Construction** and housing, including heating and cooling; **v) Agriculture and fishing**, including direct on farm energy use and fertilizers; **vi) Forestry and other land use**, direct energy use and chemicals; **vii) Waste**, consisting of solid waste, waste treatment and **waste water** treatment. Green transition will determine huge investments and their reallocation. Reallocation of capital and assets. This will lead to employment reallocation, change in demand and supply of labor force, transforming job requirements. Green transition is becoming main source of growth that affects income and wealth distribution.

Capital spending to reach the goal of net-zero CO2 emission in 2050 will require, world on average to invest 9.2 trillion USD per year or 7.5% of world GDP, in the period 2021-2050, or cumulatively 275 trillion USD (McKinsey Global Institute, 2024). However, developed countries, not too much dependent on fossil fuels should invest less. Developing countries much more. The highest investments are required for fossil fuel producing countries.

Investments for transformation per region and group of countries are presented on Graph No. 4. EU would require annual investments of 800

billion or 4,5-5% of GDP. Currently it allocates only half 400 billion or 2.1% of GDP. Workforce requirements would evolve as markets are reshaped and technological processes adapted. Job qualifications would change, and educational system would face significant challenges. The net-zero transition could lead to a reallocation of labor. McKinsey Global Institute (2024) predicts that green transition would generate 200 million direct and indirect jobs, while 185 million jobs will be lost by 2050.

Graph No. 4
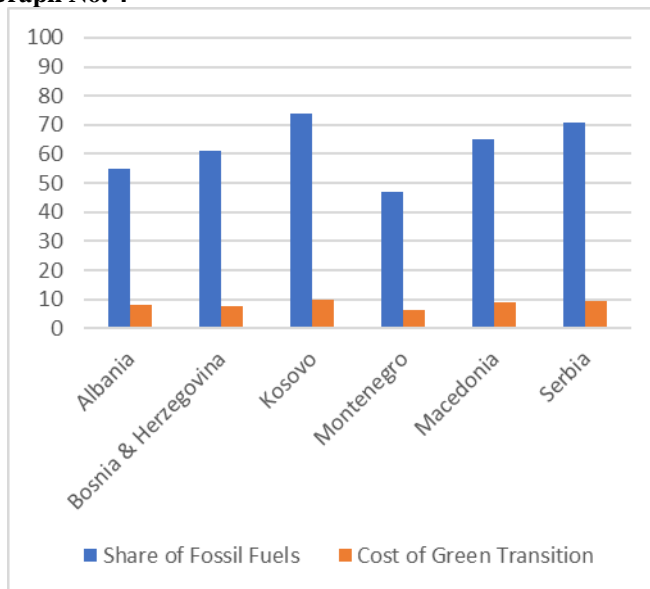
Source: Vienna Institute for International Economic Studies, February 2023 and own calculations.

Western Balkans, is facing big challenges to net-zero transition, but it may be big opportunity, as well, to transform its economies, accelerate growth and income convergence and to become an attractive place for living for its' citizens. Fossil fuel energy dominates and decisively determines structure of WB economies. Graph No. 4, presents the share of fossil fuel energy in total produced energy. Serbia, North Macedonia and Kosovo, rely heavily on coal. Hence, they will face greater challenges in transition and higher costs. Transformational investments for these countries are assessed between 8-10% of GDP annually. Albania, heavily rely on oil. Its costs of transformation are assessed 8% of GDP. Montenegro is in the best position, with energy more than 50% from renewables. Its transformation costs are predicted around 6.5% of GDP, and for Bosnia and Hercegovina around 7.5% of GDP. Thus, almost a third of total investments in Western Balkan in the period 2024-2050 would refer to energy transition to net-zero.

Investments for transformation per regions and group of countries are presented on Graph No. 4. EU would require annual investments of 800 billion or 4,5-5% of GDP. Currently it allocates only half 400 billion or 2.1% of GDP. Workforce requirements would evolve as markets are reshaped and technological processes adapted. Job qualifications would change and educational system would face significant challenges. The net-zero transition could lead to a reallocation of labor. McKinsey Global Institute (2024) predicts that green transition would generate 200 million direct and indirect jobs, while 185 million jobs will be lost by 2050. Western Balkans, is facing big challenges to net-zero transition, but it may be big opportunity, as well, to transform its economies, accelerate growth and income convergence and to become an attractive place for living for its' citizens. Fossil fuel energy dominates and decisively determines structure of WB economies. Graph No. 4, presents the share of fossil fuel energy in total produced energy. Serbia, North Macedonia and Kosovo, rely heavily on coal. Hence, they will face greater challenges in transition and higher costs. Transformational investments for these countries are assessed between 8-10% of GDP annually. Albania, heavily rely on oil. Its costs of transformation are assessed 8% of GDP. Montenegro is in the best position, with energy more than 50% from renewables. Its transformation costs are predicted around 6.5% of GDP, and for Bosnia and Hercegovina around 7.5% of GDP. Thus, almost a third of total investments in Western Balkan in the period 2024-2050 would refer to energy transition to net-zero.

Limited domestic savings in Western Balkans, should be not obstacle for comprehensive green transition for fundamental changes in structure of the economy, dislocation of work, changing relative prices, justice within and across society, nations and communities. Part of funds will be secured through Growth Plan for Western Balkans. FDIs and Public Private Partnerships (PPP) should play considerable role as well. However, emitters of CO2 should contribute as well to cover costs of transition. Harmonized carbon tax, should be introduced in all WB countries. It will equally refer to CO2 producers, but also to consumers of goods produced by energy from fossil fuels. Cheap long-term financing is key ingredient for successful green energy transition. Renewables make long-term gains for society. They do not bring high short-term returns for investors. For example, expected rate of return for renewable energy from photovoltaics is 8-10 percent within a period of 15-20 years. Thus, they cannot bear financing costs higher than 3-3.5% (OECD, Environment Working Papers No. 245/18 July 2024). Furthermore, they cannot bear interest rate risk as a result of volatility of interest rate. Thus, financing costs has to be low and fix. Public investments

in transmission network, chargers, stocking of energy (batteries) should complement private investments.

Well designed, risk sharing, guarantee schemes should be in place for renewable energy investments, research and development (R&D). Targeted subsidies for winning investors and for consumers should be in place. For example, energy efficient materials implementation in construction industry, incentives for installation of battery systems for households and for producers of renewable energy, subsidy for storage systems, subsidies for substitution of household systems on coal and oil to thermo- pumps, and so on. Creation of integrated Western Balkan energy market, is very important in order to create sufficiently big market to exploit economies of scale. For this WB need to be connected with sufficient transmission lines, to create Balkan balancing energy Group, Balkan storage capacity and regional plants for hydrogen production. First step in this direction is creation of SEEPEX – Belgrade Market Operator for an organized electricity market/power exchange. Together with HUPX – Hungarian Power Exchange, they mainly determine prices of electricity in WB countries.

The agri-food industry is characterized by a large share in most economies of the Western Balkans, both in terms of GDP and in terms of employment. In terms of GDP, the share of agri-food varies from 25% in Albania to slightly above 10% in Montenegro and Bosnia and Hercegovina (Jovanovic and Vujanovic, WIIW, 2023). All economies of WB, have a revealed comparative advantage in this sector. The industry is supported by various government programs and subsidies. It aligns with the agenda outlined in the European Green Deal, primarily in terms of ecological and sustainable food production, using clean energy. Scientific potential in agricultural and biological sciences is one of the strongest in the region, with several regional institutions having high reputation even in EU. Full scale transformation of agri-food process and technologies should take place. Relying on fossil fuel in production process and fertilizers and agri-chemicals, produced from fossil-fuel will be not possible on long run. Also, equipment utilized in agri-food industry has to be substituted with non CO_2 emission equipment. For such a transformation, role of state will be important, having in mind scare resources in this industry and low profitability of agri-food industry involved in production of basic agricultural products.
The general strategy for the agri-food sector should be to create value chains from production of primary agricultural goods until high value-added processed products. The focus should be providing high quality, ecologically premium products.

Some of the actions that policy makers in the WB could undertake in order to achieve this would be: **a)** Providing support for adopting new, modern and clean technologies, **b)** create a system of permanent education of employees in agri-food sector, **c)** support for development of premium products, design, packaging, marketing, promotion and creation of brands, **d)** support for logistic centers for storage and distribution of agri-food products, **e)** financial support, low cost financing, grants, targeted subsidies, guarantee schemes and risk-sharing schemes**, f)** support for development and introduction of high quality and production standards that satisfy EU standards and requirements. Building and rehabilitating buildings and housing with high energy and ecological standards is important ingredient in green transformation but as well as increasing living standard and quality of life and happiness. As far as the environmental footprint of housing is concerned, the residential sector accounts on average, for 26 percent of total emissions and 29 percent of total energy use in the western Balkan and Cassius region – EBRD regions, compared with 22 percent of total emissions and 26 percent of total energy use in advanced European comparators (EBRD, Transition Report 2023/2024). Depending on the mixture of hitting, in some EBRD economies, residential sector are the single largest contributor to total emissions, exceeding emissions from industry, transport or other services. In countries, where citizens predominantly are using coal, household emissions are reaching 40% of total. High quality housing is closely associated with superior socio-economic outcomes. People whose homes are in better condition tend to be healthier and less likely to experience mental distress, taking into account education, income and other individual characteristics. (EBRD, Transition Report 2023/2024). Living in high quality housing creates happiness, better health, optimism which increases enthusiasm of economy. Thus, rehabilitating housing towards high quality, energy efficient do not have only direct effect – increasing development and GDP per capita, but also indirect effect – affecting wellbeing, happiness and optimism. In this respect, situation in WB is not encouraging. Over half of citizens live in housing constructed between 1953 and 1989, t.e. before transition to a market economy. Thus, the largest stock are energy inefficient, low and medium quality housing. However, ownership structure is encouraging in WB. Home ownership is high measured by international standards, with 90% of households, owning their home (in Germany 30%, and in Turkey 50%). This creates opportunity through easy access to finance (mortgages) quickly to rehabilitate homes, make them energy efficient, substitute hitting and cooling systems, increase quality of home and thus make housing key cathylist of

economic development, high living standard and happiness. This may create enormous possibilities for children and grandchildren in western Balkan.

The green transition cannot take place without an adequately skilled workforce, that is able to satisfy the demands of a greener economy and technologies that do not produce emissions. New types of job will emerge as households and producers adopt greener technologies. Demand for workers with green skills is already on the rise, and there is an evidence that there is on average wage premium of 4 percent for such workers. However, green wage premium accrues disproportionately to highly skilled workers and less to individuals who are more likely to be climate sceptics. This will require changing curricula in the educational system, on job training and retraining in order to embrace green technological changes, reduce transition costs and become fast growing economy creating better future. Contrary to technological changes caused by digital transformation that replace workers with machines, green transformation do not create large scale labor substitution. It mainly substitutes types of energy, increases quality of life and environment.

4. Digital transition and economic possibilities

Productivity is a key ingredient of competitiveness, high added value and high living standard. Statistics indicates, that the average labor productivity level in the WB was just 36% of that in the EU in 2023, which more or less resembles to average GDP per capita level in Western Balkans (OECD, Western Balkans Competitiveness Outlook, 2024). Boosting productivity, means boosting development and higher living standard. Introducing new technology, R&D, are crucial for boosting productivity. AI leads to enormous changes. It transforms businesses to the core; from how they operate, to the products and services they offer. AI automate processes, makes them faster, with high quality and low cost. Final phase is digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. Thus, AI do not only increase productivity, well-being and happiness, it reduces working hours for human beings. It becomes widespread, that in progressive countries, instead five days, working week will consists of four days (Financial Times, September 2024). It seems, with some delay of 20-30 years, prediction of Keynes, that working week will be 15 hours. Human beings will work less, but will have much higher living standard and much more free time. For Keynes, the key problem will become, how to use the freedom, how to organize our live, once permanent economic problem is overcome. How to enjoy abundance, how to cultivate perfection, when it comes, and workers do not work for

their lives? Keynes does not offer straight answer to this question. " Yet there is no country and people, I think, who can look forward to the age of leisure and of abundance without a dread. For we have been trained too long to strive and not to enjoy. It is fearful problem for the ordinary person, with no special talent to occupy himself…"

Embracing the path of accelerated technological adoption with proactive worker redeployment could help Europe achieve an annual productivity growth rate of up to 3 percent through 2030 (McKinsey Global Institute, A New future of work: The race to deploy AI and raise skills in Europe and beyond, 2024). This will create enormous pressure to WB. To converge to EU, their productivity growth and redeployment of labor must be higher. At least productivity growth has to be 1.5 percentage points higher, and reach at least 4.5%. Heavy demand of skilled workers in Europe will be the biggest challenge for WB**.** Based on McKinsey Global Institute. By 2030, Europe could require up to 12 million occupational transitions, double the pre pandemic pace. Businesses will need a major skills upgrade. Demand for technological and social and emotional skills could rise as demand for physical and manual and higher cognitive skills will stabilize and steadily drops. Advanced IT and data and behaviour analysis specialists, but also persons for critical thinking, creativity, and teaching and training, is assessed to be in shortage. Occupations with lower wages are likely to see reductions in demand, and workers will need to acquire new skills to transition to better paying work. If that doesn't happen, there is a risk of a more polarized labor market, with more higher-wage jobs than workers and too many workers for existing low-wage jobs. McKinsey Global Institute Report, predicts that health and entertainment professionals, individuals working in Science, Technology, Engineering or Mathematical – STEM, field will be in a heavy demand (Graph No. 5).

Graph 5 Net expected change in labor demand in Europe in period: 2022 - 2030

Employment change in percent

Office Support	
Production Work	
Agriculture	
Education	
Creative management	
Transport Services	
Bussiness legal professionals	
Healthcare	
Health and Welness, Aids, Technicians	

■ Employment change in percent

-30 -20 -10 0 10 20 30

Employment change in million

-2 -1 0 1 2 3 4
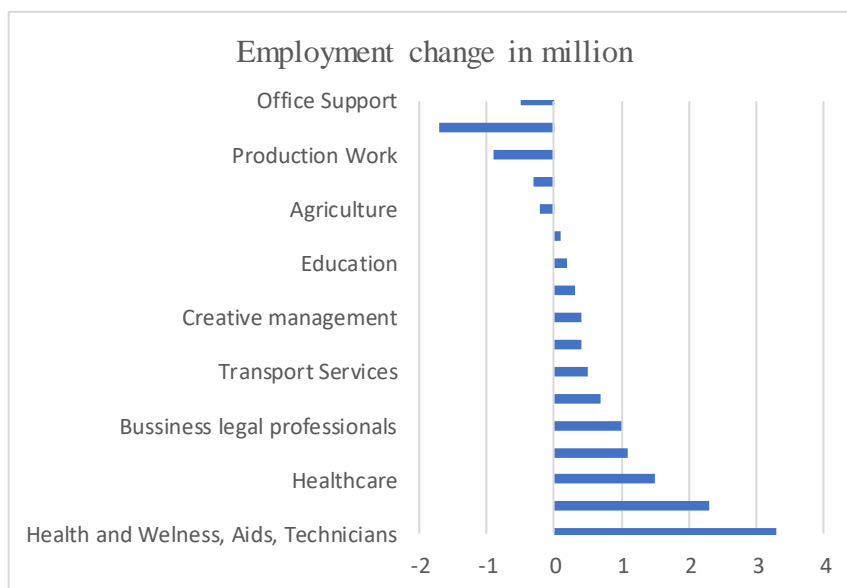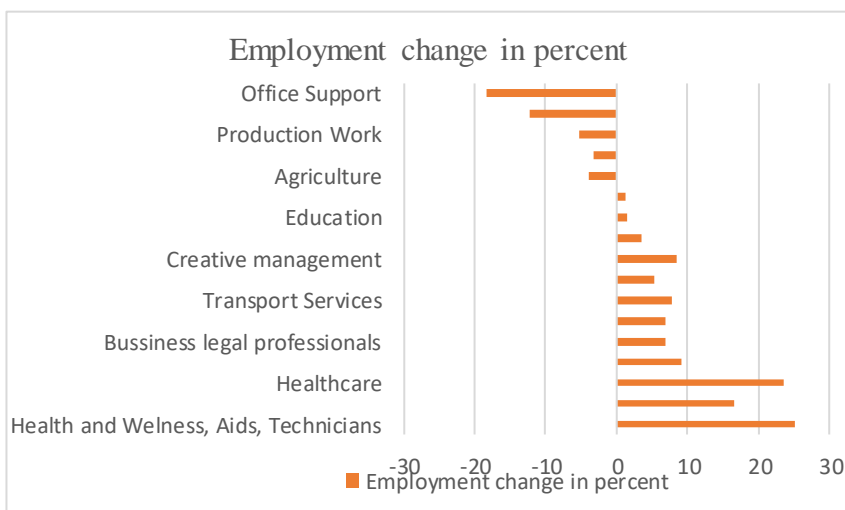
Source: McKinsey Global Institute, A new future of work: the race to deploy AI and raise skills in Europe and beyond, May 21, 2024.

Up to 2030, demand for health professionals, health aides, health technicians, wellness and STEM professionals, in Europe will increase by 30% in comparison to 2022. Contrary, demand for workers in food services, production work, customer services, sales, and office support (back offices)

would continue to fall in next decade, as it was in the period 2012 – 2022. These jobs involve a high share of repetitive tasks, data collection, and elementary data processing – all activities that automated systems can handle efficiently.

Huge expansion of data centers, machine learning models, AI are exponentially increasing demand for energy. Based on estimations of Financial times (Financial Times, AI power demand, could stifle industry's growth, 19 August, 2024), in the period 2022 – 2026, data centers and cryptocurrencies will double demand for electricity. In combination with green transition, this represents serious constrain for rapid development of AI technologies. Only development of data centers, will increase demand for electricity by 28%, worldwide in the period 2024 – 2030. Thus, green transition and technological revolution relying on AI are firmly aligned. Businesses and governments has to develop long term viable strategies for green and AI – Artificial Intelligence transformation, together with transformation and upgrading skills of workers. All three ingredients are necessary for comprehensive, well-designed transition towards higher living standard, happiness, more freedom and free time.

Especially, this refers to Western Balkan countries. They need comprehensive, well designed, and bold strategy for at least a quarter of century. Period within which WB will significantly accelerate and become prosperous and progressive region. National authorities should make an effort to reach as high as possible consensus for the strategy and mobilize citizens to support transformation. Long term view is important to widespread optimism and entrench the notion that on long run everything is possible. The higher living standard is possible if each citizen makes her/his contribution by changing himself, gaining additional and better skills, shifting to higher paid jobs. We have to understand that we are not ill from "rheumatics of old age, but from the growing gains of over-rapid changes…" Citizens of Western Balkan region should embrace technological changes, and make rapid and comprehensive transformation. Make the economies work for them.

5. Conclusion

Current period of rapid technological transformation represents good opportunity for WB countries to accelerate and swiftly converge their living standard towards EU average, from current GDP per capita ranging from 25% to 52%. Decisive and bold long-term action is needed to bring back optimism, enthusiasm, and dedication of WB citizens. A development strategy at least for a quarter century is needed to set up clear

transformational goals, that would create opportunities for citizens, especially to young generation that in large numbers are leaving the region. WB economies should deliver sustainable, inclusive development shared by their citizens. Green transition will require investment costs of WB economies on average between 8-10% of GDP annually. Almost a third of total investments in the period 2024-2050, will be devoted to energy transition to net-zero. This will lead to reallocation of assets, labor and change in relative prices. Statistics indicates that the average labor productivity level in the WB was just 36% of that in the EU in 2023, which more or less resembles to GDP per capita level. Introducing new technologies; R&D, are critical for boosting productivity, which should be by 1.5 percentage points higher than average productivity growth in EU region. AI leads to enormous changes. It transforms businesses to the core; from how to operate to the products and services they offer. AI automate processes, makes them faster, products with high quality and at lower costs. It also, reduces working hours and 3-4 working days a week becomes new normal. Heavy demand of skilled workers and stagnant or declining demand for unskilled and low skilled labor force will be consequence of twin transition that is underway. These processes will enormously accelerate, and unskilled and low skilled workers will become irrelevant. Green and digital transition heavily rely on high skilled labor force. WB educational system will be under big challenge to support these processes and educate, train and retrain and deliver high skill workers for future businesses. McKinsey Global Institute, predicts, up to 2030, demand for health professionals, health aides, health technicians, wellness and STEM professionals, in Europe will increase by 30% in comparison to 2022. Contrary, demand for workers in food services, production work, customer services, sales, and office support (back offices) would continue to fall in next decade, as it was in the period 2012 – 2022. These jobs involve a high share of repetitive tasks, data collection, and elementary data processing – all activities that automated systems can handle efficiently. These developments will be pronounced in WB, having in mind high existing outflow of qualified labor force to progressive Western Europe countries. Long term view is important to widespread optimism and entrench the notion that on long run everything is possible. The higher living standard is possible in Western Balkan region if each citizen makes her/his contribution by changing himself, gaining additional and better skills, shifting to higher paid jobs. We have to understand that we are not ill from "rheumatics of old age, but from the growing gains of over-rapid changes…" Citizens of Western Balkan region should embrace technological changes, and make rapid and comprehensive transformation. Make the economies work for them.

References

Bishev Gligor, Uzunov Vancho, Hristova-Zaevska Olimpija. (2023). How to increase the domestic production of energy and food?, New era, New Hope, Fridrich Ebert Stiftung, Skopje

EBRD, Transition Report 2023-2024, 2024.

European Commission, Western Balkans Value Chains, (2022) Matusiak M., Radovanovic N., Rakhmatullin R.

Financial Times, AI power demand, could stifle industry's growth, 19 August, 2024

Georgieva Kristalina. (2024). A promise to my Grandchildren, King's College, IMF, March 14

McKinsey Global Institute, (2024). A New future of work: The race to deploy AI and raise skills in Europe and beyond

McKinsey Global Institute, The net-zero transition, January 2022.

Jovanovic Branimir and Vujanovic Nina, (2023). Towards effective industrial policy in the Western Balkans, The Vienna Institute for International Economic Studies, Policy Notes and reports 66

Keynes Maynard John, Economic Possibilities for our Grandchildren, Social Science Encyclopedia.

OECD, Environment Working Papers No. 245, 18 July 2024.

OECD, Western Balkans Competitiveness Outlook, 2024.

OECD, Economic Convergence Scoreboard for the Western Balkans, 2022.

OECD, Bridging the clean energy investment gap, 18 July 2024.

World Bank Group, (2024). Country Climate and Development Report, Western Balkans 6: North Macedonia

COMPARATIVE ANALYSIS OF GREEN FINANCIAL INSTRUMENTS IN THE REPUBLIC OF NORTH MACEDONIA AND THE REPUBLIC OF SERBIA

Snežana Radukić[1], Meri Boshkoska[2]

Abstract

Achieving the sustainable development goals defined in the UN 2030 Agenda is impossible without green financing. Green financing refers to the financing of environmental goals, which are primarily related to the mitigation of climate change. By issuing green and socially sustainable financial instruments, countries can raise the necessary financial resources, increase awareness of the importance of sustainable financing and promote it at the international and local level. The main goal of the paper is a comparative analysis of green financing in the Republic of North Macedonia and the Republic of Serbia in order to compare it with the EU and other countries in the world. The research results showed that both countries successfully issued green bonds, while Serbia was the first non-EU country to do so. Also, although there is a growing trend in green credits and bank loans in the mentioned countries, further development of these financial instruments is expected, as well as better recording and ensuring comparability of data between countries. The latest development challenges of any economy include a green transformation, which cannot be achieved without green finance.

Keywords: Green Finance, Green Bonds, Green Credits, Sustainable Development.

---

[1] Faculty of Economics, University of Niš, Trg kralja Aleksandra Ujedinitelja 11 Niš, Serbia, snezana.radukic@eknfak.ni.ac.rs.

[2] Faculty of Economics – Prilep, University "Kliment Ohridski" - Bitola, St: „Prilepski Braniteli" 143, Prilep, North Macedonia, meri.boskoska@uklo.edu.mk.

1. Introduction

Green finance has seen an expansion in recent years both due to increasingly significant climate change and the interest of regulators and investors in the low-carbon economy. These interests were particularly strengthened by the countries' signing of the UN Framework Convention on Climate Change in Paris in 2015, such as the investment needs associated with Agenda 2030 and the goals of sustainable development.

Green financing includes investments in projects that reduce emissions of harmful gases and climate change but encourage the use of renewable energy sources. The most important green financing instrument is green bonds. Green bonds are a long-term capital market debt instrument with a fixed yield that collects funds to finance green projects that are socially responsible in terms of environmental protection and the use of clean energy. Green bonds can be issued by states, local governments, business entities, as well as commercial banks and other financial institutions for the purpose of collecting long-term sources of financing. Green loans are similar to green bonds, as they are provided by banks to their clients to finance green projects.

The paper will analyze the main green financial instruments in the Republic of North Macedonia and the Republic of Serbia, such as green bonds and green credits and bank loans. The aim of the work is to provide recommendations for the accelerated development of this market and to encourage the green transformation of the economy of these countries in accordance with international policies and programs of sustainable development.

2. Literature review

The concept of a green economy, as defined by the United Nations Environment Programme encompasses improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities. UNEP highlights that economic growth and employment should be driven by investments that reduce carbon emissions, enhance resource efficiency, and prevent biodiversity loss. These investments, supported by targeted public expenditure, policy reforms, and regulation changes, are crucial for maintaining and enhancing natural capital, especially for vulnerable populations dependent on natural resources. (UNEP, 2011 p.2)

Green finance is increasingly becoming a prominent research topic, though its study history remains relatively brief. Researchers focus on various aspects, aiming to define concepts such as green finance, green

economy, and green investment (Höhne *et al*., 2012; Lindenberg, 2014; Zadek and Flynn, 2013; Loiseau *et al*., 2016; Eyraud et al., 2011; Golub *et al*., 2011, as cited in Aleknevičienė & Bendoraitytė, 2023). The scope of green finance includes a wide range of financial instruments and tools, such as green bonds, stocks, loans, mortgages, weather derivatives, venture capital, government subsidies, carbon taxes, pollution permits, tax credits, and green public procurement. Consequently, researchers often concentrate on specific instruments or tools and their related issues.

In their research, Mavlova *et al.,* (2023, p.5) emphasized that green finance is a concept with varied definitions across publications, organizations, and economic sectors. According to the World Bank Group in 2016, it broadly refers to funding investments that yield environmental benefits. Their research has identified several enablers of green finance, such as economic indicators, regulatory frameworks, investment support, government commitment, scientific advancements, and financial market developments. A key instrument in green finance is green bonds, which have emerged to fund projects aligned with the United Nations' Sustainable Development Goals and the Paris Agreement. These bonds, similar to traditional fixed-income securities, mobilize capital for initiatives like climate change mitigation and renewable energy. The issuance of sovereign green bonds is accelerating as governments aim to promote sustainable policies and meet national sustainability targets. The success of these bonds relies on the issuer's reputation, credit rating, and environmental, social, and governance performance.

The process of green transformation of the banking sector in the Republic of Serbia requires both financial and regulatory incentives that contribute to the achievement of sustainable development goals. Serbia is a signatory to the 2030 Agenda and it is "expected to make significant efforts and mobilize available resources to reduce the rate of poverty, economic and social inequality, the negative effects of climate change through intensive ecologically sustainable investments and the entry to the green transition (Ristanović, 2021). Despite the 48% increase in allocated funds for the environment in 2020, their further growth and the adoption of more ambitious environmental goals targeting zero carbon emissions are needed (Ostojić, 2023).

According to the estimates of the Fiscal Council, an increase in public investments in environmental protection by 1.3% of the gross domestic product (500 million euros) would accelerate the economic growth of Serbia in the short run by at least 0.5% (Fiscal Council, 2018). The regulatory framework, successfully formulated strategies and their effective implementation, as well as involving the private sector and creating a larger

market, are key factors for attracting green investments. Green financing is not yet sufficiently represented in Serbia and improvements are needed both on the supply side (low-interest rates on loans, different green financing instruments) and on the demand side (growth the demand for green sources of financing). Ostojić (2023) recommend that it is necessary to provide incentives for green investments in the form of subsidies, grants, tax breaks and credit guarantees from international development finance institutions, but also to adopt and apply regulations in the field of green financing promptly.

Ilić *et al.,* (2019) provided an overview of the economic instruments used to finance the green economy. Based on the practice of developed countries and the way in which they achieve green financing, the authors give recommendations for green financing projects in Serbia as a less developed country. The authors compared the countries of the ASEAN association with Serbia in the part of aggregate indicators of the green economy. They stated that for the financing of ecological projects, green bonds in Serbia would be of great importance. In the financial market, banks are buyers of bonds and give loans to local governments. Based on the regulations of the National Bank of Serbia, only banks have the opportunity to purchase bonds, while non-banking institutions, i.e. local governments, do not have the right to participate in the market. That is why it is necessary that the legal regulations of the National Bank create favorable market conditions for the issuance of municipal bonds at lower prices in order to include citizens in the bond market in Serbia.

Ilić *et al.*, (2018) studied green finance by comparing Indonesia and Serbia and the results showed that Indonesia is ahead of Serbia. They believe that in order to prevent climate change, it is necessary to harmonize the price of carbon through the elimination of subsidies for fossil fuels and to introduce a system of trading emissions or a tax on carbon, and the proposed measures require the development of an appropriate financial system.

Martin (2023) considers the development of green finance in Serbia from two aspects: the regulatory aspect and the aspect of issuing green instruments. Regarding the first aspect, the Republic of Serbia passed several important laws that contributed to better regulation of the financial market and further development of green instruments in the domestic regulatory framework. The second aspect of the analysis refers to the issuance of a seven-year green bond worth one billion euros in September 2021, as the only country outside the EU. They conclude that increased investor awareness has led to an increase in the market value of green instruments, and that further engagement of private and public sector investors is important to enhance existing and develop new green instruments.

Nikolić & Milojković (2023) analyzed green finance, which includes the procurement of energy-efficient equipment in Serbia in order to determine their impact on the management of sustainable development. Authors presented six successful business practices from a group of small and medium-sized companies in Serbia that, with the support of two Leasing companies, acquired more energy-efficient equipment, which had an impact on business improvement, reduction of resource use costs, and lower carbon-dioxide emissions. The authors concluded that the development of green economy and green finance in Serbia is in the initial phase, so in order to encourage a faster transformation, it is necessary to create a green financial system and influence the awareness of people and companies through public information and programs.

Zafirova & Angelova (2022) considered opportunities and challenges of green financing in the Republic of North Macedonia and concluded that in addition to the voluntary approach to defining guidelines for green instruments, certain financial and regulatory incentives are needed for the process of green transformation of the financial sector in the Republic of North Macedonia. They pointed out the low level of participation of green financing sources in the total sources of domestic banks and the lack of private capital for green investments in the country. A developed business climate, the rule of law, as well as defining the investment regime in green investments with a coordinated approach of all public and private actors in the financial sector at all levels would represent a catalyst for green investments.

Bilalli (2022) claims that there are not many options for sustainable financial products in North Macedonia, but there is a high level of interest from investors to contribute to solving environmental and social issues with their investments. The research showed that the main concerns of investors regarding investing in sustainable products are the lack of global standardization of defining green projects and the unclear use of the revenues.

According to transitory green economy expert Antia (PMCG, 2024), the green economy is crucial for promoting sustainable development and solving environmental issues. He emphasizes the role that the green economy has in solving the climate change issues, promoting resource efficiency, waste reduction and minimizing environmental impact. The green economy also supports the use of renewable energy sources, leading to greater energy security, while ensuring more green jobs, equity and greater social inclusion. He also points out that the main challenges for developing countries in their process of transition to a green economy are the limited availability of relevant financing and the lack of financial access for

businesses. Specifically, there are inadequate support and incentive schemes to stimulate businesses to adopt sustainable practices in developing countries. Also, the lack of awareness about the transition to a green economy or sustainability in general is an additional problem.

2. The Role of Green Finance in Sustainable Development

The UN Agenda 2030 set 17 global sustainable development goals and called on the signatory countries to establish an institutional framework for implementing and monitoring the achievement of these goals. It is estimated that investments of approximately US$ 5 to 7 trillion annually worldwide are necessary to achieve the goals of sustainable development (UNEP). Global green finance is gaining more and more importance and focuses on protecting the environment and promoting sustainable social development by allocating economic and financial resources aimed at green development (Mohd and Kaushal, 2018). Green financing projects are in line with the framework of the Paris Climate Agreement from 2015, which focuses on mitigating global warming and represents important basis for the development of the global green bond market. The practice of global green financing is dominated by green bonds. Green bonds, which are known for their risk mitigation features and attractiveness to investors, are increasingly important for financing climate change and sustainable development (Tolliver *et al.,* 2019).

Green financing is a key factor in promoting sustainable development due to its characteristics. First, green finance is increasingly popular and attracting the attention of central banks. Second, green financing focuses on the balanced development of economic activities and the environment, thereby achieving sustainable social development. Green finance distributes "idle social capital to various economic industries, such as renewable energy, green buildings, climate crises, corporate governance, and ecological protection" (Urban & Wójcik, 2019). Third, green financial products are continuously developing and mainly include green bonds, green investment, green insurance, and carbon finance (Akomea-Frimpong *et al.,* 2021). The main current financial instruments, such as green bonds and green stocks, green loans and budget financing instruments, and private green investments are effective means of directing investment capital towards climate change mitigation and adaptation projects (Kazlauskiene and Draksaite, 2020). Therefore, in the context of globalization, the consensus on environmental protection, solving the climate crisis and achieving the goals of sustainable development by 2030 cannot be considered separately from the powerful financing channel of green finance (Amidjaya & Widagdo, 2019).

By allocating capital towards environmentally sustainable projects, green finance helps reduce the environmental impact of economic activities and promotes sustainable economic growth (Holland, 2019). Furthermore, by promoting responsible and long-term investment strategies, green finance can help create more stable and resilient financial markets (Meng *et al.,* 2019). Green finance also contributes to the achievement of the UN Sustainable Development Goals, especially those related to clean energy, sustainable infrastructure and climate action (Hsu *et al.,* 2018). Dhiman, Singh, & Anand, (2019) argue that green finance is key to achieving sustainability goals and can help address challenges such as climate change, resource depletion and environmental pollution.

According to Sheikh *et al.*, (2023) understanding the requirements of green projects as well as setting green goals for banks is significant for the application of green financing as a key factor in achieving sustainable entrepreneurship and the emergence of clean industries. Cheng, Tan, & Huang, (2021) examine the relationship between green finance and corporate sustainable performance and argue that green finance can foster innovation in sustainable technologies and practices, leading to improved environmental performance. Also, Gao, Zhang, & Song (2019) argue that green finance can encourage companies to adopt more sustainable practices, leading to improved environmental performance and reduced environmental risks.

3. Exploring Key Green Finance Mechanisms in North Macedonia and Serbia

Before presenting a comparative study of the key green financial instruments in North Macedonia and Serbia, this section will first provide an explanation of green finance, outline the most commonly used green finance instruments, and examine global trends in the field.

3.1 Global trends in the green bonds

When the term green finance is used, it refers to various financial products designed to support green investments in both the private and public sectors. The aim of green finance is to strategically engage the financial sector in addressing climate change issues and transitioning to minimal carbon emissions, thereby contributing to increasing the economic well-being. (Mavlutova *et al.,* 2023)

Green bonds are debt securities issued by governments, financial institutions, and companies to fund environmentally beneficial projects. Defined by the Climate Bonds Initiative as instruments that raise funds specifically for projects with environmental benefits, green bonds are

essential in mobilizing capital for sustainability. Green loans are another green financing instrument, created to finance broad range of green activities, from renewable energy projects to energy-efficient buildings. As defined by the Loan Market Association, green loans are any loan instrument entirely dedicated to financing or refinancing eligible Green Projects, whether existing or new developments. Additionally, green financing incorporates other forms such as green equity, grants, and insurance, all of which contribute to environmental sustainability and transition to a low-carbon economy. (Ye, & Dela, 2023, p.5)
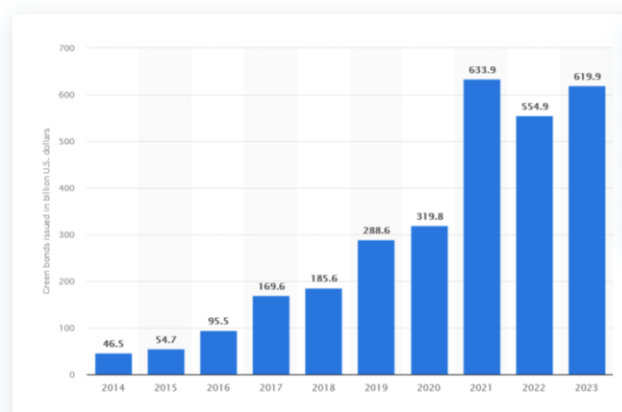
Figure 1. Value of green bonds issued worldwide from 2014 to 2023 (in billion U.S. dollars)
Source: https://www.statista.com/statistics/1289406/green-bonds-issued-worldwide/

Globally, there has been a significant rise in the issuing of green bonds in recent years. The total amount of green bonds issued in 2014 was 46.5 billion dollars. This amount had significantly increased by 2021, rising to almost 634 billion USD. Although there was some decline in green bond issuances during 2022 and 2023, the trend still points to significant growth in green bond markets over the last ten years. (Fig. 1)
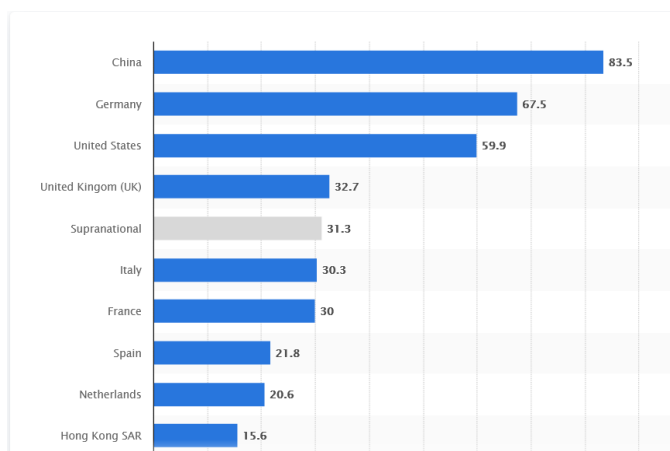
Figure 2. Leading countries in terms of green bonds issued in 2023 (in billion U.S. dollars)
Source: https://www.statista.com/statistics/1289016/green-bonds-issued-worldwide-by-country/

When analyzed by country, China led in 2023 with USD 83.5 billion in green bond issuance, followed by Germany with USD 67.5 billion, and the US with USD 59.9 billion. (Fig. 2)

3.2. Global trends in the green loans

As cited in Practical Law Journal (2024), "The Green Loan Principles (GLP) define green loans as any type of loan instruments and/or contingent facilities (such as bonding lines, guarantee lines, or letters of credit) made available exclusively to finance, refinance, or guarantee, in whole or in part, new and/or existing eligible Green Projects and which are aligned to the four core components of the GLP". This definition is regularly reviewed to reflect the ongoing development and expansion of the green loan market.

A green loan functions similarly to a green bond in that it raises funds specifically for eligible green projects. However, green loans are typically smaller in scale and are executed through private transactions. In contrast, green bonds often involve larger amounts of capital, may incur higher transaction costs, and can be traded on exchanges or placed privately. Both green loans and green bonds adhere to established principles: the GLP and the Green Bond Principles (GBP) set forth by the International Capital Market Association (ICMA). These principles ensure that all proceeds, 100%, are dedicated exclusively to financing activities that meet environmental criteria. (World Bank Group, 2021)

The concept of green lending was pioneered in 2005 by U.S. banks including Wells Fargo and Bank of America. These institutions began providing financing for the construction of sustainable and environmentally friendly buildings. This marked the beginning of the global development of the green loan market. Since then, green lending has expanded significantly, with financial institutions around the world increasingly supporting projects that promote environmental sustainability and energy efficiency. This growth reflects a broader shift in the financial sector towards sustainable investment practices. (Aleknevičienė, & Banderite, 2023)
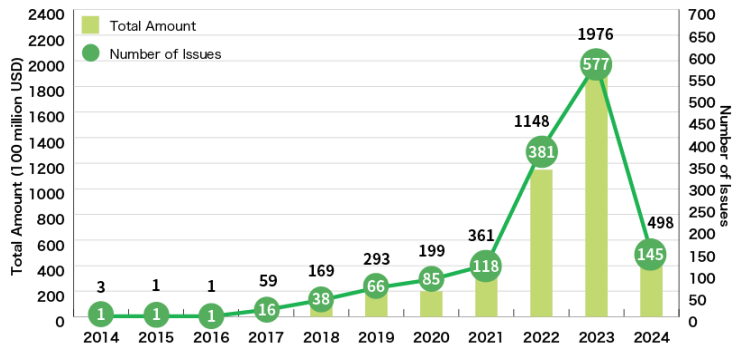
Figure 3. Global Green Loan Amount
Source:https://greenfinanceportal.env.go.jp/en/loan/issuance_data/market_status.html

The graph above compares the total amount of green funding (in 100 million USD) and the number of issues from 2014 to 2024. There is a clear correlation between these two metrics. Both the total amount of funding and the number of issues show a significant peak in 2023. (Fig. 3).
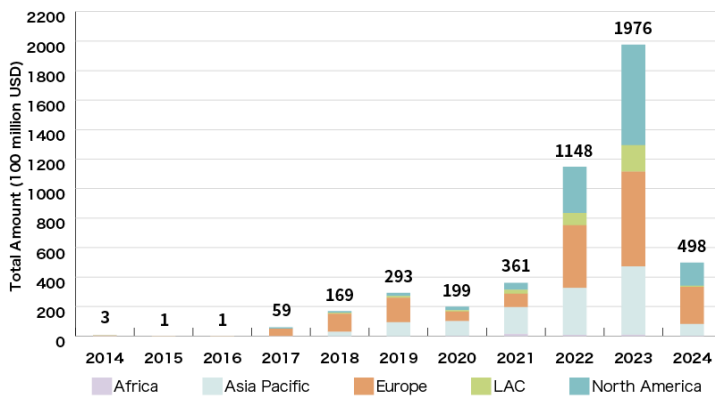
Figure 4. Global Green Loan Amount (by region)

Fig. 4 presents the total amount of funding (in 100 million USD) distributed across different regions from 2014 to 2024.

- **North America**: Dominates the funding landscape, with especially notable peaks in 2022 and 2023.
- **Europe and Asia Pacific**: Both regions are significant contributors. Europe shows a steady increase, while Asia Pacific experiences a substantial rise in 2022 and 2023.
- **Latin America and the Caribbean (LAC) and Africa**: These regions have relatively smaller contributions, but they still follow the overall increasing trend.

Both graphs show a significant growth trend in funding and the number of issues, especially post-2021. The peak year for both total funding amount and the number of issues is 2023. North America, followed by Europe and Asia Pacific, are the primary regions driving this substantial increase in total funding.

3.3. Green bonds in North Macedonia and Serbia

On October 3, North Macedonia's finance ministry successfully auctioned 600 million denars (approximately 9.8 million euros) worth of two-year green bonds, among strong investor demand that exceeded the initial offering nearly three times over. The auction attracted bids totaling over 1.6 billion euros from a diverse range of participants including banks, financial institutions, and individual investors. The green bonds, which carry a fixed annual interest rate of 4.75%, will channel funds towards supporting green corporate projects through the Energy Efficiency Fund. (Petrushevska, 2023)

The minister of Finance of North Macedonia, m-r Besimi, emphasized that the Energy Efficiency Fund, that was established as a part of the Development Bank of North Macedonia, through issuing grants, favorable loans and guarantees will support projects from the public and private sector for energy efficiency and environmental protection. The initial capital of the Fund is 15 million euros, of which 5 million euros were obtained through the Energy Efficiency Project from the World Bank, and 10 million euros from the issued green bonds. In the future it will be supplemented by new issues of green bonds and other sources of financing.

In contrast, Serbia has a more established history with green bonds. In September 2021, Republic of Serbia for the first time issued green bonds worth one billion euros with a maturity of seven years with a coupon rate of 1%, which is the lowest annual interest rate on the international market, while the yield rate was 1.26% with investor demand which exceeded 3 billion euros during the auction. The bonds are listed for trading on the

regulated market of the London Stock Exchange (Ostojić, 2023). Serbia was the only non-EU country that issued a green debt financial instrument and raised awareness of the necessity of green financing. The framework document for the issuance of green bonds in Serbia defines six key "Green Categories": renewable energy, energy efficiency, transport, sustainable water and waste water management, pollution prevention and control and circular economy, environmental and biodiversity protection and sustainable agriculture (Dimić *et al.,* 2023).

For the second time, the Republic of Serbia issued sustainable bonds labeled ESG (environmental, social, and governance) on the international market in June 2024, which raised $1.5 billion for financing sustainable development, green projects, and projects that encourage social responsibility. Bonds with a maturity of 10 years were issued in dollars at a coupon rate of 6%, and after the swap transaction an interest rate of 4.754% was secured with the total demand of investors was 6.5 billion dollars (Ministry of Finance of the Republic of Serbia).

3.4. Green loans in North Macedonia and Serbia

According to data from the National Bank of North Macedonia (NBRM), by the end of 2023, the value of bank claims from green loans reached 19.9 billion denars, or around 325 million euros. This is a significant increase from the 7.17 billion denars recorded at the end of 2019. Despite this growth, green loans still represent only 4.5% of the total loan portfolio, indicating a relatively low share. These loans are designed for projects that promote sustainability and environmental objectives, or that aid in society's green transition, such as the development of new environmentally friendly technologies. (Table 1)

Table 1. Green credits and bank loans in North Macedonia

Green credits and bank loans	2022	2023
1. Banks' green loans, by customer type (in 000 MKD)	**15,389,336**	**19,863,692**
1.1 Non-financial companies	1,308,573	1,224,249
1.2 Non-financial companies	14,080,763	18,639,443
2. Green loans of large banks, by customer type (in 000 MKD)	**9,725,750**	**13,254,288**
2.1 Households	739,120	561,846
2.2 Non-financial companies	8,986,630	12,692,442
3. Green loans of medium-sized banks, by	**5,581**	**6,387,**

customer type (in 000 MKD)	,871	155
3.1 Households	566,964	660,417
3.2 Non-financial companies	5,014,907	5,726,738
4. Green loans of small banks, by customer type (in 000 MKD)	**81,716**	**222,249**
4.1 Households	2,489	1,986
4.2 Non-financial companies	79,227	220,263
5. Share of green loans in total bank loans (in percent)	**3.6**	**4.5**
5.1 Participation of banks' green loans in total loans, large banks	2.8	3.6
5.2 Participation of banks' green loans in total loans, medium-sized banks	11.9	13.2
5.3 Participation of banks' green loans in total loans, small banks	0.3	0.9
6. Banks' green lending, by bank size (in 000 MKD)	**4,159,889**	**7,788,196**
6.1 Large banks	3,642,300	7,200,351
6.2 Medium-sized banks	417,288	472,393
6.3 Small banks	100,300	115,452
7. Share of green lending in total bank lending (in percent)	**10.6**	**17.7**
7.1 Participation of green lending in the total lending of banks, large banks	18.8	34.4
7.2 Participation of green lending in the total lending of banks, medium-sized banks	2.2	2.1
7.3 Participation of green lending in the total lending of banks, small banks	15.9	27.8

Source: https://www.nbrm.mk/ns-newsarticle-pregled-na-zeleni-pokazateli.nspx

There is no official data for green credits and bank loans in the Republic of Serbia. However, research was carried out on the representation of green financing in the banking sector of Serbia in order to analyze incentive and support programs for the green transition on the example of domestic banks and companies. Based on a standardized questionnaire and interviews of banking experts and representatives of micro, small, and medium-sized companies and entrepreneurs, a total of 150 respondents participated in the research, and a Likert scale was used to measure respondents' attitudes (Ostojić, 2023). Research has shown that green loans

in Serbia are approved in euros, with a variable interest rate linked to EURIBOR and increased by an interest margin. The bank provides financial resources from parent banks or international financial institutions, most often the European Bank for Reconstruction and Development (EBRD) or the European Investment Bank (EIB), and depending on the specific bank, a grace period of 6 to 24 months is provided. In the domestic banking sector, loans for the improvement of energy efficiency are dominated.

The conclusions of the research are that: the state does not sufficiently encourage green entrepreneurship through subsidies or tax reliefs, there is a significant demand for green loans, but there is no satisfactory offer of green bank credit lines. "The most common obstacle for companies to invest in green projects is a poor offer of financial products, an underdeveloped capital market, demanding banking procedures, as well as high interest rates on loans" (Ostojić, 2023, p. 31). To encourage small and medium-sized enterprises to take green credits and loans from banks, "they have more favorable conditions and additional benefits such as effective interest rates, available capital, technical assistance, repayment period, grace period, necessity of security instruments, return of part of invested funds, etc." (Ostojić, 2023, p. 29).
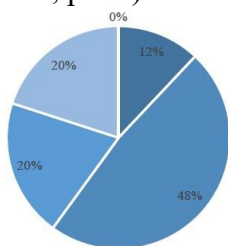
Figure 5. The investment climate in Serbia favors green financing[3]
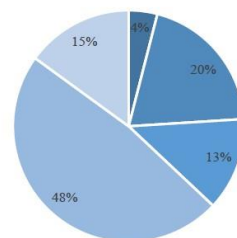
Figure 6. Green financing contributes to the improvement of the domestic financial system

It is interesting that only 14% of respondents among banking experts confirmed that the bank where they were employed approved green loans to micro, small, and medium enterprises and entrepreneurs, while the share of approved green loans in the bank's total loans is less than 10%. This means that there is a lot of unused potential for green financing in the Serbian banking sector. Thus, more than 60% of respondents believe that green financial instruments of banks contribute to the improvement of the domestic financial system, while 60% of respondents agree with the statement that the

investment climate in Serbia is not suitable for green financing of domestic companies. (Fig. 5 and 6)

Based on the analysis, it can be concluded that green finance projects in North Macedonia are still in the development phase and the Green Finance Fund is an important link to support green projects. Strong investment demand for green bonds indicates a market boom, which can be used to increase the share of green bonds in debt portfolios.

Serbia has shown a strong approach to green finance through a series of green bonds issues. However, challenges remain in encouraging green entrepreneurship through subsidies or tax reliefs and expanding the offer of green financial products. The significant demand for green loans indicates a market opportunity that can be addressed by improving financial product offerings and support programs for green projects.

4. Conclusion

Achieving the sustainable development goals requires global action by countries and global institutions that will support the creation of new financial instruments such as green bonds and green loans, as well as new financial institutions such as green banks and green funds, to meet the growing demand for green sources of financing.

Although a positive trend of green bond issuance has been observed since their first issue in 2007, this market is underdeveloped and requires international regulatory compliance to accelerate the further development of this market. Also, green credits and bank loans are starting to become more important financial instruments, so it is necessary for the state to create the most favorable conditions that contribute to increasing their volume. Also, accurate records of these data are necessary to monitor their growth and enable comparability of data between countries.

Green finance in North Macedonia and Serbia is still in the development phase. Despite their growth, green loans in the analyzed countries have a relatively low share of the total loan portfolio. It is necessary to increase the volume of green financing in the observed countries by the state promoting green entrepreneurship through subsidies or tax reliefs, while banks should respond to the significant demand for green loans with a satisfactory offer of green bank credit lines. Green financing enables the green transformation of society through the application of innovative business practices.

Acknowledgment

References

Aleknevičienė, V., Bendoraitytė, A. (2023). The Role of Green Finance in Greening the Economy: Conceptual Approach, Central European Business Review, Volume 12 | Issue 2 | 2023 https://doi.org/10.18267/j.cebr.317 (accessed 20.05.2024).

Bilalli, D. (2022). Development of Investments in the Sustainable Financial Products (Case of North Macedonia), Trends in Economics, Finance and Management 4 (2), pp. 29-46. tps://www.researchgate.net/publication/378374975 (accessed 22.05.2024).

Dimić, M., Gajdobranski, A, Marjanović, M. (2023). Investment funds and green bonds in the Republic of Serbia. Ecologica, 30(112), pp. 653-662.

Fiscal Council (2018). Investments in environmental protection: social and fiscal priority. Belgrade: Fiscal Council of the Republic of Serbia. https://www.fiskalnisavet.rs/doc/eng/FC%20-%20Investments%20in%20environmental%20protection.pdf. (accessed 20.06.2024).

Ilić, B., Đukić, G., Balaban, M. (2019). Management of green finance on the global level. In: Agić, Z. (Ed.) Conference proceedings "Accounting and audit in theory and practice" (pp. 205-220), Banja Luka College. t: https://www.researchgate.net/publication/333619066. (accessed 18.06.2024).

Ilić, B., Stojanović, D., Pavićević, N. (2018). Green financing for environmental protection and sustainable economic growth – a comparison of Indonesia and Sebia. Progress in Economic Sciences, No. 5, pp.181-200. DOI: 10.14595/PES/05/012. (accessed 20.06.2024).

Martin, V. (2023). Green Finance: Regulation and Instruments. *Journal of Central Banking Theory and Practice*. Central bank of Montenegro, vol. 12(2), pp.185-209.

Mavlova, I. et.al (2023). The Role of Green Finance in Fostering the Sustainability of the Economy and Renewable Energy Supply: Recent Issues and Chalengess. *Energies* 2023, 16, 7712. https://doi.org/10.3390/en16237712. (accessed 27.06.2024).

Ministarstvo financija Republike Srbije. https://mfin.gov.rs/sr/aktivnosti-1/mali-srbija-uspeno-emitovala-odrive-obveznice-1. (accessed 25.06.2024).

Ministry of Finance (2023). Besimi at a ministerial meeting of the Global Coalition for Climate Action – Green bonds and the Energy Efficiency Fund are part of the steps to develop a green economy.: https://shorturl.at/gps1Y. (accessed 18.06.2024).

Nikolić, M. and Milojković, D., (2023). The role of green finance in the management of sustainable development in Serbia. in FINIZ 2023 - Sustainable development as a measure of modern business success, Belgrade, Singidunum University, Serbia, 2023, pp. 50-55. doi: 10.15308/finiz-2023-50-55. (accessed 25.06.2024).

Ostojić, I. (2023). Green financing in Serbia – challenges and opportunities. In: International Scientific Conference "Challenges of modern economy and society through the prism of green economy and sustainable development". Educational and business center for development of human resources, management and sustainable development, Novi Sad, pp. 24-38.

Petrushevska, D. (2023). N. Macedonia sells out debut green bond issue. Available online at: https://seenews.com/news/n-macedonia-sells-out-debut-green-bond-issue-835739. (accessed 01.07.2024).

Policy and Management Consulting Group. (2024). Exploring the Green Economy's Role in Sustainable Development. an interview with Otar Antia, Green Economy Transition Expert at the Investors Council of Georgia. Available online at: https://pmcg-i.com/exploring-the-green-economys-role-in-sustainable-development/. (accessed 07.07.2024).

Republic Secretariat for Public Policies (2021). Serbia and 2030 Agenda Mapping the National Strategic Framework vis-a-vis the Sustainable Development Goals. Belgrade. https://rsjp.gov.rs/wp-content/uploads/Serbia-and-2030-Agenda_November-2021.pdf. (accessed 17 June 2024).

Ristanović, V. (2021). Serbia and Agenda 2030. Mapping the National Strategic Framework. https://rsjp.gov.rs/wp-content/uploads/Serbia-and-2030-Agenda_November-2021.pdf. (accessed 05.07.2024).

UNEP (2011). Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers. https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=126&menu=35. (accessed 01.07.2024).

World Bank Groups (2021). What You Need to Know About Green Loans. https://www.worldbank.org/en/news/feature/2021/10/04/what-you-need-to-know-about-green-loans. (accessed 27.06.2024).

Ye, J. and Dela, E. (2023). The Effect of Green Investment and Green Financing on Sustainable Business Performance of Foreign Chemical Industries Operating in Indonesia: The Mediating Role of Corporate Social Responsibility. *Sustainability,* 2023, 15, 11218. https://doi.org/10.3390/su151411218. (accessed 06.07.2024).

Zafirova, A. & Angelova, B. (2022). Green Financing: Opportunities and Challenges for The Banking Sector In The Republic Of North Macedonia. *Economic Development/ Ekonomiski Razvoj*, 2022, Vol 24, Issue 5, pp.38-51.

https://greenfinanceportal.env.go.jp/en/loan/issuance_data/market_status.html. (accessed 27.06.2024).

https://www.nbrm.mk/ns-newsarticle-pregled-na-zeleni-pokazateli.nspx. (accessed 24.06.2024).

https://www.reuters.com/practical-law-the-journal/transactional/understanding-green-loans-2024-05-01/#header_34. (accessed 05.07.2024).

https://www.statista.com/statistics/1289016/green-bonds-issued-worldwide-by-country/. (accessed 23.06.2024).

https://www.statista.com/statistics/1289406/green-bonds-issued-worldwide/. (accessed 23.06.2024).

PERSONAL INCOME TAX IN CROATIA AND NORTH MACEDONIA: A COMPARATIVE ANALYSIS

Helena Blažić Pečarić[1], Kristina Kregar[2]

Abstract

The paper provides an overview of the personal income tax (PIT) in Croatia and North Macedonia. The research objective is to compare the most important elements of the PIT, such as the tax base, the tax schedule (rate(s)), the tax reliefs and the special treatment of different types of capital income. Particular attention is paid to the positioning of the two PIT systems within the classical (Schanz-Haig-Simons income) as well as the newer taxation concepts and trends that also affect the other countries in the region, such as the flat tax and the dual income tax. The purpose of the paper is to determine how different, but also how similar, the PIT systems in Croatia and North Macedonia are. The PITs of both countries follow contemporary trends. While the Croatian PIT is the almost typical example of dual income tax, the North Macedonian PIT is a flat tax. Both countries apply virtually no non-standard tax reliefs, which is in line with the requirements of both tax models. The taxation of capital incomes is not fully in line with the requirements of both models, especially in North Macedonia. Both countries apply a (semi-) classical system of dividend taxation, but still with the relatively low tax burden, especially in North Macedonia.

Keywords: personal income tax, Croatia, North Macedonia, flat tax, dual income tax

---

[1] University of Rijeka, Faculty of Economics and Business, Ivana Filipovića 4, Rijeka, Croatia, helena.blazic.pecaric@efri.uniri.hr

[2] University of Rijeka, Faculty of Economics and Business, Ivana Filipovića 4, Rijeka, Croatia, kristina.kregar@efri.uniri.hr

1. Introduction

The paper provides an overview of the personal income tax (PIT) in Croatia and North Macedonia.

The research objective is to compare the most important elements of the PIT such as the tax base, the tax schedule (rate(s)), the tax reliefs and the special treatment of different types of capital income. Particular attention is paid to the positioning of the two PIT systems within the classical (Schanz-Haig-Simons income) as well as the newer taxation concepts and trends concerning also the other countries in the region, such as the flat tax and the dual income tax.

The purpose of the paper is to determine how different, but also how similar, the PIT systems in Croatia and North Macedonia are.

The methodology includes different types of comparison. In addition to comparing the Croatian and North Macedonian PIT, its main elements are compared with the theoretical and prevailing international concepts and trends, especially including other countries in South Eastern Europe (SEE). These include (besides Croatia and North Macedonia) Bosnia and Herzegovina, Serbia, Montenegro, Albania, Kosovo, Bulgaria and Romania as well as Slovenia (alternatively and usually placed in Central Europe).

The paper follows the classic IMRAD structure. After the Introduction, the first section describes the methodological framework, followed by the results (the main PIT elements) and the discussion. The Conclusion identifies the main differences and similarities between two systems that are relevant for international taxation in a broader sense.

2. The Methodology: comparison with theoretical models and international policy trends

The PIT systems of both countries, including other SEE countries, are compared with the theoretical PIT models, taking into account the development of these models in the current international environment. The models include the S-H-S income – a comprehensive income concept, consumption-based concepts – the standard model (tax base is income minus savings) and the alternative model (tax base is income minus capital incomes, which means that capital incomes are not taxed at all), the special hybrid model - the dual income tax (labor incomes are taxed progressively and capital incomes are taxed at a flat rate) and a Hall-Rabushka flat tax, where only one tax rate is applied to the alternative model.

Based on the models, particular attention is paid to tax rates (indirect or direct progressivity), the treatment of capital incomes such as dividends, interest and capital gains (flat or multiple rates), standard and non-standard tax reliefs (available or not, tax allowances or tax credits and their intensity). Flat tax types are primarily compared with the theoretical Hall-Rabushka flat tax model (Hall & Rabushka, 1985, 1995), which requires one tax rate combined with a personal exemption (fixed tax allowance) and no taxation of capital income. The dual income tax model requires progressive taxation of labor income and flat-rate taxation of capital income (Cnossen, 2000). Both the flat tax model and the dual income tax model require the abolition (or at least a severe restriction) of non-standard tax reliefs.

The treatment of dividends is also relevant for another reason – the existence of economic double taxation of dividends, the resulting dividend reliefs and their types (classical system and its subtypes, exemption and its intensity, lower (separate, flat) tax rate…).

3. Comparative analysis

The current trend of moving away from comprehensive (Schanz-Haing-Simons) income taxation towards dual income tax (e.g. EC, 2023, p. 66; Blažić, 2006) throughout the EC, the OECD and beyond, and towards flat tax in the former socialist countries (Stanchev, 2003; Blažić, 2008) is also visible in the SEE countries (Table 1 and Table 2). This is particularly true for Croatia and North Macedonia, as a special form of semi-dual income tax is applied in Croatia and a flat tax is applied in North Macedonia, although not entirely in line with the Hall-Rabushka model.

Table 1 shows the SEE countries with a flat tax, including those that have abandoned it.

Table 1. Flat tax in the SEE (2024)

	Year of intro./ range	Rate (%)	Basic personal relief	CIT rate (%)
B&H:				
Feder.	2009	**10**	TA	**10**
RS	2022	**8** - wages only **10**	TA+additional for low incomes	
BD			TA	
Bulgaria	2008	**10** (15 for sole traders)	TC only for taxpayers who file electronically	**10**
North Macedonia	2007-2018 and 2023→	**10** (from 2019: 10 and 18, 2021 and 2022: 10% for most incomes)	TA for salaries and pensions only	**10** (from 2019-2023: 10 and 18)
Romania	2005	**10** (16 before 2018)	TA for salaries only –income related, phasing out	16
Abolished:				
Albania	2008-2014	**10** (from 2014: 0, 13 and 23, from 2020: more sophisticated scale)		
Serbia	2003-2006	**10** (from 2007: 10 and 15)		
Montenegro	2007-2021	**9** (+ 11(temporary additional rate for high wages – abolished in'18) (from 2022: 0, 9 and 15)		

Notes:

B&H- Bosnia and Herzegovina, Feder. - Federation of B&H, RS – Republic Srpska, BD – Brčko District (District of Brčko)

TA - Tax Allowance, TC – Tax Credit

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

Some of the reasons for the abolition of the flat tax could be the lack of increased incentives to work (Stanchev, 2003), but also its (vertical) equity characteristics, as it loses its progressivity and becomes proportional for higher incomes. Figure 1 presents this effect (in the case of North Macedonia) and compares its flat tax and the simple PIT with two tax rates (in the case of Croatia).[3]

---

[3] The tax rates of the other SEE countries (not subject to flat tax) are shown in Figure 2.
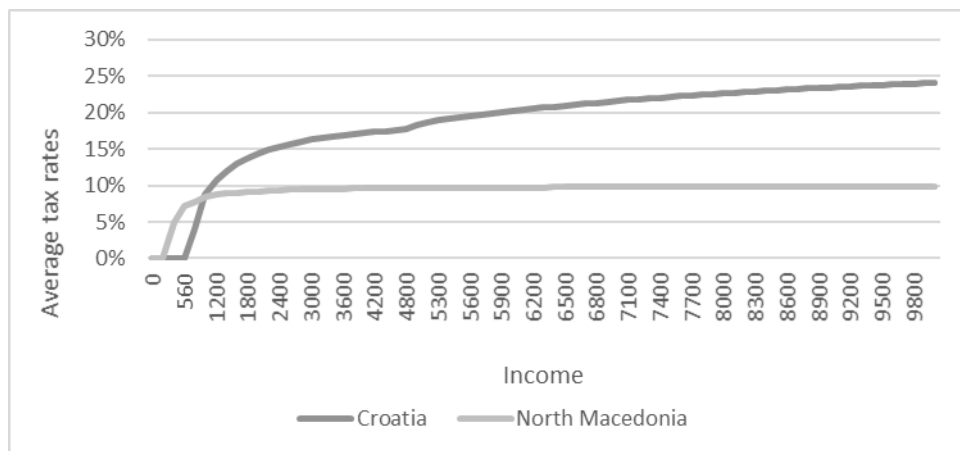
Figure 1. Average monthly tax rate in North Macedonia (flat tax) and Croatia (PIT with two rates), 2024

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

Progressive taxation, which is the "key means of redistribution at the top of the income distribution" (Gerber et al., 2020), turns into proportionality in a case of a flat tax. Policy makers are aware of this shortcoming (which was the reason why the flat tax was never introduced in the EU-15 and other highly developed countries), so some of the countries with flat tax are trying to mitigate this shortcoming by (gradually) abolishing the other source of progressivity besides the tax rate(s) – the basic personal relief in the form of the tax allowance. This is the case in Republika Srpska
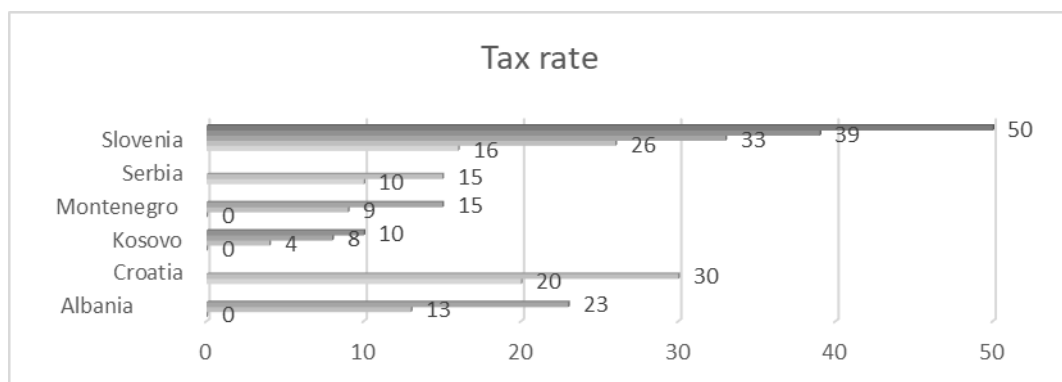
Figure 2. Statutory tax rates in the SEE countries that do not have a flat tax (2024)

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

(Bosnia and Herzegovina) and Romania, and only partially in Bulgaria. However, the fact that the basic tax allowance only relates to employment income could also contain some progressive elements. Tables 1 and 2 (and 4) show that the flat tax models are not in accordance with the Hall-Rabushka flat tax. Bosnia and Herzegovina comes closest to the model, albeit with numerous non-standard reliefs and taxation of capital gains.

The second country is right North Macedonia, mainly because of the lack of non-standard reliefs (although most capital income is taxed). It is the only country that has returned to the flat tax. Officially, this happened in 2023, but already in 2021 (and 2022) the country applied 10% for most incomes.

Table 2 shows the special treatment of interest and capital gains in the SEE countries.

Table 2. Exemption and preferential treatment of interest and capital gains in SEE (2024)

	Interest		Capital gains	
	Exempt	Preferential	Exempt	Preferential
Albania	-	15%	Other than on the rigth	Shares, real estate:15%
B&H	Gov. bonds Savings, deposits or current accounts	-	Only **for RS**: Transfers of inheritance and property rights between close relatives or due to divorce	-
Bulgaria	Bonds Bank deposits		Quoted shares Financial instruments on "growth market" (where SMEs make at least 50% of issuers) One dwelling per year, two items of any immovable property (agricultural land and forests with no limits) and vehicles, aircraft and vessels (long term)	-
Croatia	Current acc.,	All other: 12%	> 2y., owner	All other:

	Bonds, gov. securities		occupied housing	12%
Kosovo	Government securities	-	-	-
North Macedonia	Time deposits (until the EU accession)	-	Long term (10y) for securities issued by investment funds and for real estate (5y and 3y for owner occupied)[1]	-
Montenegro	Loans < EUR 5,000	-	Owner occupied housing	
Romania	State and municipal bonds and mutual benefit funds	-	Real estate	Securities and derivatives (>1y:1%, <1y:3%)
Serbia	Dinar saving and gov.bonds		Long term (10y) real estate, reinvestment (in dwelling, from industrial property rights into domestic shares)	Digital assets (50% exemption) if reinvest. in domestic shares
Slovenia	Bank deposits ≤ EUR 1.000	Other interest - 25%	Long term (15y), owner occupied housing (3y), venture capital	25 % (20% after 5y, 15% after 10y)

[1] **The capital gain from immovable property is fully exempt if:**

- the taxpayer has lived in the property at least 1 year prior to the sale and sells it 3 years after he acquired it;
- the taxpayer sells a property that was acquired under the Law on Denationalization;
- the taxpayer sells the property 5 years after he acquired it;
- the taxpayer sells immovable property which he acquired by means of an inheritance or a gift and for which at that time no tax was due under the Law on Property Taxes; and
- it arises in the context of a divorce proceeding

Source: Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

It is common practice in all former socialist countries to exempt some (or more) capital incomes from tax or at least to treat them favorably. This is an element of the alternative model of consumption taxation concept. Over

time (especially after EU accession), tax exemption was gradually replaced by preferential treatment, resulting in a (semi-)dual income tax in these countries. Thus, the dual income tax originally developed in the Nordic countries spread throughout Europe and became the predominant form of PIT. In SEE, this can be observed in the case of Slovenia and Croatia, where, in contrast to the other countries, a systematic preferential treatment of interest and capital gains (as well as dividends – Table 5) is evident. The Croatian case is particularly interesting. After the reform of the former socialist tax system, the country was the first case of an alternative model of consumption taxation (from 1994 to 2001), which means that capital incomes were not taxed at all. Dividends were taxed from 2012 (they were also taxed temporarily before that), interest from 2015 and financial capital gains from 2016. Croatia deviates from this model even in the preferential treatment of capital incomes, as most of them are taxed at 10% (this is the lowest CIT rate that applies to most companies) and from 2024 at 12%, while labor income is taxed at 20% and 30%. The flat tax was also considered in Croatia, but the idea was repeatedly rejected, similar to neighboring Slovenia. The exemption of interests in the SEE countries follows the usual pattern of privileged treatment of government securities, presented in the OECD countries also, as well as bank deposits/saving, especially presented in the former socialist countries. Similar is with capital gains, with owner occupied housing being the mostly exempt.

Table 3 shows the standard PIT reliefs in the SEE countries.

Table 3. Standard PIT reliefs in SEE (2024)

	Basic	Spouse	Children	SSC (compulsory)	Old age/ retirement	Disability	Other
Albania	Z	-	-	-	Pensions not taxable	-	-
B&H: Feder.	FA	I for each child	FA, rising	FuD	Pensions not taxable	FA	
RS	FA	A	+FA, both IR	-		FA	
	FA	-		FuD			
BD		FA	FA				
		I					
		A					
Bulgaria	TC for taxpayers filing electronically (5% of tax, C) + for non-cash payments (1% of tax, C)		FA (up to 3 children) + FA for child with special medical needs	FuD	Pensions not taxable	FA	-
Croatia	FA, TC: 50% of tax on salaries in less developed regions	I A	FA (rising for each additional child)	FuD	FO, TC 50% of tax	FA	≤25y.: no lower bracket tax for salaries; ≤30y.: TC 50% l.b.t.
Kosovo	-	-	-	FuD	Pensions not taxable	-	-
Montenegro	-	-	-	-	Pensions not	-	

				taxable			
North Macedonia	FA (for salaries and pensions only)	-	-	FuD	-	-	-
Romania	FA(IR, p.o.)	I A (IR, p.o.)	FA(IR, p.o.)	FuD	FA	Pensions of disabled not taxable	-
Serbia	Z (3φsalaries), FA₁(C, IR – 50% of income-together with FA₂₃	I A₂	FA₃	FuD	-	-	-
Slovenia	FA(IR)	I A	FA (rising for each additional child)	FuD	FA	FA, TC for occupational disability: 13,5% of pensions	FA for ≤29y. for salaries FA for students with lower income

Notes:

B&H- Bosnia and Herzegovina, Feder. - Federation of B&H, RS – Republic Srpska, BD – Brčko District (District of Brčko)

SSC – social security contributions

Z – zero rated first bracket

TA – tax allowance; FA – fixed allowance; PD – partial deduction; FuD – full deduction

TC – tax credit; FC – fixed credit, PK – partial credit (part of the costs); FuC – full credit

C – ceiling (upper limit)

---(IR) – income related: as income rises the relief is lower or relief exists only for low incomes; could also refer to ceiling (ceiling as % of income)

p.o. – «phasing out»: as income rises the relief is gradually lower, diminishing in the end

Voluntary (private) contributions/premiums paid by the employer on behalf of their employees not covered

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

Similar to the developed countries, there are basic personal reliefs in all SEE countries, mostly in the form of fixed tax allowances. The same type of relief also applies to spouses and children, although some countries do not apply these reliefs at all (child reliefs are substituted by family transfers). SSC are deductible in most cases, but the lack of old age/retirement tax relief common in developed countries is due to the fact that pensions (especially state pensions) are not taxable at all in most SEE countries. Table 4 shows the non-standard tax reliefs in the SEE countries.

Table 4. Non-standard tax reliefs in SEE (2024)

	Voluntary pension contributions	Life insurance premiums	Medical expenses incl. vol health ins.	Commuting expenses	Donations	Interest paid	Other
Albania	FuD (C)	-	FuD (C)	-	-	FuD for education	-
B&H: Feder.			FuD			FuD for	

RS		FuD				private dwellings	
BD	(C)	FuD (C) / (C)	(C)			FuD for first private dwelling	FuD for educational costs of children
Bulgaria	FuD (C: 10% income)	FuD (C, IR)	FuD (C, IR) for vol. health insurance premiums		FuD (C, IR) for health and education	FuD (C) for first private dwelling of young families	FuD (C) for costs of improvement/renovation of one residental real estate
Croatia	-	-	-	-	FuD (C: 2% of all receipts)	-	-
Kosovo	FuD	-	-	-	-	-	
Montenegro	-	-	-	-	-	-	-
North Macedonia	-	-	-	-	FuC (C: 20% of tax or MKD 24,000, whichever is lower)	-	-
Romania	-	-	-	-	-	-	-
Serbia	-	-	-	-	-	-	TC for investments in alternative inv. funds (C: 50% of inv. and 50% of income)
Slovenia	PD 24% of compulsory contribution (C)	-	-	-	-		-

Notes: See Table 3

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

The tax reform trends, which go back as far as the 1980s, called for the abolition or at least a drastic reduction of non-standard tax reliefs. This is reflected in particular in the Hall-Rabushka flat tax and the requirements of the dual income tax. However, neither the developed countries nor most of the SEE countries adhere to these requirements. The major exceptions are Montenegro and Romania, followed by Kosovo, but also North Macedonia and Croatia. Croatia has had the experience of a "closed circle", which started with no non-standard tax reliefs at all when applying the alternative model of consumption-based taxation, then gradually introduced more and more of them and finally abolished them all in 2010.

Table 5 shows dividend taxation in the SEE countries.

Table 5. Dividend taxation in SEE (2024)

CLASSICAL SYSTEM 1 (Flat tax):		EXEMPTION	
North Macedonia	10%		
"CLASSICAL SYSTEM" 2 (EVEN HIGHEST MARGINAL RATE!):		Bosnia and Herzgovina	100%
Montenegro	15% (highest tax rate, 9% - lower tax rate before 2022) – same rate for all capital incomes	Kosovo	100%
Serbia	15% (highest tax rate) – same rate for interest and capital gains	**SEPARATE (LOWER) TAX RATE**:	
(SEMI)CLASSICAL SYSTEM 3: same % as for other capital incomes (especially interest)		Albania	8%
Croatia	12% (10% before 2024 and 12% before 2021) - same rate as for interest, rents and financial capital gains	Bulgaria	5%
Slovenia	25% (27.5% before 2020) - same rate for interest, rents and royalties	Romania	8% (5% before 2023; earlier 16% - flat tax – classical system)

Source: Authors, based on IBFD, 2024 and Croatian legislation (Income Tax Act)

There is no preferential treatment for dividends in either North Macedonia or Croatia. North Macedonia taxes them like other income (classical system), while Croatia taxes them like all other capital income under a dual income tax (semi-classical system). The effective tax rate on dividends (combined tax burden from CIT and PIT) is 27.84% in Croatia[4] and only 19% in North Macedonia. Compared to the OECD countries (OECD, 2024), this is a relatively low burden for both countries, especially for North Macedonia, as the OECD burden ranges from 20% (in Estonia) to more than 50% in as many as eight countries.

In Bosnia and Herzegovina and Kosovo, on the other hand, there is a full exemption of dividends. In Bosnia and Herzegovina, this could be due to

---

[4] $Td = td + (1-td)w,$ where td is the CIT rate and w is the final withholding tax rate of PIT on dividends. It is usually calculated for the highest marginal PIT rate (30% is the upper tax rate in Croatia, and most local units do not apply an allowed increase in the rate, but the basic rate of 30%) and the highest CIT rate (18% in Croatia; the CIT rate for SMEs is 10%). As shown in Table 1, both rates for North Macedonia are 10%.

the fact that most capital incomes are exempt from tax due to the strict application of the flat tax, while in Kosovo the privileged treatment of dividends appears to be the reason for this. Albania, Romania and Bulgaria are the typical example of preferential treatment using lower rates. Serbia and Montenegro, however, are the most interesting cases. Here, dividends (and almost all capital incomes) are taxed at a higher rate. The classification of dividend taxation in the literature does not even recognize the case where dividends are systematically taxed as belonging to the highest tax bracket and not receiving preferential treatment. But such treatment is not surprising given the recent trends towards globalization and digitalization, where labor income is becoming almost as mobile as capital income (EC, 2023, p. 50).

4. Conclusion

The PITs of Croatia and North Macedonia follow contemporary trends. While the Croatian PIT belongs to the dual income tax typical for most EU countries, North Macedonia has a flat tax typical for the former socialist countries, especially SEE.

In both countries, there are virtually no non-standard tax reliefs, which is in line with the requirements of both tax models and recent taxation requirements.

The taxation of interest and capital gains is not fully in line with the requirements of both models, especially in North Macedonia. Both countries apply a (semi-)classical system of dividend taxation, which means that there are no special reliefs for dividends. Nevertheless, the burden on dividends is relatively low, especially in North Macedonia, due to the low CIT and the flat PIT rate.

Acknowledgment

References

Blažić, H. (2006). *Usporedni porezni sustavi - Oporezivanje dohotka i dobiti.* Rijeka: Sveučilište u Rijeci, Ekonomski fakultet. https://repository.efri.uniri.hr/islandora/object/efri%3A2263/datastream/FILE0/view (accessed 09.08.2024)

Blažić, H. (2008). *Flat tax in the SEE: Has it reached the peak?* In Pevcin, Primož (ur.) Second International Symposium on the Development of Public Administration in South East Europe, Symposium Proceedings, Ljubljana: University of Ljubljana, Faculty of Administration

Cnossen, S., ed. (2000). *Taxing Capital Income in the European Union – Issues and Options for Reform.* Oxford: Oxford University Press.

European Commission (2023). *Annual Report on Taxation* 2023, Directorate-General for Taxation and Customs Union, European Commission, Publications Office of the European Union, Luxembourg. https://taxation-customs.ec.europa.eu/taxation/economic-analysis-taxation/annual-report-taxation_en (accessed 08.08.2024)

Gerber, C., Klemm, A., Liu, L. and Mylonas, V. (2020), Income Tax Progressivity: Trends and Implications. *Oxf Bull Econ Stat*, 82: 365 – 386. https://doi.org/10.1111/obes.12331 (accessed 08.08.2024)

Hall, R. E.; Rabushka, A. (1985, 1995). *The Flat Tax*. Stanford: Hoover Press Publication.

Income Tax Act (Croatia), Official Gazette 115/16, 106/18, 121/19, 32/ 20, 138/20, 151/22, 114/23

IBFD (2024). Tax Research Platform. IBFD. http://www.research.ibfd.org (accessed 08.08.2024)

OECD (2024): OECD Tax Statistics, OECD Data Explorer, Corporate Income Tax, Overall statutory tax rates on dividend income. https://doi.org/10.1787/tax-data-en (accessed 14.08.2024)

Stanchev, K. (2023). The Fate of Flat Tax in the EU Countries. Warszawa: CASE – Centrum Analiz Społeczno-Ekonomicznych – Fundacja. https://www.case-research.eu/en/the-fate-of-flat-tax-in-eu-countries-102685 (accessed 08.08.2024)

EMPIRICAL EVALUATION OF GOVERNMENT EFFECTIVENESS AND REGULATORY QUALITY INFLUENCE ON BANKING SYSTEM STABILITY: EVIDENCE FROM WESTERN BALKANS ECONOMIES

Milaim Mehmeti[1], Qazim Tmava[2], Esat Durguti[3],
Filloreta Kunoviku-Demiri[4]

Abstract

The purpose of this research is to examine empirically government effectiveness (GE), and regulatory quality (RQ) as well as some specific determinants of the banks as they influence the bank's financial stability. The research employed secondary data provided by the database of the International Monetary Fund, on an annual basis, including the period 2012-2023. The empirical methodology used is the traditional approach through OLS, applying a certain number of diagnostic tests. The findings of the study provide evidence that RQ and non-performing loans have a positive influence on the creation of banking stability, even though the GE and lending interest rates statistically influence it negatively. Capital adequacy has shown a surprising result, with insignificant influence. This paper aims to provide additional empirical evidence in this context, and as a novelty, two variables of the governance index have been established which have not been addressed by researchers so far. Therefore, starting from this fact, we consider that through the careful selection of these variables, we will offer an original contribution both from the aspect of originality and also from the aspect of the behavior of innovations.

Keywords: Banking system stability, government effectiveness, regulatory quality, OLS.

[1] Faculty of Economics, University Isa Boletini - Mitrovicë, Ukshin Kovaçica, Mitrovicë, Kosova, milaim.mehmeti@umib.net
[2] Faculty of Economics, University Isa Boletini - Mitrovicë, Ukshin Kovaçica, Mitrovicë, Kosova, qazim.tmava@umib.net
[3] Faculty of Economics, University Isa Boletini - Mitrovicë, Ukshin Kovaçica, Mitrovicë, Kosova, esat.durguti@umib.net
[4] Faculty of Economics, University Isa Boletini - Mitrovicë, Ukshin Kovaçica, Mitrovicë, Kosova, filloreta.demiri@umib.net

1. Introduction

The banking system stability (BSS) is one of the important mechanisms in the development of the economy and monetary system of a certain country, or more broadly. Specifically, in the region of Southeastern Europe, where banks have a dynamic role in financing economies and supporting various sectors, BSS takes special importance. To identify the determinants that impact better on BSS, it is important to consider numerous features, including GE, RQ, CAR, LIR, and NPLs. In this respect, the research seeks to estimate the impact of these factors on BSS in the Southeastern European region within the timeframe of 2012-2023. The study utilizes secondary panel data from International Monetary Funds and World Bank databases, with the use of the static OLS regression technique to bring out clearly the empirical association that exists between these variables and BSS. Taking into account the current trends as regards the application of good management practices, GE and RQ are considered to be vital parameters that could directly influence the functioning of the banking organization (Malik et al. 2022; Angelini et al. 2020). Both of these, if of good quality, directly contribute to creating an environment with stable finance, ensuring that the banks are operating transparently and sustainably (Malik et al. 2022). On the other hand, capital adequacy establishes the ability of banks to withstand losses and risks, hence adding to their overall stability (Andersen and Juelsrud, 2024). Meanwhile, according to Carbó-Valverde et al. (2021) various structures have found out that the prime concern is on LIR and NPLs, which mostly affect BSS. Hence, high interest rates can escalate the profit of a bank but also risk bad loans. NPLs indicate the quality of a bank's loan portfolio and represent one of the main threats to financial stability (Durguti et al., 2023; Abuselidze, 2023). The research is an attempt to cover the existing gaps in the scientific literature concerning BSS in the region of South Eastern Europe, underlining the influence of the above-mentioned factors. With these, the study results are expected to offer useful insights to legislators and monetary institutions in the region for the design of effective policies and guidelines to ensure a stable and secure banking system.

2. Theoretical Background

Many recent studies consider the BSS as a decisive component for the financial and economic stability of a country, particularly in developing and emerging economies. Current research emphasizes the role of institutions, particularly governments, in establishing a sustainable and BSS

through laws, regulations, and governance structures. In this context, the effectiveness of the government is reflected in the creation of a BSS through legal regulations to avoid excessive risks and to withstand internal and external shocks, without causing systemic crises. In addition to the requirements set by regulatory authorities, current attention is also given to factors identified in corporate governance. Therefore, Angelini (2020) explicitly addresses the effectiveness of government, which should act as a significant catalyst in the formulation and implementation of quantitative regulations, which are essential for creating stability in monetary systems. Similarly, Ullah et al. (2022) highlight that the formulation of adequate policies and procedures helps in preventing risks and the abuse of poor practices, which can harm banking healthiness.

Another critical component in the context of creating banking stability is the integrity of governance (GI). Cieslik and Goczek (2018) found that a lack of effective functioning of the judicial system directly affects GI, creates opportunities for corrupt practices, and directly impacts BSS. According to Arifi (2023), an unstable banking system negatively affects the overall finances of the country. Moreover, low profitability, capital base, and asset quality led to banking instability, which ultimately caused fiscal concerns. Additionally, Pham, Oanh Dao, and Nguyen (2021) point out that capital regulations set by central banks have significantly supported BSS across European Union countries, including those addressed in the analysis. However, within this regulatory framework, special attention must be given to credit risk, which has a significant influence on the BSS in the country. Credit risk involves the risk of non-payment of loans, which can result in financial losses for the bank, and affect liquidity, capital adequacy, and other systemic risks of banks.

On the other hand, Carbó-Valverde et al. (2021) highlight those banks holding more liquid assets, being well-capitalized, having larger reserves at central banks, and receiving more deposits from customers are more strongly affected by negative interest rates. According to findings by Athari, Irani, and Hadood (2023), banks that adequately address and meet regulatory requirements to increase capital regulation can better withstand unexpected losses and are more capable of maintaining financial stability. Furthermore, the evaluation results indicate that credit risk adversely affects BSS, with the extent of the effect being smaller as countries move from low to medium and high-income levels. To reduce the number of non-performing loans, second-tier banks need to be closely supervised by the Central Bank to protect themselves from risk exposure, which is crucial for the performance and stability of a country's banking system (Baruti & Arifaj, 2023). Reported findings based on econometric approaches show that non-performing loans impact the financial health of the banking system, emphasizing the

importance of effectively managing problem loans to ensure the stability and sustainability of the financial system.

3. Research Methodology

The strategy implemented in this research is to assess how BSS is in some European Southeast nations. Such an evaluation is derived from the secondary data obtained from reliable databases. The strategy is designed to make sure that the collection of data is detailed in nature and that the application of an appropriate econometric model can provide credible and accurate outcomes. In this research, the sample consists of European Southeast countries of 72 observation periods. We used time series panel data for the period between 2012 and 2023. The main sources from which data were gathered were both well-reputed databases: the International Monetary Fund and the World Bank. These sources present a broad variety of economic and financial indicators that would be necessary to perform the BSS. This research combines well-known good governance variables and specific banking industry variables. The Ordinary Least Squares approach is the econometric model applied in this research. Our research, in selecting variables and employing an empirical approach tailored to the specifics of our case, is inspired by the methodologies applied by the authors (Arnold 2022; Elsayed et al. 2023). This model was chosen for its ease and efficiency in evaluating the association that exists between independent and dependent variables. Its basic configuration can be expressed in the following format:

$$BSS = \beta_0 + \beta_1 GE_1 + \beta_2 RQ_2 + \beta_3 CAR_3 + \beta_4 LIR_4 + \beta_5 NPLs_5 + \varepsilon_i$$

(1)

Where: BSS - represents the dependent variable, β_0 - represents the intercept, β_1 till β_5 – are the independent variables, and ε_i – is the error term. This will be carried out in the sequence of descriptive statistics, correlation breakdown, diagnostic tests, and regression analysis using the STATA software application.

3.1 Econometric findings

In this section, we will first address the initial findings from the descriptive statistics, which are presented in Table 1. Based on the presented findings, the mean value of BSS is 13.124, with a potential standard deviation of 5.62 percent. The presented result provides evidence that BSS

during the investigated period is in the secure zone of stability. This conclusion is supported by the Z-score results; if the value is higher than 3, it is considered to be in the safe stability zone, also known as the green zone of stability (Durguti et al. 2023). The mean value of Government Effectiveness (GE) is -0.165 with a potential standard deviation of 0.31 percent. This indicates that GE in the analyzed countries has not yet shown positive signs, and the authorities of these countries need to work much more seriously to achieve satisfactory results.

Table 1. Descriptive statistics

Variables	Obs	Mean	S.D.	Min	Max
BSS	72	13.124	5.623	4.453	24.290
GE	72	-0.165	0.305	-1.043	0.292
RQ	72	0.106	0.241	-0.374	0.524
CAR	72	9.320	1.275	7.259	12.001
LIR	72	6.487	1.976	3.071	12.665
NPLs	72	9.138	5.950	1.932	22.243

Source: Author's calculations

On the other hand, Regulatory Quality (RQ) has a mean value of 0.106 with a potential standard deviation of 0.24 percent. Compared to the previous parameter, RQ shows an average with a positive sign, suggesting that the regulatory framework of these countries is aligning with the requirements set by European Union directives. Meanwhile, an explicit factor for the banking industry, the Capital Adequacy Ratio (CAR), has a mean value of 9.320 with a potential standard deviation of 1.28 percent, indicating that the capital adequacy of these countries is satisfactory as it exceeds the minimum requirements set by regulatory authorities. The Interest Rates (LIR) have a mean value of 6.487 with a standard deviation of 1.97 percent. When compared to the average values in EU countries, these countries have a higher interest rate, with the maximum value observed during the period reaching 13.66 percent. Finally, the Non-Performing Loans (NPLs) have a mean value of 9.138 with a standard deviation of 5.95 percent. This rate provides an additional indication that credit risk management should be given greater attention, as the maximum value of NPLs during the observed period reached 22.24 percent.

Table 2 demonstrates the correlation of BSS with other parameters included in the examination, divided into two categories: those known as good governance and the banking industry parameters for the complete panel of states, with a total of 72 observations. The findings of this analysis show

that RQ and NPLs have a positive interaction, while GE, CAR, and LIR have a moderately negative interaction with BSS. Specifically, the strongest connection is observed between BSS and NPLs.

Table 2. Correlation analysis

Variables	BSS	GE	RQ	CAR	LIR	NPLs
BSS	1.000					
GE	-0.069	1.000				
RQ	0.128	0.636	1.000			
CAR	-0.236	-0.470	-0.179	1.000		
LIR	-0.122	0.303	0.094	-0.112	1.000	
NPLs	0.484	0.153	0.099	-0.371	0.290	1.000

Source: Author's calculations

The investigation not only provides indications of the interaction between variables but also suggests whether the applied panel data might have potential multicollinearity issues. Based on the reflected result, the highest coefficient $r = 0.484$ indicates that the data do not present such concerns. The argument is supported by the principle that if coefficients are equal to or greater than $r \leq 0.80$, the data indicate such problems (Wang et al., 2022; Ullah et al., 2021).

To further advance the research and eliminate possible dilemmas, we conducted an additional analysis using the Variance Inflation Factor (VIF), which is most commonly applied when dealing with panel data. Therefore, Table 3 presents the detailed overall results, showing that no parameter exceeds $\alpha \geq 0.5$. The highest value is observed for GE at 2.45, and moreover, the mean value of VIF is 1.66, providing solid evidence that the applied data do not exhibit any problems related to multicollinearity.

Table 3. Vector inflation factor analysis

Variables	VIF	1/VIF
GE	2.45	0.408705
RQ	1.80	0.556841
CAR	1.55	0.643468
NPLs	1.28	0.778911
LIR	1.24	0.806783
Mean VIF	**1.66**	

Source: Author's calculations

According to the observations highlighted by Wooldridge (2012), multicollinearity issues may arise in such cases when any parameter within the VIF analysis has a coefficient greater than $\alpha \geq 0.5$. Lastly, these diagnostic verifications enable us to proceed with the commentary on other diagnostic tests before discussing the results of the OLS regression. After performing the aforementioned verifications, we will proceed to present several evaluations of the econometric model, beginning with the test for heteroscedasticity. The result of this test has a coefficient of $\alpha = 3.510$ with $\rho = 0.0609$. This result indicates that the data do not have concerns regarding this matter, as the value $\rho \geq 0.5$ (Frost, 2020). To verify the adequacy of the model, the results of the F-test (7.94) with $\rho = 0.000$ provide evidence that all variables have values lower than $F \leq 10$, and the ρ-value confirms that the model is appropriately selected and the generated results are adequate and reliable. Finally, in the context of the model summary, R2 has a coefficient of 0.3756, which means that the selected variables explain 37.6 percent of BSS for Southeast European countries. The model results presented in Table 5 show that RQ and NPLs have a significant positive statistical effect on BSS, while GE and LIR have a significant negative statistical effect.

Table 4. Regression estimation

	OLS estimation	
	β	$\rho \geq [z]$
GE	-6.608	0.021
RQ	6.812	0.028
CAR	-0.839	0.121
LIR	-0.591	0.059
NPLs	0.473	0.000
_cons	18.637	0.001
Observation	72	
Heteroskedasticity	3.510	0.0609
F-test	F(5, 66) - 7.94	0.0000
R^2	0.3756	

Source: Author's calculations

Our case shows the coefficient of GE, where β= -6.608 and $\rho = 0.021$, giving us a 99% confidence interval and indicating an adverse statistically significant impact on BSS. The result above implies, assuming the principle of Ceteris Paribus is held constant, that after every unit depreciation in the assessment of GE, BSS will decline by 6.61 units. Our findings are consistent with those of Ullah et al. (2024), where it has been

proven that GE in advanced economies significantly and negatively affects BSS. However, their study had contrasting findings among emerging economies, whereby the GE was found to have a positive influence on BSS. The second evaluator for good governance, RQ, based on the coefficient β = 6.812 with ρ = 0.028, is statistically significant and positive with a confidence interval of 99% on BSS. It, therefore, implies that an increase in one unit of this variable should lead to an increase in BSS by 6.81 units, everything else kept constant. Our hypothesis predictions and those made by Yevdokimov et al. (2018) study were confirmed as we found BSS to be positively related to RQ.

The findings for CAR using the coefficient β = -0.839 with ρ = 0.121 were statistically insignificant, and as such were in discord with previous studies that found a significant positive correlation between CAR and BSS (Ullah et al., 2024; Yevdokimov et al., 2018). The results of the regression indicate that the Lending Interest Rates (LIR) at a coefficient β = -0.591 with ρ = 0.059 have statistically proven a significant effect on BSS; however, the relationship is negative. This confirms the descriptive statistics section discussion that has pointed out the fact that such countries imply higher lending rates in comparison with EU countries. This outcome indicates that, for every 1 percent increase in LIR, BSS decreases by 0.59 percentage points. The results are very consistent with the expectation and agree with those obtained by Carbó-Valverde et al. (2021), who tested 3,155 banks within the European Union to give a clearer sight of the reduction in LIR. It was found that even when the EU nations diminished the LIR, the net interest margin stayed unharmed, and thus in this case, the imposition of high rates embodies a reduction in BSS. Lastly, the reported results for NPLs concerning the coefficient β = 0.473 with ρ = 0.000 also depicted a positively significant effect on BSS, with a confidence interval of 99.9 percent. The results of the study support such findings as those of Durguti et al. (2023) and Abuselidze (2023), which stress that the performance of this evaluator stays within the appropriate norms relative to the investment portfolio, stating a positive effect; otherwise, it is reported to be the opposite.

4. Conclusion

This research is an examination of GE, RQ, and the specific factors that influence BSS. The research is based on the secondary data obtained from the International Monetary Fund and the World Bank from 2012 to 2023. It uses the traditional OLS methodology, including many diagnostic tests. The results show that RQ and NPL contribute positively to BSS,

whereas GE and LIR have a statistically significant negative effect. Capital adequacy (CAR) presents an insignificant influence on BSS, which is against what was expected. The research makes an important contribution from an empirical point of view to a rather unexplored area: that of the association across governance indicators and BSS. It has introduced a novelty by bringing in two governance index variables, which have not been explored in the literature. This research introduces new insights into how governance influences BSS and the banking sector by bringing forth very well-selected and formulated variables. The positive significant interaction between RQ and NPLs with BSS suggests that strong regulatory structures and efficient loan portfolio handling can lead to increased effects on controlling BSS. On the other hand, the undesirable effect of GE and LIR has implied that the governance and monetary policies are too complex to ensure the sustainment of BSS across the country. The insignificance of CAR denotes that although it is an essential requirement its direct impact on stability only calls for renewing its importance in BSS decisions. In conclusion, this paper is added to the debate on BSS and its blending with governance variables into the investigation. The findings stress the importance of balanced initiatives not only concerning the RQ and loan-effective management but also regarding the potential negative effects GE and LIR could have. It thus brings new dimensions into the academic arena and provokes further research on the intricate dynamics between governance and financial stability.

References

Abuselidze, G. (2023). Analysis and Forecasts of the Impact of Non-performing Loans on the Economy in Pandemic Conditions. Digitalisation: Opportunities and Challenges for Business. ICBT 2022. *Lecture Notes in Networks and Systems*, vol 620. Springer, Cham. https://doi.org/10.1007/978-3-031-26953-0_14.

Andersen, H., and Juelsrud, E. R. (2024). Optimal capital adequacy ratios for banks. *Latin American Journal of Central Banking*. 5(2), 100107. https://doi.org/10.1016/j.latcb.2023.100107.

Angelini, F., Candela, G. & Castellani, M. (2020). Governance efficiency with and without government. *Social Choice and Welfare*, 54, 183–200. https://doi.org/10.1007/s00355-019-01217-2.

Arifi, E. A. (2023). EFFECT OF AUTOMATED TELLER MACHINES AND BANK BRANCHES ON THE PROFITABILITY OF BANKING BUSINESSES: EVIDENCE FROM KOSOVO AND NORTH MACEDONIA. *Journal of Liberty and International Affairs*, 9(3), 154-170. https://doi.org/10.47305/JLIA2393136a.

Arnold, I. J. M. (2022). The monetary overhang in times of COVID: evidence from the euro area. *Applied Economics*, 54(35), 4030–4042. https://doi.org/10.1080/00036846.2021.2020711.

Athari, S., Irani, F., and Hadood, A. (2023). Country Risk Factors and Banking Sector Stability: Do Countries' Income and Risk-level Matter? Evidence From Global Study. *Heliyon*. 9, e20398, https://ssrn.com/abstract=4583363.

Baruti, H. B., Arifaj, H. A., and Hoti, A. (2023). An Investigation into the Influence of Non-Performing Loans on Lending and Capital: A Case Study of Commercial Banks in Kosovo. *Review of Economics and Finance*. 21, 1816-1821. https://doi.org/10.55365/1923.x2023.21.197.

Carbó-Valverde, S., Cuadros-Solas, P. J., & Rodríguez-Fernández, F. (2021). The effects of negative interest rates: a literature review and additional evidence on the performance of the European banking sector. *The European Journal of Finance*, 27(18), 1908–1938. https://doi.org/10.1080/1351847X.2021.1927784.

Cieślik, A., and Goczek, Ł. (2018). Control of corruption, international investment, and economic growth – Evidence from panel data. *World Development*. 103, 323-335. https://doi.org/10.1016/j.worlddev.2017.10.028.

Durguti, E., Arifi, E., Gashi, E., & Spahiu, M. (2023). Anti-money laundering regulations' effectiveness in ensuring banking sector stability: Evidence of Western Balkan. *Cogent Economics & Finance*, 11(1). https://doi.org/10.1080/23322039.2023.2167356.

Elsayed, A.H., Naifar, N., and Nasreen, S. (2023). Financial stability and monetary policy reaction: evidence from the GCC countries. *The Quarterly Review of Economics and Finance*, 87, 396–405. https://doi.org/10.1016/j.qref.2022.03.003.

Frost, J. (2020). *Regression Analysis: An Intuitive Guide for Using and Interpreting Linear Models 1st Edition*. Statistics by Jim Publishing.

Malik, A.H., Mohamed bin Jais, A.H., and Mubashir Ali Khan, A.U.R. (2022). Financial stability of Asian Nations: Governance quality and financial inclusion. *Borsa Istanbul Review*. 22 (2), 377-387. https://doi.org/10.1016/j.bir.2021.05.005.

Pham, T. T., Dao, L. K. O., Nguyen, V. C., & David, M. (2021). The determinants of bank's stability: a system GMM panel analysis. *Cogent Business & Management*, 8(1). https://doi.org/10.1080/23311975.2021.1963390.

Ullah A, Pinglu C, Ullah S, Qian N, Zaman, M. (2021). Impact of intellectual capital efficiency on financial stability in banks: Insights

from an emerging economy abstract. *International Journal of Finance & Economics*. 28 (2), 1858-1874. https://doi.org/10.1002/ijfe.2512.

Ullah, Saif., Ullah, Atta., and Zaman, Mubasher. (2024). Nexus of governance, macroeconomic conditions, and financial stability of banks: a comparison of developed and emerging countries. *Financial Innovation*, https://doi.org/10.1186/s40854-023-00542-x.

Ullah,S., Hussain,S., Nabi,A. & Mubashir, K. (2022). Role of Regulatory Governance in Financial Stability: A Comparison of High and Low Income Countries. *Journal of Central Banking Theory and Practice*, 11(1), 207-226. https://doi.org/10.2478/jcbtp-2022-0009.

Wang, C., Du, J. & Fan, X. (2022). High-dimensional correlation matrix estimation for general continuous data with the Bagging technique. *Machine Learning*, 111, 2905–2927. https://doi.org/10.1007/s10994-022-06138-3.

Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (6th ed.). Cengage learning.

Yevdokimov, Y.V., Melnyk, L., Lyulyov, O., Panchenko, O., & Kubatko, V. (2018). Economic freedom and democracy: determinant factors in increasing macroeconomic stability. *Problems and Perspectives in Management*. http://dx.doi.org/10.21511/ppm.16(2).2018.26.

THE FINANCIAL MANAGEMENT ASPECTS OF IMPLEMENTING ADVANCED TECHNOLOGY IN THE DAIRY INDUSTRY OF REPUBLIC OF N. MACEDONIA

Nikolche Jankulovski[1], Dragica Odzaklieska[2], Tatjana Spaseska[3]

Abstract

The purpose of this paper is to examine the financial management aspects of implementing advanced technology in the dairy industry. Financial management is used to analyze the implementation of precision agriculture in dairy farms, a mid-sized firm in Republic of North Macedonia. Precision Agriculture Technology includes the latest equipment, sensors, and monitoring systems that were adopted to increase dairy production efficiency and sustainability. The study provides a comparative analysis of the financial performances of BIMILK company in 2021 and 2022. The study used a case study approach using company records, financial statements, and interviews with company management to gather data. The analysis is based on covering initial investment cost, fluctuations in revenue and expenses net income, etc. There is also discussion about non-financial benefits such as environmental improvement center operational efficiencies. The results represent a significant improvement in profitability and a reduction in operational cost with the help of conducting a payback period analysis that is helpful to determine the period to recover the initial investment. The dairy company attained eco-friendly benefits in the reduction of fertilizers and insecticides. The implementation of the latest technology significantly enhanced profitability and sustainability. The findings highlight the potential of the latest technology to change the financial management in the agriculture sector providing valuable insights

[1] Faculty of Biotechnical Sciences, Partizanska bb, Bitola, N. Macedonia, nikolce.jankulovski@uklo.edu.mk
[2] Faculty of Economics, Prilepski braniteli 143, Prilep, N. Macedonia, dragica.odzaklieska@uklo.edu.mk
[3] Faculty of Economics, Prilepski braniteli 143, Prilep, N. Macedonia, tatjana.spaseska@uklo.edu.mk

about the improvement in agriculture productivity and sustainability that is helpful for farmers and policymakers in the agricultural sector.
    Keywords: Dairy industry, Financial Management, Milk Production

1. Introduction

The agriculture sector of Republic of North Macedonia has a major contribution to the economy of the country. The dairy industry of Republic of North Macedonia is an important subsector of the agriculture sector (Sekovska, Todoroska & Jovanovska, 2015). Many dairy companies are being operated in the country that are facing different financial management challenges. The purpose of this research paper is to explore the challenges and analyze financial management practices that can be utilized to efficiently manage financial activities. The paper has included the case study of BIMILK Company which is a major dairy company in Republic of North Macedonia. BIMILK has been operating in the dairy industry for the past several decades. BIMILK is the largest dairy company in Republic of North Macedonia that helps to understand how the dairy industry is managing its financials (Lazarov, Arizankovska & Jasmina, 2021). The paper highlights the impact of modern technology on financial management in BIMILK dairy industry. With modern technology, the company will easily gain a competitive advantage over most of its competitors (Sekovska, Todoroska, & Risteska-Jovanovska, 2015).

The rest of the paper is organized as follows. Section 2 gives an overview of the dairy industry in the Republic of North Macedonia. Section 3 reviews and analyzes the challenges in Republic of North Macedonia's Dairy Industry. Section 4 deals with the financial support for the dairy industry. In section 5 authors conduct a case study on the financial performances of BIMILK, as the largest company in the dairy industry in North Macedonia. The last section concludes.

2. The dairy industry in the Republic of North Macedonia

The dairy industry in North Macedonia is a cornerstone of the agricultural sector and a vital part of the national economy. As a traditional industry with deep roots in the country's rural communities, it plays a crucial role in providing employment, sustaining livelihoods, and contributing to food security. Despite its importance, the industry faces a number of challenges, including the need for modernization, improving quality standards, and adapting to market changes. This paper provides an overview

of the dairy industry in North Macedonia, examining its structure, production trends, challenges, and future prospects.

The dairy industry in North Macedonia is primarily composed of small to medium-sized farms, with a mix of traditional and modern production practices. The majority of dairy farms are family-owned and operate on a small scale, often in rural areas where dairy farming has been a way of life for generations. These farms typically produce milk from cows, sheep, and goats, with cow's milk being the most dominant in terms of volume. Larger, more commercialized farms also exist, particularly in regions with favorable conditions for dairy farming. These farms are often better equipped with modern milking and feeding technologies, which allow for higher productivity and better quality control. However, they represent a smaller portion of the industry compared to the numerous small-scale producers.

Milk production in North Macedonia is characterized by the predominance of cow's milk, which accounts for the majority of the total milk output. Sheep's milk and goat's milk are also significant, particularly in certain regions where traditional farming practices are maintained. The production of cow's milk has seen fluctuations over the years, influenced by factors such as climatic conditions, feed availability, and market demand. According to data of the state statistical office, the last 10 years the milk production registered oscillations, i.e. saw a drastic decrease of about 37,4% in 2023 compared to 2013. Sheep's milk production, on the other hand, has shown steady growth, reflecting the importance of sheep farming in the country's agricultural economy.

The domestic market for dairy products is strong, with most of the milk produced being consumed locally. However, there is also potential for export, particularly to neighboring countries and the European Union (EU).

Despite its importance, the dairy industry in North Macedonia faces several challenges that hinder its growth and development. One of the most significant challenges is the fragmented nature of production. The prevalence of small-scale farms makes it difficult to achieve economies of scale, leading to inefficiencies and higher production costs. This fragmentation also contributes to variability in milk quality, which poses a challenge for accessing more lucrative markets, particularly in the EU where stringent quality standards are in place.

Another challenge is the limited infrastructure, especially in rural areas. Inadequate cold storage facilities and poor transportation networks can

lead to post-production losses and reduced product quality. These issues are exacerbated by the fact that many small-scale producers lack the financial resources to invest in modern equipment and infrastructure improvements.

Environmental concerns also present a challenge to the industry. Dairy farming, particularly cattle farming, is associated with greenhouse gas emissions and significant water usage. While there is growing awareness of the need for more sustainable farming practices, the transition to environmentally friendly methods has been slow, particularly among smaller producers who may struggle to afford the necessary investments.

3. Challenges in Republic of North Macedonia's Dairy Industry

3.1. Price Volatility

The price of dairy products keeps on changing with time. The external environment factors, including economic factors, political factors, social factors, and technological factors have a major impact on the pricing strategy of the organization. When economic instability increases in the country, the cost of doing business might increase, and corporations have to increase their prices to meet the costs. The price of dairy products keeps on changing with time. The rise in price can cause a decline in demand and ultimately revenue and profitability of the organization will suffer a lot. Therefore changes in pricing strategy sometimes become a major challenge for the companies (Chandra, 2011).

3.2. Financing Constraint

Dairy farms and businesses are associated with the dairy industry often have to face various financial constraints. Major dairy farmers or dairy organizations that have been working in the industry for a very long time might not have to face many financial difficulties because such corporations, because of their high profitability and strong market position, are able to get loans from various financial institutions. On the other hand, small dairy farmers or dairy companies often struggle to access financing due to limited collateral and lenders' risk perception that is associated with the agricultural sector. In short, financing is a major challenge for various dairy companies (Fridson & Alvarez, 2011).

3.3. Changes in Production

The product of Milk keeps on changing with time. Sometimes changes in cattle feed or other environmental factors place a major impact on milk

production. Suppose milk production is going to be reduced. In that case, there is a huge chance that the production of various dairy products will also be reduced, which will have a negative impact on the revenue generation and overall profitability of the business. Sometimes, the demand for dairy products increases significantly due to sudden changes in market trends, which also increases the burden on dairy companies to produce more (Kluyver & Pearce, 2021).

4. Financial Support for the Dairy Industry

The government of the Republic of North Macedonia, agency for financial support of agriculture and rural development, and the Ministry of Agriculture, through their policies, continue to create favorable measures and policies that will support the growth and development of the agricultural sector, including the production of milk and milk products. In terms of dairy business support, the latest information shows that the organization for the Monetary Assistance of Agriculture and the Improvement of the country moved 255.9 million denars to the records of 7,347 elements. It alludes to the repayment of ranchers who created and provided sheep, goat, and cow milk. Ranchers who produced and transported cow milk received aid of 3.5 denarii per liter, while individuals who supplied goat and sheep milk were each given financial assistance of 4.5 denars per liter of milk transported (James, 2016).

Consumers, milk producers, and suppliers of cows, sheep, and goats are the criteria for direct payments related to livestock production, which are set out in the Direct Payments Regulation 2021. It specifies the requirements for direct payments related to livestock production. The beneficiaries of this event are agricultural cooperatives - producers of cow, sheep, and goat's milk registered as breeders of dairy cattle, sheep, and goats in the Register of Breeders of specific types of animals (oxen, sheep, and goats). As the milk and dairy industries are among the most important parts of the agro-industrial complex, investment and financial support are particularly important for shaping the policy of the government and the Ministry of Agriculture, Forestry, and Water Management. Financial aid for domesticated animal supply measures has been expanded. In addition, this project received almost 1.5 million euros. This action is essential to work on the hereditary potential that will finally affect the nature of the final result, while various measures are envisaged to help this area. Regardless, actions are additionally accessible through the IPARD2 program, which opens the door to interest in developing or reproducing dairy farms and ranches and

tackling stocks (Jansson, 2020). Financial aid for domesticated animal supply measures has expanded.

A number of mechanisms are used in the EU to protect the dairy industry during large-scale trade disturbances. These brokerage estimates are meant to address potential market irregularities by protecting customers, producers, and processors within the dairy business. The European Association is generally considered to be the largest exporter of milk and milk products. Daily milk production represents proper cash income and depends on the nature of milk organization, clean standards, and irregularity. In addition, the salary includes the offer of slaughtered animals and other salaries in dairy industry, such as the offer of compost. The dairy business provides various monetary benefits that are not exchanged, including compost for use on the farm as natural excrement (in a few rural areas, fertilizer is the main source of plant performance supplements). Milk creatures are considered a type of capital speculation or a way of selling reserve funds amid hardship, despite the gamble of robbery or extinction. Because limited-scale dairy farmers use domestic labor for the most part, the cost of producing limited-scale milk (per unit of milk supplied) is often the same as that of large-scale dairies (Mahadevan, 2010).

5. Case Study of BIMILK

BIMILK has been operating in Republic of North Macedonia for the past several years. The organization begins its operations in the year 1952. *"Mlekara AD Bitola"* is no doubt the largest producer of dairy products and milk in Macedonia. This organization is meeting the needs of millions of customers each day. The organization provides a variety of dairy products to its customers. Due to the quality products offered by the organization to its customers at affordable prices, the company has gained huge customer loyalty. The company has maintained a high reputation in the market by maintaining the quality of its dairy products (Stiglitz, 2019).

As BIMILK is the largest company in the dairy industry of Macedonia analyzing its financial performance will provide deep insights regarding how dairy companies who are part of the agriculture sector are managing their financials. Through analyzing the financial statement of BIMILK, the current status of financial management will be known, and based on the analysis, recommendations can be given regarding how financial management can be further improved (Warren, Reeve, & Duchac, 2016).

5.1. Revenue

Figure 1: Statement of Comprehensive Income-Revenue

Statement of Comprehensive Income

For the year ended 31 December

In thousands of denars	Note	2022	2021
Realization	6	2.415.132	2.293.289
Costs of realization **Gross**	10	(1.753.386)	(1.673.473)
profit		661.746	619.816
Other income	7	3.022	4.421
Distribution and sales expenses Administrative	10	(398.093)	(388.730)
expenses Other expenses **Profit**	10	(62.882)	(67.000)
from regular	8	(7.005)	(5.861)
operations		196.788	162.646

Source:https://www.mse.mk/en/announcement/14/9/2023/Mlekara-AD-Bitola/Audited-financial-statements

The industry in the year 2021 has generated revenue of 2,293,289,000 Macedonian Denars which increased up to 2,415,132,000 in the year 2022. By analyzing the statement of comprehensive income, it can be said that the revenue of the organization has increased in the 2nd year. The organization has taken initiatives to increase its revenue generation so that the overall profitability of the company can increase. Overall, the business is utilizing its assets efficiently to generate sales. The corporation should enhance its focus on modern technology so that it can further increase its productivity. By increasing productivity, the corporation can serve more customers in a short time period (Spender, 2014).

The rise in the revenue of the company is a good sign which indicates that the business is managing its sales effectively. By focusing on marketing initiatives, the business can further enhance its revenue generation. If the corporation is going to boost its asset utilization then this will also have a positive impact on revenue generation and overall profitability of the business (Sikdar, 2020).

5.2. Expenses

Figure 2: Statement of Comprehensive Income-Expenses

Other income	7	3.022	4.421
Distribution and sales expenses Administrative	10	(398.093)	(388.730)
expenses Other expenses **Profit**	10	(62.882)	(67.000)
from regular	8	(7.005)	(5.861)
operations		196.788	162.646
Financing income Financing		1.968	84
expenses **Net financing income/**		(5.753)	(655)
(expenses).	11	(3.785)	(571)
Profit before tax		193.003	162.075

Source:https://www.mse.mk/en/announcement/14/9/2023/Mlekara-AD-Bitola/Audited-financial-statements

The statement of comprehensive expenses for Mlekara AD Bitola shows a profit before tax of 193,003,000 Macedonian denars, up from 162,075,000 denars. Despite spending 398,093,000 denars on distribution and administration, the company made 196,788,000 denars from regular operations. The net financing expense was 3,785,000 denars, with a financing income of 1,968,000 denars. Overall, the company performed well, with a rise in pre-tax profit.

In Figure 2, it is evident that in the year 2022, the expenses of the organization have increased from the previous year. As the business grows, its expenses also grow. In the year 2022, the corporation made more sales, which means that the costs associated with making those sales will also increase. In 2022, more dairy products were produced, meaning more materials and labor were utilized, increasing the organization's expenses. By analyzing the statement of comprehensive income, it can be said that the business has managed its expenses effectively (Sekovska, Todoroska & Risteska-Jovanovska, 2015).

5.3. Debt Management

From the financial statements of the company, it is evident that the company has financed its assets from both debt and equity. It is suggested that the corporation and other dairy companies operating in the agriculture sector to maintain an optimum capital structure. By maintaining an optimum capital structure, the company's cost of capital will decline, and it will not face debt repayment issues. Too much debt can cause payment issues for the company, and in the worst-case scenario, the organization might have to face

an insolvency. According to financial statements (2021-2022), the business has a stable debt condition (Pandey, 2015).

5.4.   *Profitability & Cash flow*

Figure 3: Cash Flow Statement

For the year ended 31 December			
In thousands of denars	**Note**	**2022**	**2021**
Cash flows from operating activities Profit for the year		169.093	145.385
Adjustment for: Real estate			
depreciation			
expense			
plant and equipment	13	113.920	150.985
Amortization costs of intangibles			
funds	14	892	1.291
Capital gain on sale of property, plant and equipment Write-off of			
property, plant and	7	(487)	(79)
equipment and			
intangible assets Inventory		437	3.879
valuation allowance Valuation allowance for	10	3.209	2.028
doubtful and disputed			
receivables	11	4.685	2.398
Write-off receivables from customers Collected	11	470	
previously written-off receivables Interest income Expenses	11	(607)	(884)
from late interest Income	11	(1.361)	(2.043)
tax Write-off payables to suppliers	11	329	167
	12	23.910	16.690
		(100)	(142)
		314.390	319.675
Changes in: -			
trade receivables and other receivables		(25.835)	129.496
- the advances given		24.297	(12.286)
- the supplies		15.238	3.021
- reservations -		2.211	71
benefits to employees - obligations		310	(669)
to suppliers and other obligations **Cash generated from**		50.748	(5.785)
operational activities		381.359	433.523
Interest paid Income		(329)	(167)
tax paid **Net cash flows from**		(18.278)	(16.337)
operating			
activities		362.752	417.019

The total profit for the year 2022 was 169,093,000 which was way higher than the previous year. In the year 2021, the profit of the business was 145,385,000. From increasing profit, it is evident that the business is moving in the right direction. The rise in revenue of the company was one of the key reasons for its increased profitability. If the business wants to further enhance its profitability then the business will definitely have to reduce its expenses and improve the efficiency of its operations (Mohana, 2011).

If the organizational cash flow statement is analyzed, it is clear that net cash flow from operating activities declined in 2022. In 2022, the cash flow from operations was 381,359,000 but 433,523,000 in 2021. The net cash balance at the end of the year 2022 was 362,752,000 which was lower from the previous year. The business needs to improve its cash generation and will have to reduce its expenses. There is a significant need to bring improvement in the current asset management (Chandra, 2011).

6. Recommendation for Improvement

6.1. *Implementation of the Latest Technologies*

Implement various risk management strategies so that BIMILK and other dairy companies operating in the agricultural sector can better manage their financial activities. The implementation of the latest technologies has become essential for the dairy companies because without the modern technologies, dairy companies cannot gain a competitive edge over competitors. With the help of the latest technologies, companies cannot only manage their operations effectively but also reduce their costs to a large extent. The latest technologies consume fewer resources and are more efficient than traditional technologies. In short, with the latest technologies, financial management of dairy companies can be improved to a large extent (Campbel, Edgar, & Stonehouse, 2011).

6.2. *Cost Reduction/Improvement in Profitability*

Reducing costs is very important for an organization if it wants to improve its profitability in the near future. After analyzing the financial statements, it is evident that the business needs to reduce its costs. Through implementing new technologies, the costs of the business can be reduced. Along with the reduction in costs, the business will have to shift its focus on corporate social responsibility (CSR) activities and marketing activities so that the reputation and brand image of the company can be improved. With a

good reputation and brand recognition the business can improve its profitability in the market (Kluyver & Pearce, 2021).

6.3. *Improvement in Cash flow*

The analysis of the cash flow statement has shown that the cash balance of the company has declined from the previous years. It means that the company needs to bring improvement in cash generation. By effectively managing the current assets, the organization can boost its cash flow generation. By increasing sales generation through modern technology and controlling unnecessary expenses, the business will have the opportunity to enhance its cash flow generation. The organization should improve cash flow generation so that the industry can sustain itself for a longer time period in the agricultural sector (Fridson & Alvarez, 2011).

7. Significance of Financial Management for BIMILK & Diary Industry

Companies like BIMILK rely on effective financial management in the Republic of North Macedonian dairy industry to ensure long-term viability and success. As a key player in the dairy business, BIMILK should manage its funds successfully to explore cash difficulties, increase benefits, and push through key decisions for development and expansion. BIMILK financial management is crucial for a number of reasons, one of which is ensuring the efficient use of investments and resources. With a strong money management system, BIMILK can accurately evaluate its cash position, distinguish areas of progress, and successfully distribute assets to increase returns. By monitoring the key monetary indicators such as income, benefit, and liquidity, BIMILK can make informed decisions about where to contribute its assets to achieve the most ideal results. In addition, monetary management that mitigates gambling and guarantees monetary stability is essential for BIMILK (Sulejmani & Isen, 2023).

In the volatile dairy industry, companies like BIMILK are exposed to a number of external factors that have the potential to affect their financial health. These external factors include shifting consumer preferences, shifting milk prices, and regulatory changes. BIMILK can better prepare for and deal with these risks by implementing robust financial management practices, minimizing potential financial losses, and ensuring the company's long-term viability. In addition, viable cash management enables BIMILK to increase its benefits and seriousness. BIMILK can distinguish valuable chances to reduce costs, increase revenue, and work for the common good by

controlling key monetary measurements and conducting intensive monetary research. This does not only help the bottom line of the business but also gives BIMILK the opportunity to reinvest profits into the company to further grow and expand. In addition, financial management is essential for BIMILK to meet its monetary obligations and keep up with great partner relationships (Kourdi, 2015).

BIMILK can ensure that it has the funds necessary to pay suppliers, employees, and creditors on time by effectively managing its finances, and fostering trust and credibility with key stakeholders. In addition, the growth and expansion efforts of BIMILK can be supported by sound financial management practices that can help the company secure funding from investors and banks for future projects and investments. In the dairy region of Republic of North Macedonia, where competition is fierce and market elements are constantly evolving, monetary management is a crucial calculus that decides the progress of organizations like BIMILK. BIMILK can gain the upper hand by conducting convincing monetary administration trials, driving development, and achieving sustainable business progress. In conclusion, dairy businesses operating in Republic of North Macedonia like BIMILK require effective financial management to ensure long-term growth, profitability, and sustainability. By properly managing its funds, BIMILK can improve part of its assets, mitigate hazards, increase productivity, and keep up with great partner relationships. In a serious and dynamic industry such as the dairy industry, proper monetary administration tests are essential for organizations like BIMILK to thrive and win over the long term (James, 2016).

8.   Conclusion

BIMILK milk production has experienced fluctuation. Milk production is the primary culprit, and in 2019, an average of 3,438 liters were produced per cow. However, sheep also produce milk in large quantities, even if it is inconsistent. The gradual increase in total and mean output volumes over time concentrates on efficiency, especially cow milk. With a gross profit of 661,746,000 denars compared to 619,816,000 denars, as presented in the financial statements for the year ending 2021, the financial statements for the year ending 2022 demonstrated increased net profit of about 6.34% compared to the previous year which indicate strong financial performance of the company. This growth in gross profit rate demonstrates successful cost control despite growing realization costs. However, net income before taxes advanced from 162,075,000 denars to 193,003,000 denars indicating efficiency and profitability. However, cash flow from operating activities decreased to 362,752,000 denars from 417,019,000 denars in the previous

year (Cash Flow Statement). Cash from operations is affected by changes in working capital, such as trade receivables and other current liabilities. BIMILK remained profitable, signaling its ability to fund operations and invest in new technology

From all this above, it can be concluded that reduction in costs is very important for the organization and leads to improved profitability. The financial analysis confirmed that the business needs to reduce its costs, of course through implementing new technologies. Along with the reduction in costs the business will have to shift its focus on CSR activities and marketing activities so that the reputation and brand image of the company can be improved. Therefore, to improve the financial management it is crucial to implement various risk management strategies in the case of BIMILK and other dairy companies. The implementation of the latest technologies has become essential for dairy companies because without modern technologies dairy companies cannot gain a competitive edge over competitors.

References

Campbel, D., Edgar, D., & Stonehouse, G. (2011). *Business Strategy: An Introduction.* Macmillan International Higher Education.

Cencini, A. (2012). *Macroeconomic Foundations of Macroeconomics* (illustrated ed.). Routledge.

Chandra, P. (2011). *Financial Management.* Tata McGraw-Hill Education.

Dixit, A. (2014). *Microeconomics: A Very Short Introduction* (illustrated ed.). OUP Oxford.

Fridson, M. S., & Alvarez, F. (2011). *Financial Statement Analysis: A Practitioner's Guide.* John Wiley & Sons.

James, G. (2016). *Introduction to Republic of North Macedonia.* Bible Reading Fellowship.

Jansson, H. (2020). *International Business Strategy in Complex Markets.* Edward Elgar Publishing.

Kluyver, C. A., & Pearce, J. A. (2021). *Global Business Strategy* (2 ed.). Business Expert Press.

Kourdi, J. (2015). *The Economist: Business Strategy 3rd edition: A guide to effective decision-making.* Profile Books.

Lazarov, D., Arizankovska, J., & Jasmina, M. (2021). Qualitative Analysis of preliminary priority areas in the smart specialization process in the Republic of North Macedonia.

Mahadevan, B. (2010). *Operations Management: Theory and Practice* (illustrated ed.). Pearson Education India.

Mohana, R. P. (2011). *Financial Statement Analysis and Reporting.* PHI Learning Pvt. Ltd.

MAKStat Database. Milk production in Republic of Macedonia, by years. State Statistical Office of the Republic of North Macedonia, Skopje, North Macedonia. Available from: http://makstat.stat.gov.mk/ [Accessed: August 29, 2024]

Pandey, I. (2015). *Financial Management.* Vikas Publishing House.

Sekovska, B., Todoroska, M., & Risteska-Jovanovska, S. (2015). Dairy sector in the Republic of Macedonia: Yesterday, today, tomorrow. *Economics of Agriculture, 62*(4), 1109-1116.

Sikdar, S. (2020). *Principles of Macroeconomics* (3 ed.). OUP India.

Spender, J.-C. (2014). *Business Strategy: Managing Uncertainty, Opportunity, and Enterprise.* OUP Oxford.

Stiglitz, J. E. (2019). *Rethinking Microeconomics.* Oxford University Press.

Sulejmani, E. I., & Isen, M. A. (2023). Sustainability and perspectives of the Republic of North Macedonian Dairy Industry. *Journal of Agricultural Sciences (Belgrade), 68*(1), 19-41.

Warren, C., Reeve, J. M., & Duchac, J. (2016). *Financial & Managerial Accounting.* Cengage Learning.

CHATGPT AND GEMINI PREDICTIONS ON THE MACEDONIAN STOCK EXCHANGE (MSE)

Davor Jovanoski[1]

Abstract

We are exploring the potential of Large Language Models (LLMs) to provide forecasting analysis for multiple stocks on the MSE. With the advancement of artificial intelligence, the comprehensive data understanding by LLMs raises questions regarding the potential accuracy in financial market predictions. This is an important topic in academia and finance, and its inclusion in the financial world becomes imperative as it provides an alternative for reducing risk in market decision-making. This research relies on publicly available chatbots Gemini and ChatGPT, without focusing on a specific training on data. We solely depend on the input of raw stock data to analyze and predict stock prices for several companies traded on the MSE, considering the maximum, minimum, average, last trade prices and volume. Our focus begins with examining historical data, allowing the LLM to forecast based on data from last years. The conducted experiments focus on observing errors to assess the consistency between predicted and actual stock prices, demonstrating the viability of the approach using these LLMs for predictions on the MSE.

Keywords: ChatGPT, Gemini, MSE, Forecasting.

---

[1] Doctorate Paneuropean Studies, Joint PhD Programmes, Campus 2, 7000 Eisenstadt, Austria, djovanoski@gmail.com

1. Introduction

Stock market forecasting plays a crucial role in guiding investor analysis and decision-making. Genereteve artificial intelligence and LLMs have shown considerable achievements exploring the potential in various fields. As the models are trained over huge inputs of text data, they reach a point of enabling them to be capable of undersading the context of a natural language. Leveraging those capabilities in resolving large inputs of data provide an exceptional strength towards the challenges in finance (Zhao H., 2024). Similarly the interest extends its gaining momentum in the research area of forecasting. Targeting different dimensions in the approach in finance and research in order to understanding the alternative options to provide a practical application of forecasting models. Making connections where other models were not capable provides a unique position in which LLMs can offer supportive role for the financial analysts. Finance is complex and specialized field which involves great deal of prediction, data analysis and decision making. Considering the amount of varous sources to understand the future trends in stockprices bring certain challenges.

Financial decisions often is based on high risk which counteracts to the need of extreme degree of accuracy and realibility of the forecast. Thus the challenge is followed by continuously upgrading and improving the models. (Lopez-Lira A., 2023) show that incorporating advanced language models into the decision making can yield more accurate predictions and enhance performance of quantitative trading strategies. In our research we are focusing on leveraging the capabilities of ChatGPT-4 (OpenAI, 2024) and Gemini (Google, 2024). We leverage the use of the publicly available model with providing a designed prompt including with the price history of the past two years. The limitation of input data fixes us on the range of the past two years when providing the information about the maximum, minimum, average, last trade price and volume.

Stock prices are inherently volatile and complex, making their prediction a challenging task. By focusing on the Macedonian Stock Exchange, along with trade volumes and volatility, we investigate the daily and weekly forecasts for four companies listed in the MBI10 index. The selected companies are from different sectors: ALK in pharmaceuticals, KMB in banking, MPL in oil and gas and GRNT in construction.

2. Related Work

Deep Learning forecasting models have become prominent area of research as they are demonstrating remarkable performance on larger scale.

For forecasting the general focus is on zero-shot inference as the ability of a model to predict classes or categories that were not seen during training, as shown in (Azul Garza, 2024). Generally the use of LLMs forecasting stock prices is based on data input related to trends using the news headlines. In (Lopez-Lira A., 2023) they find that chatGPT outperforms traditional sentiment analysis methods. Similarly the potential of predicting stock market trends based on Twitter(X) Sentiment Analysis shown in (Ummara Mumtaz, 2023). They focus on determining if a tweet has postivive, negative or neutral effect on Microsoft and Google's stock values, and find a positive link between ChatGPT evaluations and the following day's stock results.

Other approaches focuses on time series forecasting by reprogramming LLMs as shown in (Ming Jin, 2024). LLMs posses robust pattern recognition and reasoning abilities over complex sequences. The challenge lies in aligning of time series data and natural language capabilities with providing a high performing forecasting model in both few-shot and zero-shot learning scenarios. The approach is based on reprogramming the input time series with text prototpes before feeding it into the frozen LLM to align the two modalities. Using Prompt-as-Prefix(PaP) by enriching the input context and directing the repgrammed input patches.

Regarding the stock price forecasts in expands into fine tuning LLMs to enable language understanding and generation tasks. As presented in (Tian Guo, 2024) they compare methods of integrating LLMs token-level representation into the forecasting module and experiment on real news and descover agregated representations from LLMs token-level embedings produce return predictions that enhance the performance of long-only and long-short porfolios.

The classical task of time series forecasting received an impact with LLMs as shown in (Hua Tang, 2024) where they study an LLMs excel in predicting time series with clear patterns and trends but face challenges with datasets lacking periodicity. They focus on the capability of the large language model to pinpoint the periodicality of a dataset and with it provide two techniques to enhance the model performance. Providing supplementary information enabling the LLM to grasp the periodic nature of the time series, and transofmring the numerical data into natural language format.

It is not always the case where LLMs are considered an improvement over existing methods. In (Mingtian Tan, 2024) they found that removing the LLM component or replacing it with a basic attention layer does not degrade the forecasting results and most cases the results even improved. Additionally pre-trained LLMs do not outperform models trained from scratch.

Our work focues on providing the daily and weekly forecasting based on our generated prompt including the input of the timeseries and details regarding the company we are currently forecasting. This allows for a hybrid approach between timeseries and provisioning of information in order to prepare the daily and weekly forecasts suggested in (Jovanoski, 2022).

3. Methodology

Levaraging on the LLMs for predicting fluctuating stock prices is an interesting and challenging problem. With the increase of data availability of the companies and their business area, we can extract information from multiple perspectives regarding the stock price, thus offering different approaches to predict it. Similar to other approaches toward LLMs focusing on zero-shot and short-term forecasts, we investigate with focusing on the daily and weekly stock prices. With the expectation of progressive loss of accuracy and increased error when forecasting weekly vs daily stock prices. Due to input limitations we were not able to provide data longer than two consecutive years of history for each company, both for daily and weekly forecast. Thus, implying less data as an input for each prompt. With those preconditions we focus our forecasting over companies which are part of the MBI10 index and have a history of stocks being traded on the MSE.

Visualized in Fig. 1 our method encompases three main components (1) prompt preparation with input MSE data preparation (2) LLMs analysis and (3) output projection.
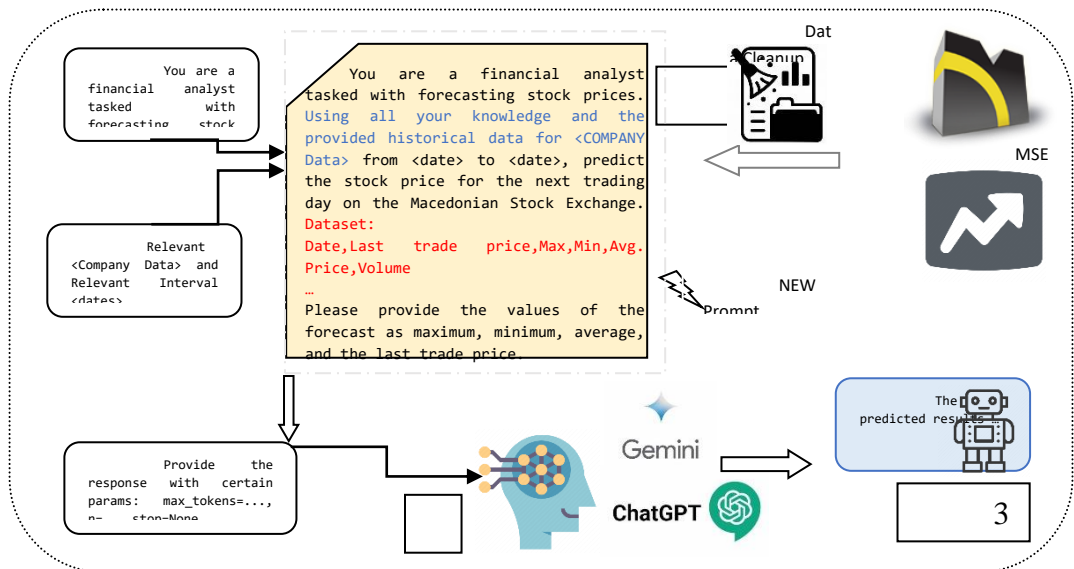

Figure 1. The workflow of our analysis process

We evaluate the results from both models using the forecasted values compared with the trailing real values for all variables together. As we are limited with the input data of two years we focus only on the results for the month 2024-07 with providing only the input data from 2022-06 to 2024-06. Both LLMs ChatGPT and Gemini are different in handling information. With ChatGPT always having a date of latest training, in our case, August 2023 and Gemini with having a continous training and updates. Our initial expectations were that Gemini would yield better results due to having latest data. In our study the same prompt is applied on both LLMs and we compare them by calculating the errors similarly as in (Lv et al., 2022).

With pt as forecasted, *yt* as real and $\bar{y}$ as average of the real values for the forecasted day and week prices. We choose following statistics to assess the consistency and deviation between forecasted and observed stock values. Mean Absolute Error (MAE), this metric, as expressed in Eq. (1) quantifies the average magnitude of errors in the forecasted set. Root / Mean Square Error (RMSE/MSE) presented in Eq. (2), this quadratic scoring rule also assesses the average magnitude of errors, emphasizing larger deviations. Mean Absolute Percentage Error (MAPE) in Eq. (3) measures the percentage error of the forecast relative to the actual values. Eq. (4) R-squared (R^2) is a statistical measure in a regression model that indicates the proportion of variance in the dependent variable explained by the independent variable. A higher R^2 typically implies greater predictive accuracy.

$$MAE = \frac{1}{n}\sum_{t=1}^{n}|p_t - y_t| \qquad \text{1)}$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(p_t - y_t)^2} \qquad \text{2)}$$

$$MAPE = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{p_t - y_t}{y_t}\right| \times 100 \qquad \text{3)}$$

$$R^2 = 1 - \frac{\sum_{t=1}^{n}(p_t - y_t)^2}{\sum_{t=1}^{n}(p_t - \bar{y})^2} \qquad \text{4)}$$

Additionally we perform a linear regression using the regression line *y=ax+b* to evaluate the correlation between the actual and forecasted values of the minimum, maximum, average, and last trade prices of the variables. The standard error (SE), *p-value,* and t-value are used to measure the

strength of this relationship. Analyzing the trading days in 2024-07, we observe the slope *a*, expecting a low SE for *a*, a *p-value* below the standard threshold of *0.05*, and a high *t-value* for *a*.

4. Experimental Results and Discusisons

We present the experiment of both models Gemini and ChatGPT for the MSE datasets considering the metrics, forecasted results, errors and linear regression analysis for the next trade day and next trade week predictions.

4.1 Datasets

The dataset is collected from MSE for the four companies KMB, ALK, GRNT and MPT and their historical data from MSE daily reports in the range from 06-2022 to 07-2024. We consider the statistical analysis of the last tride price of each company with the count, average, maximum, minimum, standard deviation and ADF test results found in Table 1. We observe a relatively large gap between minimum and maximum and large standard deviation, indicating that the last trade values present good volatility within the study range. The ADF test for ALK and GRNT p-values are greater than significant value *0.05*. Thus, the series is non-stationary and volatile. KMB and MPT exhibit the opposite characteristic.

Table 1. Descriptive statistics of the opening stock price

Company	count	mean	std	min	max	ADF*
ALK	488	1806 3.022	1325. 349	1555 6	1000	0 .3889
KMB	488	1344 0.732	2578. 486	1040 0	1700	0 .0001
MPT	488	6781 4.213	3814. 152	6270 1	4000	0 .0332
GRNT	488	1238. 029	98.56 2	1100	546	0 .5261

* p > 0.05

4.2 Models - Forecast results and errors

Our initial expectation prompted Gemini 1.5 Flash to provide better results due to its continued trainings compared to ChatGPT4o which training ended with August 2023. With our study we analyze the maximum, minimum, average and last trade price and we present the forecasts focusing

on the last trade price. We consider only the default values provided by both models, thus restricting our input prompt bounded by input tokens limits.
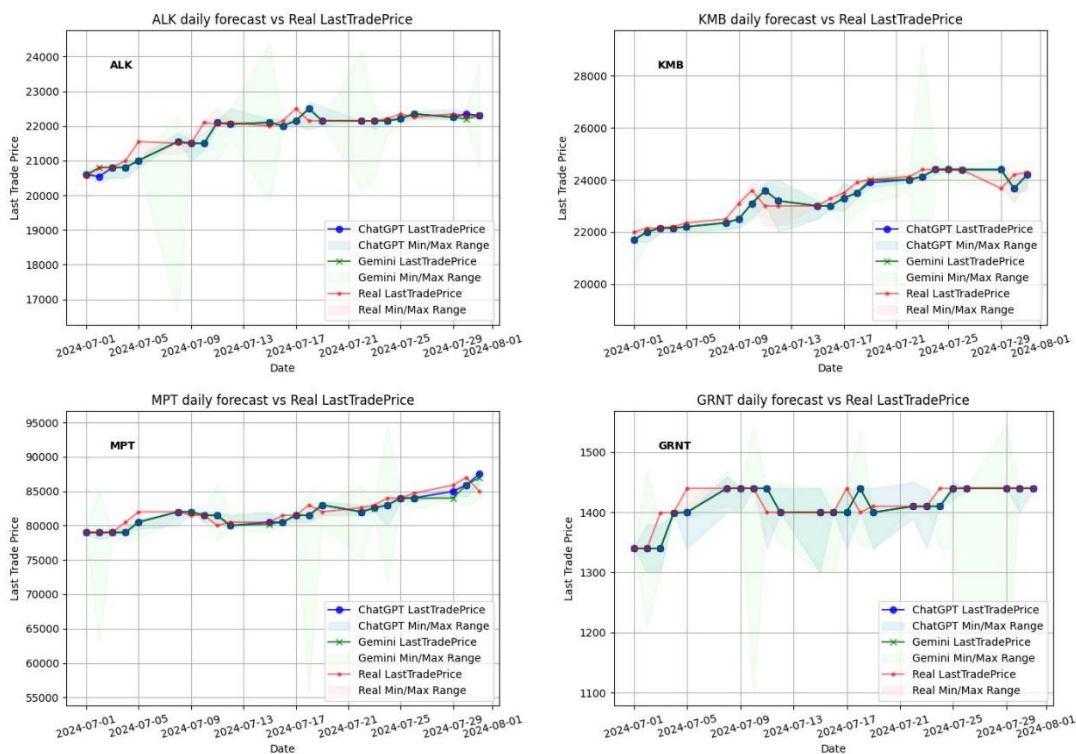
Figure 2. Daily forecasts: ChatGPT vs Gemini – ALG, KMB, MPT, GRNT for 2024-07

The similarity between both models is visible in the Fig. 2, as both models forecasted the last trade price predictions close for MPT and ALK, and equal for GRNT and KMB. However, both forecasts are deviating from the actual values. Additionally we observe that Gemini spaned between bigger difference of minimum and maximum esstimations. With our study we calculate the errors from the forecasted against the real values for last trade price.

Table 2. Daily last price trade forecasting ChatGPTvs Gemini errors

C ompany	M odel	MAE	MS E	R MSE	M APE %	R ²
A LK	C hatGPT	140.348	479 21.739	21 8.910	0. 642	0 .886
	G emini	131.130	452 91.478	21 2.818	0. 597	0 .881
K	C	237.261	103	32	1.	0

MB	hatGPT		153.696	1.175	015	.878
	G	232.652	102	31	0.	0
	emini		008.652	9.388	996	.879
M	C	704.174	946	97	0.	0
PT	hatGPT		435.304	2.849	849	.821
	G	743.261	978	98	0.	0
	emini		174.391	9.027	896	.814
G	C	11.304	473.	21	0.	0
RNT	hatGPT		130	.752	798	.590
	G	11.304	473.	21	0.	0
	emini		130	.752	798	.590
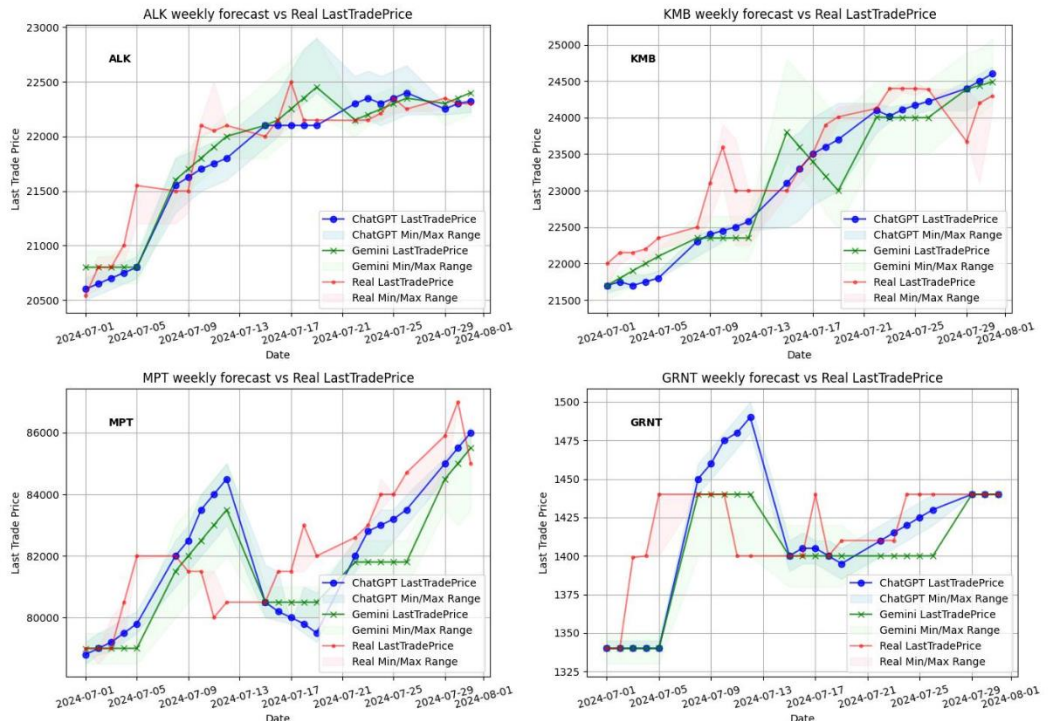
Figure 3. Weekly forecasts: ChatGPT vs Gemini – ALG, KMB, MPT, GRNT for 2024-07

From Fig. 3 we observe much higher discrepancy when forecasting the weekly last trade price. ChatGPT forecasts for MPT and GRNT is more dependent on the previous trend compared to Gemini, where we observe a lower impact on the forecasted value depending on the trend. Additionally we notice bigger span between minimum and maximum for Gemini compared to ChatGPT.

Table 3. Weekly last price trade forecasting ChatGPTvs Gemini errors

| C | M | MAE | MSE | R | M | R |
| ompany | odel | | | MSE | APE % | 2 |

ALK	ChatGPT	167.391	5665.652	238.024	0.767	0.872
	Gemini	146.043	4692.130	216.620	0.671	0.868
KMB	ChatGPT	358.913	193475.174	439.858	1.544	0.878
	Gemini	459.043	298427.565	546.285	1.959	0.742
MPT	ChatGPT	1317.304	3081426.522	1755.399	1.604	0.467
	Gemini	1378.043	2939565.609	1714.516	1.667	0.491
GRNT	ChatGPT	24.304	1544.826	39.304	1.715	0.277
	Gemini	21.260	1173.087	34.250	1.496	0.329

From Tables 2 and 3 we observe that the weekly forecasts tend to perform worse than the daily forecasts, as expected. The error values for both models are relatively similar, though the difference between the models is greater for the weekly forecasts and smaller for the daily ones, particularly with GRNT and KMB. The quality of this statistical measure depends on various factors, such as the nature of the variables used in the model, the units of measurement, and any data transformations applied. R^2 is commonly interpreted as a measure of how well the regression model explains the observed data. Generally, a low R^2 value is undesirable for forecasting models, as we typically expect it to be closer to 1.0. Both our models resulted in low to mid-range R^2 values, raising questions about their practical utility as forecasting tools.

4.3 Regression Analysis

With the observation for all companies and both models in Tables 4 and 5, the slope *a* for all companies in the regression analysis is with *p* lower than the standard cutoff of *0.05*. Both models show relatively high standard error and positive *t*.

Table 4. Daily- last price trade forecasting ChatGPTvs Gemini regression analysis

Company	Model	Parameter	Estimation	SE	*t*	*p*
ALK	ChatGPT	a	1.022	0.068	12.754	0.0
		b	-553.86	1481.484	2.012	0.057
	Gemini	a	0.975	0.073	12.459	0.0

Company	Model	Parameter	Estimation	SE	t	p
		b	485.930	1581.826	1.37	0.185
K MB	ChatGPT	a	0.984	0.073	12.266	0.0
		b	267.306	1692.911	1.55	0.136
	Gemini	a	0.988	0.072	12.332	0.0
		b	187.471	1680.262	1.589	0.127
MPT	ChatGPT	a	0.937	0.089	9.8	0.0
		b	4912.679	7321.064	1.426	0.168
	Gemini	a	0.892	0.095	9.591	0.0
		b	8539.544	7789.062	0.96	0.348
GRNT	ChatGPT	a	0.852	0.126	5.493	0.0
		b	204.557	177.716	2.472	0.022
	Gemini	a	0.852	0.126	5.493	0.0
		b	204.557	177.716	2.472	0.022

Table 5. Weekly - last price trade forecasting ChatGPT vs Gemini regression analysis

Company	Model	Parameter	Estimation	SE	t	p
AL K	ChatGPT	a	1.03171	0.071	11.949	0.0
		b	-778.38	1540.984	2.246	0.036
	Gemini	a	0.988	0.075	11.75	0.0
		b	232.086	1633.312	1.643	0.115
K MB	ChatGPT	a	1.143	0.063	12.265	0.0
		b	-3584.66	1449.436	3.874	0.001
	Gemini	a	0.983	0.097	7.775	0.0
		b	142.650	2247.067	2.634	0.016
MPT	ChatGPT	a	0.711907	0.153	4.293	0.0
		b	23413.	12	2.	0.

			55	530.83	265	034
	Ge mini	a	0.6168 7	0.1 77	4. 498	0. 0
		b	30795. 74	14 412.8	1. 204	0. 242
	Ch atGPT	a	0.818	0.1 19	2. 835	0. 01
GR NT		b	253.80 6	16 8.529	5. 564	0. 0
	Ge mini	a	0.714	0.1 43	3. 207	0. 004
		b	389.32 5	20 0.968	3. 836	0. 001

Similarly, observing the plots in Figs. 4 and 5 the points are scattered unevenly for the weekly forecasts with low tendency towards the diagonal. However, the daily forecasts show higher tendency towards the diagonal, with the advantage towards ChatGPT over Gemini.
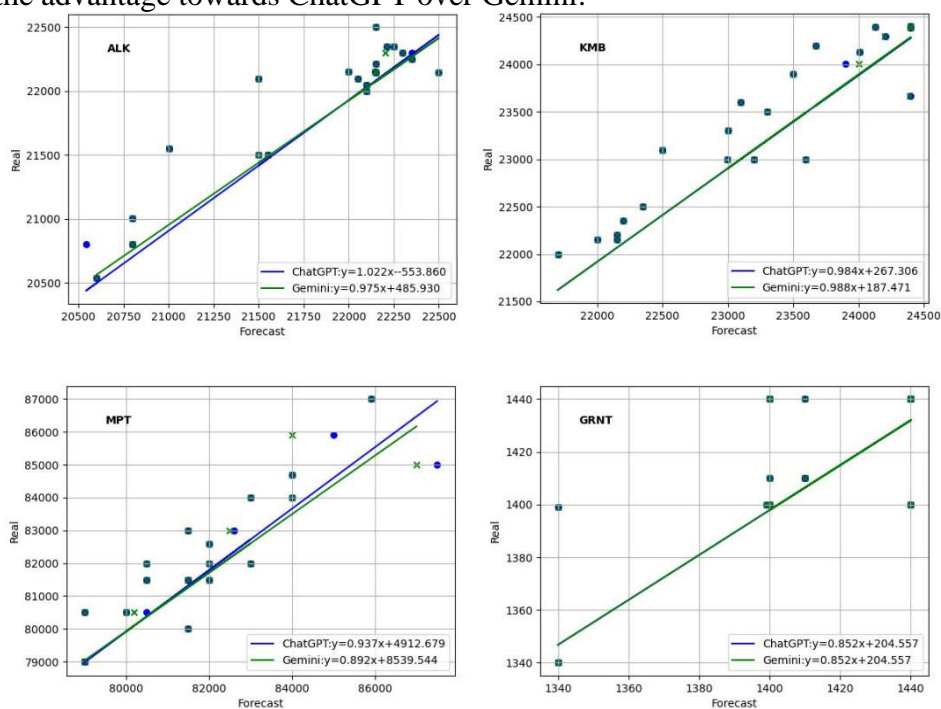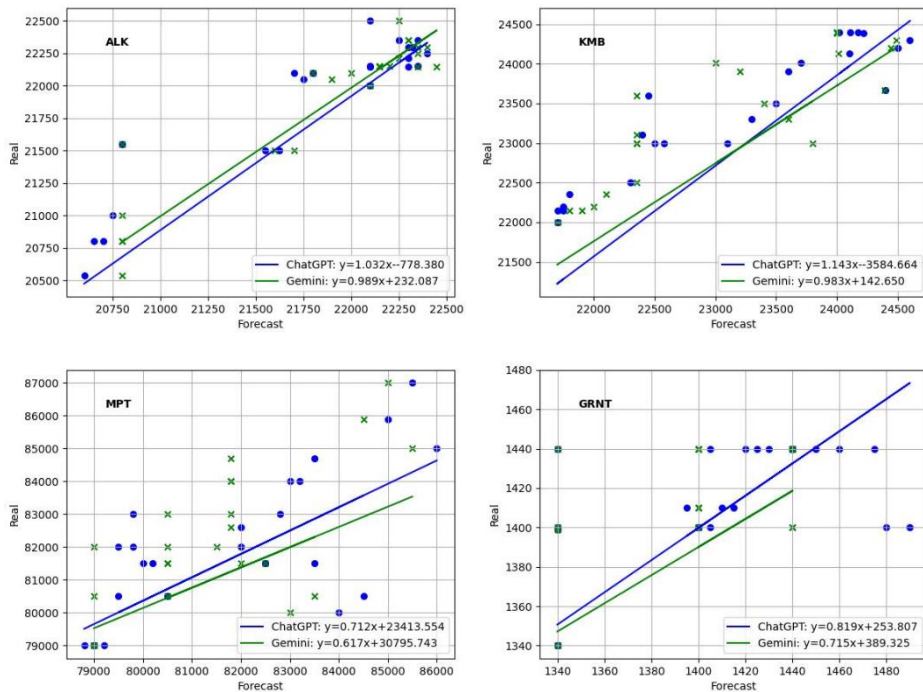

Figure 4. Daily - Linear regression analysis ChatGPT vs Gemini

Figure 5. Weekly - Linear regression analysis ChatGPT vs Gemini

With observing the analysis in Figs. 4 and 5 and Tables 4 and 5, considering the min and max values on the real and predicted with their relative difference we expect significant errors for both models in regards to daily and weekly forecasts. Therefore, the regression analysis does not yield a practically applicable forecasting for both models.

5. Conclusion

In some financial markets, particularly those with frequent volatility, prediction models often have limited forecasting ability. Based on empirical evidence and the constraints of our approach, we find that while our hybrid model combining time series with LLMs shows some promise, its practicality remains questionable. The results indicate that ChatGPT generally delivers more accurate predictions than Gemini, though both models demonstrate a questionable level of predictability. While the forecasts generated by both models can offer valuable insights for companies experiencing specific volatility, they are not recommended for making real investment decisions.

References

Azul Garza, C. C.-C. (2024). TimeGPT-1. doi:https://doi.org/10.48550/arXiv.2310.03589

Google. (2024, August 1). *Gemini [Large Language Model]*. Retrieved from https://gemini.google.com/app

Hua Tang, M. J. (2024). Time Series Forecasting with LLMs: Understanding and Enhancing Model Capabilities. doi:https://doi.org/10.48550/arXiv.2402.10835

Jovanoski, D. (2022). LSTM Forecasting on the Macedonian Stock Exchange. *Horizonts*. doi:https://doi.org/10.20544/horizons.a.30.1.22.p07

Lopez-Lira A., Y. T. (2023). Can ChatGPT Forecast Stock Price Movements? Return Predictability and Large Language Models. doi:https://doi.org/10.48550/arXiv.2304.07619

Lv et al. (2022). Stock Index Prediction Based on Time Series Decomposition and Hybrid Model. *Entropy 24, no. 2: 146.* doi: https://doi.org/10.3390/e24020146

Ming Jin, S. W.-Y.-F. (2024). Time-LLM: Time Series Forecasting by Reprogramming Large Language Models. doi:https://doi.org/10.48550/arXiv.2310.01728

Mingtian Tan, M. A. (2024). Are Language Models Actually Useful for Time Series Forecasting?. doi:https://doi.org/10.48550/arXiv.2406.16964

OpenAI. (2024, August 1). *ChatGPT [Large Language Model]*. Retrieved from https://chat.openai.com/chat

Tian Guo, &. E. (2024). Fine-Tuning Large Language Models for Stock Return Prediction Using Newsflow. doi:https://doi.org/10.48550/arXiv.2407.18103

Ummara Mumtaz, &. S. (2023). Potential of ChatGPT in predicting stock market trends based on Twitter Sentiment Analysis. doi:https://doi.org/10.48550/arXiv.2311.06273

Zhao H., Z. L. (2024). Revolutionizing Finance with LLMs: An Overview of Applications and Insights. doi:https://doi.org/10.48550/arXiv.2401.11641

CAPITAL STRUCTURE DETERMINANTS IN CROATIAN TRADE COMPANIES

Mira Dimitrić[1], Ivana Tomas Žiković[2], Marija Sarkotić[3]

Abstract

One of the most important issues in financial theory and practice is the question of borrowing, i.e. the capital structure, as it represents a balancing lever between company performance and security. Given the importance and significance of trade activities in the economy, this issue is particularly important for companies in the economy. This paper analyzed the specifics of trade industry in the Republic of Croatia in comparison with EU countries and synthetic data on the basic determinants of the business activity of trade companies - indebtedness, profitability, liquidity and efficiency - were presented. The most important theoretical approaches to capital structure and optimization are also presented. The determinants of capital structure were examined using a panel data analysis on a sample of trade companies in the Republic of Croatia. The results obtained are consistent with the pecking order theory. The results of the study contribute to the few empirical studies on the capital structure of Croatian companies and are particularly useful in the context of the importance of trade in the economic structure.

Keywords: Capital structure, Trade companies, Panel data analysis

[1] Faculty of Economics and Business, University of Rijeka, Ivana Filipovića 4, Rijeka, Croatia, mira.dimitric@efri.uniri.hr

[2] Faculty of Economics and Business, University of Rijeka, Ivana Filipovića 4, Rijeka, Croatia, ivana.tomas.zikovic@efri.uniri.hr

3 Gacko pučko otvoreno učilište (Public Open College), Trg Dražena Bobinca 2, Otočac, Croatia, marijasarkotic@gmail.com

1. Introduction

In recent years, trade in the Republic of Croatia has become the leading sector in terms of total revenue and expenses compared to other sectors of the economy. This is part of the general trend towards the expansion of the tertiary sector of the economy in both developed and developing countries. Since the most important indicator of the financial position is precisely the capital structure and the issue of debt, determinants of that indicator are the focus of this paper's research.

2. Theoretical background and research hypotheses

Although in the Republic of Croatia, according to the Ministry of Economy and Sustainable Development, trade activity accounts for one tenth of economic value added, employs one fifth of the total number of employees and accounts for about one fifth of the total number of active economic entities, it can be assumed that this is not enough to be above the average of trade activity in the European Union. In addition, the Croatian GDP per capita of 17.5 thousand euros is only 60% of the average European GDP. In accordance with the expectation that the basic indicators of trade follow the general economic trends, the first research hypothesis was formulated:

H1: The development of trade activity in the Republic of Croatia is below average compared to the countries of the European Union.

Central topis of this research, the question of capital structure determinants is very often in numerous empirical studies. Each study supports one of the theoretical approaches. Traditionally, it has been assumed that there is an optimal capital structure, i.e. a precisely defined ratio of debt to equity with which the company has the greatest value. Since the price of debt is lower than that of equity due to risk, increasing debt lowers the average cost of total capital up to a certain level, above which the price of all its components begins to rise due to risk. Miller and Modigliani presented an initial model according to which, under the conditions of a perfect market, the profitability of investments and not the capital structure determines the value of the company. In a next step, the original model is corrected for the tax shelter effect, according to which a company with debt is worth more than an identical company without debt because it pays less tax based on interest expenses. According to the trade-off theory, the optimal structure is a compromise between the advantages of borrowing due to tax shelter and the disadvantages of borrowing due to the increased risk of financial disruption. This theory assumes a positive impact of profitability on

debt. According to the agents' theory, increased borrowing increases the value that belongs to the creditors, which is not in the interest of the owners. To address the problem of information asymmetry between management and investors, the pecking order theory and the signaling theory were developed. The pecking order theory states that when management has reliable information, it favors the financing of retained earnings, then debt and finally equity. This theory assumes a negative impact of profitability on debt. The order presented is supported by the signaling theory, according to which increased borrowing sends a signal to the investing public of good business and company prospects to be realized through new investments. More recent theories are based on the interaction between production and the market, i.e. the effects on competition, on the maintenance of corporate control, on market cycles, i.e. periods of under- and overvaluation of shares on the capital market, on the behavior of management, which tends to imitate the capital structure of the industry leader, and on numerous other assumptions that have proven to be significant in empirical research.

To illustrate this, some empirical researches on the determinants of capital structure that support more recent theories, the pecking order theory and the trade-off theory are presented below:

Table 1. Some empirical studies on capital structure determinants

Authors	Area (country) of capital structure research	Determinants of financial leverage
Antoniou,, A, Guney, Y i Paudyal, K (2014)	France, Germany, UK	company size, term structure of interest rates, past stock price movements, tangible assets
Alipour, M, Seddigh Mohammadi M.F. i Derakhshan.H (2015)	Iran	liquidity, growth, profitability, tax rate, size
Serrasqueiro, Matias i Salsa (2016)	Portugal	size, liquidity, profitability, growth, tangible assets structure, tax, tax shelter
Harc (2019)	Croatia	profitability, company size, tangible assets, tax shelter, liquidity, growth
Haji, A (2020)	EU–members and non-members of the eurozone	company size, profitability, tangible assets, non-debt tax shelter, growth, inflation
Arribas, Tortosa-Ausina i Zhu (2021)	EU – first 15 members	profitability, tangible assets, company size, liquidity, tax shelter, GDP ,inflation
Ali, Rangone i Farooq (2022)	USA, UK	tax rate, tangible assets, profitability, liquidity

| Czerwonka i Jaworski (2022)	Poland, Portugal	tangible assets, growth, profitability, liquidity, tax rate

Source: Authors

Following the findings described above, which confirm the same or similar determinants of financial leverage in different areas (countries), the second hypothesis is formulated:

H2: It is expected that the company-specific factors of company size, age, profitability, growth potential and liquidity have a significant influence on the capital structure of the company.

3. Basic comparative analysis and features of Croatian trade industry and trade companies

To test the first hypothesis, basic data on the trade sector, the number of companies and turnover during the five-year period as well as other comparative data and indicators are presented below. The analysis of characteristics and trends in the business performances of Croatian trade companies also contributes to the picture of the creditworthiness of companies, which is assessed and presented using data from the Financial Agency.

From the presented and illustrated data, it can be concluded that in all EU countries the number of trading companies and realized trade turnover are relatively variable in the observed period and that Croatia (HR) is at the bottom of the EU countries in terms of both characteristics.
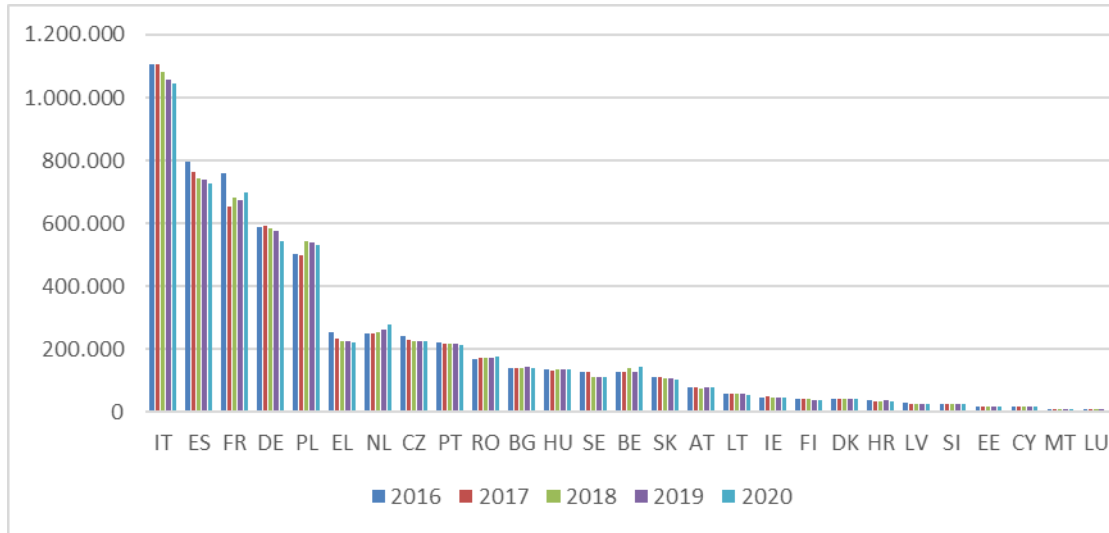
Figure 1. Number of companies in trade industry – EU countries
Source: Authors, based on EUROSTAT data
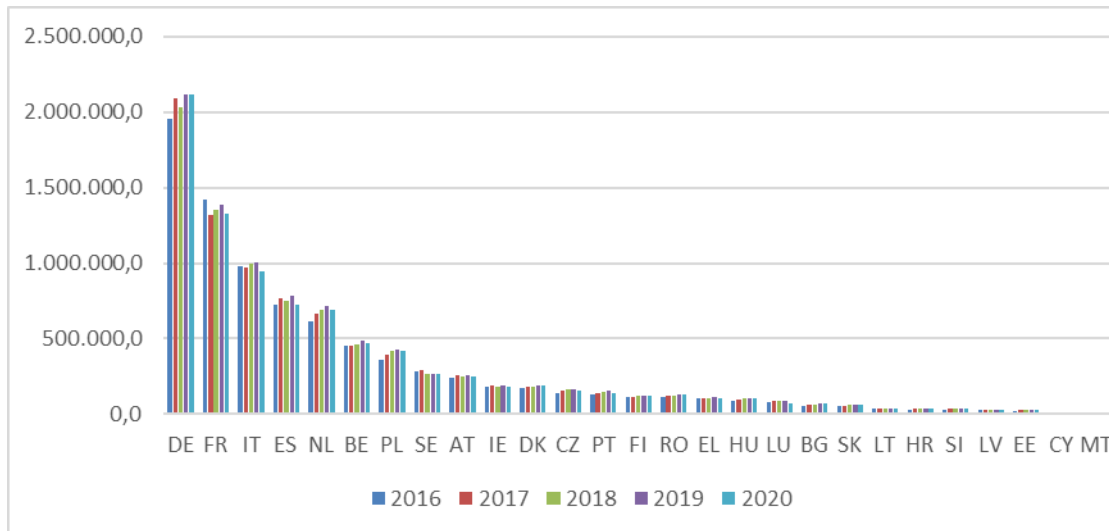
Figure 2. Turnover in trade industry – EU countries (in mill.euros)
Source: Authors, based on EUROSTAT data

Table 2. Other comparative data and indicators in trade industry (2016.-2020.)

		2016.	2017.	2018.	2019.	2020.
Share in the total number of companies(%)	CRO	24,88	23,85	22,62	20,33	19,74
	EU-average	24,24	23,09	22,80	22,05	21,60
Turnover (in mil.euros)	CRO	28.177	30.046	32.876	34.155	30.703
	EU-average	272.341	280.849	280.767	287.970	277.673
Gross salaries and other fees per employee (in thusands euros)	CRO	12,2	12,8	13,8	14,1	14,3
	EU-average	29,1	29,8	30,3	31,2	31,0

Source: Authors, based on EUROSTAT data

In relative terms, the share of the total number of companies in Croatia is around the EU average and has fallen below the EU average in the last two years observed. Considering the fact that the share of realized turnover in trade has remained stable compared to the EU average over the last three years (around 11%), this could be a consequence of the integration and consolidation of trade companies. The most striking data are gross wages and salaries per employee, which are more than twice as law in Croatia as the EU average, although they are slightly increasing.

Table 3. Financial indicators of companies in trade industry (2016.-2021.)

	2016.	2017.	2018.	2019.	2020.	2021.
Debt coefficient	0,70	0,66	0,72	0,65	0,63	0,60
Return on sales	2,29	2,67	2,72	2,70	2,92	3,91
Return on assets	5,14	5,80	5,41	5,64	5,69	7,30
Return on equity	11,34	12,32	16,49	12,45	11,76	16,23
Liquidity coefficient	1,17	1,21	1,05	1,23	1,33	1,40
Turn-over coefficient of total assets	1,47	1,51	1,56	1,55	1,44	1,57
Receivables collection (number of days)	70	59	53	52	55	49

Source: Authors, based on Croatian Financial agency data

As can be seen, all indicators of the business creditworthiness of trading companies improve in the period under review. Indebtedness decreases, profitability, liquidity and efficiency (turnover coefficient) increase, and consequently the time to collect receivables decreases. The above shows that despite the fact that trade activity in the Republic of Croatia is below the EU average in terms of basic indicators, it has a positive outlook for future development.

4. Data, methodology and empirical results

The sample for the analysis was obtained from the Orbis Europe database, which contains information on companies across Europe. This database was used to collect data on all active companies in Croatia operating in 46 - Wholesale trade and 47 - Retail trade according to NACE 2007. The initial sample consisted of 24,578 companies operating in the period 2016-2021. The final sample comprises 9,660 companies after removing companies with missing values for assets, long-term tangible assets and profitability indicators. Companies with an observation period of less than four years were also excluded from the sample.

4.1 Data and methodology

The analysis of the collected data is based on microeconomic determinants, i.e. variables that are unique to each company and are assumed to influence the capital structure of companies. The dependent variable is debt, i.e. the ratio of total debt to total assets (DEBT). The following independent variables are considered as potential determinants of capital structure: Profitability (ROA), Tangibility (TANG), Growth Opportunity (GROWTH), Non-Debt Tax Shield (NDTS), Current Ratio (CR), Nat Asset Turnover (NAT), Age (AGE), Size (SIZE) and Legal Form (LEGAL). In addition, a macroeconomic determinant of GDP per capita expressed as natural logarithm (LGDP) is used to represent changes in the macroeconomic environment. Table 4 contains the list of variables and their definition.

Table 4. Variable description

	Symbol and type	Definition	Source
	Dependent variable		
DEBT	Debt ratio	(Non-current liabilities + Current liabilities) / Total assets	Authors calculation according to Orbis Europe (OE) data
	Explanatory variables - Firm-specific variables		
ROA	Profitability	(Profit after tax / Total Assets) * 100	Orbis Europe
TANG	Tangibility	(Long-term fixed Assets) / Total assets	Authors calculation according to OE data
GROWTH	Firm growth	(Operating revenue (OR) in current period – OR in the previous period) / OR in the previous period	Authors calculation according to OE data
NDTS	Non-debt tax shield	Depreciation / Total Assets	Authors calculation according to OE data
CR	Current ratio	Current Assets / Current Liabilities	Orbis Europe
NAT	Net assets turnover	Operating revenue / (Shareholders funds + Non current liabilities)	Orbis Europe
Age	Firm age	Year – Incorporation date of a firm	Authors calculation according to OE data

Size	Firm size	Natural logarithm of total assets	Authors calculation according to OE data
Legal status	Dummy variable on legal status of a firm	Three categories: 1. Joint stock companies (reference dummy) 2. Private limited liability companies (d.o.o) 3. Simple limited liability companies (j.d.o.o)	Orbis Europe
Macro variable			
LGDP	GDP per capita	Natural logarithm of gross domestic product per capita	Croatian National Bank

Source: Authors, based on Orbis Europe data

The average debt level is 67,9%, measured by the sum of current and non-current liabilities in relation to total assets, while the average profitability, measured by the return on assets of retail companies, is 6,45%. This is in line with the results for the entire retail sector (Table 3), where the debt ratio is between 60 and 70% in the observed period, while the return on assets is between 5,14 and 7,30%.

Panel data analysis is appropriate method when there are multiple observations for each unit in the sample. In static panel analysis, there are three types of estimators that can be used to estimate the model: 1) the pooled ordinary least squares (POLS) estimator, which has the most limitations but can serve as an introduction to panel analysis, 2) the fixed effects (FE) estimator, and 3) the random effects (RE) estimator. The following model is formulated in accordance with the panel analysis:

$$DEBT_{it} = \alpha + \beta_1 ROA_{it} + \beta_2 TANG_{it} + \beta_3 GROWTH_{it} + \beta_4 NDTS_{it} + \beta_5 CR_{it} +$$
$$+ \beta_6 NAT_{it} + \beta_7 Age_{it} + \beta_8 Size_{it} + \beta_9 Legal_i + \beta_{10} GDP_t + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In addition to the variables listed in Table 4, μ_i stands for the unobserved characteristics of each company (such as training and skills of management and employees, customer perception, supplier relationships, etc.), which are constant over time and specific to each company. λ_t stands for time dummy variables that change over time but are the same for all companies in the observed period, while ε_{it} is the error term. The choice between the fixed effects model and the random effects model is made based on the results of the Hausman test. The estimators are consistent if there is no correlation between the individual characteristics of the observation units and the independent variables (regressors). For large samples, the parameter estimates converge towards the true parameter value, i.e. in this case the estimates of the fixed effects estimator do not differ significantly from the estimates of the random effects estimator. Since the random effects estimator has a lower variance, it is considered more efficient and is used in such situations. However, if the random error component is correlated with an

independent variable, the random effects estimator becomes inconsistent, while the fixed effects estimator remains consistent. In such cases, the fixed effects model is used.

4.2. Empirical results

	(1)	(2)	(3)
DEBT – dependent variable	POLS	RE	FE
ROA	-0.011***	-0.005***	-0.005***
	[-32.448]	[-29.885]	[-25.845]
	(0.000)	(0.000)	(0.000)
TANG	0.090***	0.017	-0.027
	[4.316]	[0.928]	[-1.153]
	(0.021)	(0.019)	(0.023)
GROWTH	0.052***	0.019***	0.018***
	[11.190]	[7.886]	[7.168]
	(0.005)	(0.002)	(0.003)
NDTS	0.472***	0.194***	0.146***
	[5.366]	[3.893]	[2.968]
	(0.088)	(0.050)	(0.049)
CR	-0.029***	-0.014***	-0.012***
	[-35.404]	[-29.668]	[-24.220]
	(0.001)	(0.000)	(0.000)
NAT	0.016***	0.002	-0.002
	[4.258]	[0.650]	[-0.540]
	(0.004)	(0.003)	(0.004)
Age	-0.006***	-0.006***	-0.009***
	[-11.880]	[-10.685]	[-6.622]
	(0.000)	(0.001)	(0.001)
Size	-0.053***	-0.071***	-0.082***
	[-15.997]	[-13.913]	[-7.610]
	(0.003)	(0.005)	(0.011)
Legal (d.o.o.)	-0.211**	-0.307***	
	[-1.994]	[-2.688]	
	(0.106)	(0.114)	
Legal (j.d.o.o.)	-0.292***	-0.374***	
	[-2.680]	[-3.152]	
	(0.109)	(0.119)	
LGDP	0.050**	0.014	0.071***
	[2.059]	[0.676]	[4.715]
	(0.024)	(0.021)	(0.015)
Constant	0.883***	1.402***	0.672***
	[3.593]	[6.828]	[5.105]
	(0.246)	(0.205)	(0.132)
Time dummies	Yes	Yes	Yes
Number of firms	9,660	9,540	9,540
Number of observations	42,290	42,290	42,290
F-test	27,91***		
Hausman test (chi-square)		1288,35***	

The justification for using the fixed-effects model was tested with an F-test, which determined that the FE estimator is more appropriate than the POLS estimator. The null hypothesis, which assumes that the fixed effects of all observed units are the same, was rejected, indicating that the observed units do not share the same constant term. In addition, the Breusch-Pagan-Lagrange multiplier test showed that the RE estimator is more appropriate than the POLS estimator. Finally, based on the Hausman test, it was concluded that the FE estimator is more appropriate than the RE estimator, and thus the estimates of the fixed effects model are interpreted. As the presence of heteroscedasticity is confirmed, model is presented with corrected standard errors using White's heteroscedasticity-corrected variances and standard errors.

All determinants, with the exception of long-term tangible assets, measured by the share of tangible assets in total assets (TANG) and the turnover ratio (NAT), are significant determinants of the capital structure. The profitability of companies (ROA), measured by the profitability of total assets, has a negative impact on leverage, because of generating their own funds. High and stable profits allow for significantly higher retained earnings, which can be used to finance the company's activities (Pecina 2018). According to the pecking order theory (theory of the hierarchy of financial choices), managers favour financing projects first from retained earnings, then with debt and finally by issuing hybrid securities and ordinary shares. The growth potential of companies (GROWTH) has a positive impact on leverage. Companies that are aiming for growth require more funds, and in the absence of sufficient internal funds, they resort to borrowing. According to the pecking order theory, it can be assumed that companies with higher growth potential have a higher leverage ratio. These are often young companies with high growth potential whose own funds are not sufficient to finance the desired projects. In order to avoid abandoning projects, which would hinder development, they turn to external financing. Non-debt tax shields (NDTS), measured as the ratio of depreciation to total assets, also have a positive impact on the debt ratio, which is contrary to expectations. A negative impact was expected, as depreciation provides tax shields without increasing financial distress, and most research is consistent with this expected sign. The current liquidity ratio (CR), measured by the ratio of current assets to current liabilities, has a negative impact on the leverage ratio. More liquid companies have a higher free cash flow and

consequently need to borrow less. In addition, liquidity reduces the likelihood of financial disruptions, lowers their costs and increases the company's ability to borrow. The age of a company (Age) is a significant variable, with a negative impact on leverage, which means that older companies are less leveraged than younger ones. It can be assumed that older companies have more equity than young or newly established companies. This supports the fact that younger companies are more dependent on external financing due to less equity generated. The impact of company size (Size), on leverage is negative, i.e. larger companies with more assets are less leveraged than smaller companies. The negative effect of company size on leverage can be explained by the higher profits of larger companies and their lower need for borrowing compared to smaller companies. Company size is also related to profitability, as the negative impact of profitability on the leverage ratio is stronger with increasing company size. Gross domestic product (GDP) per capita has a positive impact on the capital structure. In times of economic growth, companies are more leveraged, which can be explained by the greater willingness of banks to lend to companies, as the likelihood of financial distress is lower in prosperous times. In addition, economic growth offers companies more investment opportunities and projects, which leads to a greater need for loans. The impact of the legal form of the company is not shown in FE model because the fixed effects estimator cannot estimate the effects of variables that are constant over time.

5. Conclusion

Trade activity is subject to numerous microeconomic and macroeconomic influences, which were confirmed in the analysed period from 2016 to 2021. These influences include economic instability caused by the trend of slowing global economic growth, the slowdown in international trade, high levels of debt, deflationary pressures and other crises. All of the aforementioned facts support first research hypothesis that the development of trade activity in the Republic of Croatia is below average compared to the countries of the European Union.

After conducting the empirical analysis, the results are consistent with the pecking order theory. In line with second research hypothesis profitable companies generate their own funds and thus reduce the need for loans. Companies seeking growth need more funds and in the absence of sufficient internal funds they resort to borrowing, which is also consistent with pecking order theory. More liquid companies have more free cash flow and therefore need to borrow less. Older companies borrow less because they have more equity than young or newly founded companies. In addition, younger companies are more dependent on external financing than large

companies due to the lower equity generated. When the economy is growing, companies engage more loans due to favourable conditions, which stimulates more investments and projects and leads to more borrowing to finance them.

References

Ali S, Rangone A & Farooq M. (2022). Corporate Taxation and Firm-Specific Determinants of Capital Structure: Evidence from the UK and US Multinational Firms. *Journal of Risk and Financial Management*. 2022; 15(2):55. https://doi.org/10.3390/jrfm15020055

Czerwonka, Leszek & Jaworski, Jacek. (2022). Capital structure and its determinants in companies originating from two opposite sides of the European Union: Poland and Portugal. *Economics and Business Review*. 8. 24−49. 10.18559/ebr.2022.1.3.

Alipour, Mohammad & Sadigh Mohammadi, Mir Farhad & Derakhshan, Hojjatollah. (2015). Determinants of capital structure: An empirical study of firms in Iran. *International Journal of Law and Management*. 57. 53−83. 10.1108/IJLMA-01-2013-0004.

Antoniou, Antonios & Guney, Yilmaz & Paudyal, Krishna. (2008). The Determinants of Capital Structure: Capital Market-Oriented Versus Bank-Oriented Institutions. *Journal of Financial and Quantitative Analysis*. 43. 59−92. 10.1017/S0022109000002751.

Arribas, Iván, Tortosa-Ausina, Emili & Zhu, TingTing (2021). Optimal capital structure, model uncertainty, and European SMEs, No. 11, Working Papers, Economics Department, Universitat Jaume I, Castellón (Spain), https://EconPapers.repec.org/RePEc:jau:wpaper:2021/11.

Eurostat, European Commission, online: https://ec.europa.eu/eurostat

Fina Info.BIZ, https://infobiz.fina.hr/serviceinfo

FINA, Consolidated Financial Statements for the Trade sector in the period from 2016 to 2021.

Haji, A. (2020). Capital Structure Determinants of European Union firms: Comparison analysis between euro area members and non-members, Radboud Univerasity, Faculteit der Managementwetenschappen, https://theses.ubn.ru.nl/handle/123456789/10648 (assesed 10.06.2024)

Harc, M. (2019). Capital Structure of Small And Medium-Sized Enterprises in the Republic of Croatia. *Poslovna izvrsnost*, 13 (1), 87−101. https://doi.org/10.22598/pi-be/2019.13.1.87

Pecina, E. (2018). Oblikovanje strukture kapitala i identifikacija ograničenja financiranja hrvatskih poduzeća, Orsag, Silvije (menthor); Zagreb, Ekonomski fakultet, Zagreb.

Serrasqueiro, Z. & Matias, F. & Salsa, L. (2016). Determinants of capital structure: New evidence from Portuguese small firms. Dos Algarves: A Multidisciplinary e-Journal. 13−28. 10.18089/DAMeJ.2016.28.1.2.

CAN WE MEASURE HOW FAR IS A JUST ENERGY TRANSITION?

Yiannis Karagiannis[1], Konstantinia Nikolaidou[2], Despoina Kanteler[3], Lefteris Topaloglou[4]

Abstract

The purpose of this paper is an effort to delve into measuring the fairness of Just Energy Transitions. In the literature review, we present the state of the art in measuring just energy transition processes, by investigating and analysing all the relevant indices and indicators. Furthermore, we assign each of the criteria used to create these indices to the appropriate justice dimension. The principles that we consider relevant are the recognitional, distributive, procedural, restorative and cosmopolitan dimension of justice. The next step is to survey a panel of experts on which of the previous collected and categorised criteria are fundamental to describe and measure each justice dimension. Our focus is to select criteria that are relevant to the EU27 countries' current socioeconomic and environmental state. The main pool of criteria comes from the indicator set that is used by Eurostat to monitor the EU27 progress in achieving the Sustainable Development Goals that were established by the United Nations. The central result of our endeavour is to produce a set of criteria to evaluate each justice dimension in the context of a just energy transition process. This result, we conclude, makes a positive contribution to determine the fairness of Just Energy Transitions.

---

[1] Department of Chemical Engineering, University of Western Macedonia, ZEP P.C. 50100, Kozani, Greece, i.karagiannis@uowm.gr

[2] Department of Chemical Engineering, University of Western Macedonia, ZEP P.C. 50100, Kozani, Greece, k.nikolaidoy@uowm.gr

[3] Department of Chemical Engineering, University of Western Macedonia, ZEP P.C. 50100, Kozani, Greece, d.kanteler@uowm.gr

[4] Department of Chemical Engineering, University of Western Macedonia, ZEP P.C. 50100, Kozani, Greece, etopaloglou@uowm.gr

Keywords: fairness, just energy transition, measuring, Sustainable Development Goal

1. Introduction

Climate change, (Rockström et al., 2009), and the need for sustainability in energy production have sped up the transition to renewable energy usage. According to the International Energy Agency, (IEA, 2023), on the global scale, the energy production from clean renewable energy sources (hydro, solar, wind) has doubled between 2010 and 2020, from 2.5% to 5%. This energy transition process, interlinked with the notion of justice, forms the concept of just energy transition (JET), which can be described in simple terms, (García-García et al., 2020), as the transition towards low carbon or even decarbonised energy production systems protecting social justice, equity and welfare.

In order to measure the fairness of a transition process, we should employ a theoretical framework. The fundamental tenets of justice could serve as essential components in an integrated theoretical framework (Wang & Lo, 2021). This framework conceptualises energy justice, (Heffron & McCauley, 2017; Sovacool & Dworkin, 2015), together with environmental and climate justice, into the following principles - dimensions, (McCauley et al., 2019; Sovacool et al., 2019): (a) distributive: equitable distribution of social and economic benefits and costs, fair and open access, (b) procedural: adherence to due process, fair and adequate public participation, inclusion and consent, (c) restorative: prevent and correct people/society/environmental impacts, (d) recognition: appreciation for the vulnerable, marginalized, poor, or otherwise under-represented groups, and (e) cosmopolitan: protection of global human rights, accounting and mitigation of global externalities.

The usage of these five justice dimensions as a research tool to assess the impact of energy transitions has grown significantly, (Heffron et al., 2024), the last ten years.

2. Literature review

In the energy justice literature, a multitude of methodologies, indices and indicators appeared in the previous years with their main characteristic being their effort to assess the impact of low carbon transitions. Siksnelyte-Butkiene, 2021, narrows the research to energy poverty and identifies 43 publications assessing it. Using this publication as a starting point for our research and by extending the scope to the five justice dimensions previously described, (McCauley et al., 2019; Sovacool et al.,

2019), we identified 21 indicator sets that can be used in assessing JET processes.

Table 1, summarises the results of our research, showing only 8 of the most important indicator sets that contribute to more than one justice dimension and contain criteria useful in assessing the impact of JET processes. For each one of these indicator sets we provide an estimate of the justice dimensions that it can assess, based on the categorisation of their variables.

Table 1. A collection of indicator sets for measuring the impact of JET processes

Indicator set	Justice dimensions	Indicator categories	Sources
SDG Index - Sustainable Development Report	distributive justice; procedural justice; restorative justice; recognition justice; cosmopolitan justice	17 Sustainable Development Goals	(Lafortune et al., 2018)
Transitions Performance Index	distributive justice; procedural justice; restorative justice; recognition justice	economic transition; social transition; environmental transition; governance transition	(European Commission et al., 2022)
Leave-No-One-Behind Index	distributive justice; procedural justice; recognition justice	extreme poverty and material deprivation; access to and quality of services; gender inequality; income inequality	(Lafortune et al., 2024)
European Social Progress Index	distributive justice; procedural justice; restorative justice; recognition justice	basic human needs; foundations of wellbeing; opportunity	(European Commission et al., 2020)
Beyond GDP	distributive justice; procedural justice; restorative justice; recognition justice; cosmopolitan justice	Health; economic development; human capital; climate neutrality; governance that delivers	(European Commission et al., 2023)
Just Energy Investment Index	distributive justice; procedural	distributive justice; procedural	(Heffron et al., 2024)

		justice; restorative justice; recognition justice; cosmopolitan justice	justice; restorative justice; recognition justice; cosmopolitan justice	
EU Indicators	SDG	distributive justice; procedural justice; restorative justice; recognition justice; cosmopolitan justice	17 Sustainable Development Goals	(European Commission & Eurostat, 2022)

Source: Own elaboration.

3. Methodology

An online questionnaire was created, with 2 main questions, for each of the 17 Sustainable Development Goals (SDGs), addressing the following questions: First, do the measuring indicators of the SDG, contribute to measuring the impact of "Just Energy Transition" processes? Answer range: between 0 (total disagreement) and 10 (total agreement). Second, define your agreement to the statement whether this SDG has important contribution to each one of the five dimensions of justice: distributive, procedural, restorative, recognition and cosmopolitan. Answer range: a 5-point Likert scale.

Each SDG was accompanied by an explanatory text containing a set of indicators used to measure it, as a way to help the experts in expressing their opinion in the first question. As for the second question, which is even more theoretical than the first one, a short description of each of the five justice dimensions was added after the question.

The link to the online questionnaire was distributed to two distinct groups of experts in Western Macedonia Region, Greece, which is a region under transition to a post-lignite era. The first group consisted of 8 academics and researchers that have major experience in studying Just Energy Transition processes and the second group of 10 business sector experts who have extensive involvement in local and regional development, urban and rural planning, and enterpreneurship support.

Since the number of responses is very small, 18 total, we employed only very basic statistical methodologies to process the results and avoided any methodologies that expect the data to have normal distribution. We used descriptive statistics and boxplots for graphic visualisation to reveal the distribution, central tendency and variability of the variables involved.

4. Results

Our first task was to investigate what is our experts' opinion about the contribution of the measuring indicators of each SDG to measuring the impact of Just Energy Transition (JET) processes. Fig. 1, shows that our experts consider SDGs 7 – Affordable and clean energy and 13 – Climate action, the SDGs with the most appropriate indicators to measure the impact of JET processes. The median value is 10 and the dispersion is very small (interquartile range-IQR is 1 and the total range is 2). A second group of SDGs with indicators well suited, according to our experts, to measure the impact of JET processes includes SDGs 1 – No poverty, 9 – Industry, innovation and infrastructure, 8 – Decent work and economic growth, 10 – Reduced inequalities, 11 – Sustainable cities and communities, 17 – Partnerships for the goals and 12 – Responsible consumption and production. The SDGs in this second group have median values between 8 and 9 and relatively small dispersion, IQ less than 2.5. For the rest of the SDGs the experts' opinion is inconclusive. Although the median values are between 5 and 7 the range of the answers covers all the answer domain (0-10) and the IQR is equal or more than 3.
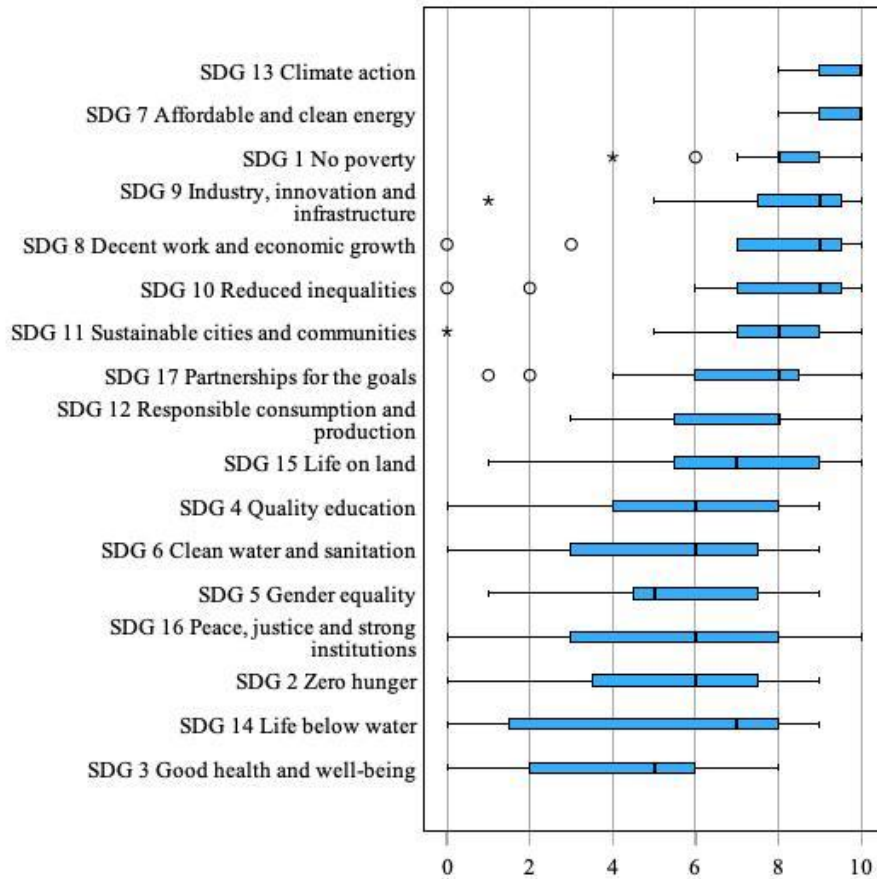
Figure 1. Boxplots of the responses to whether the measuring indicators of each SDG contribute to measuring the impact of "Just Energy Transition" processes. Source: Own elaboration

In order to investigate further whether the respondent's position in the quadruple helix plays a role in their views concerning the ability of the SDGs indicators to measure the impact of JET processes, we developed Fig. 2. This figure shows boxplots of the 17 SDGs partitioned by the respondent's position in the quadruple helix, academic / research and business sector in this case. The academic / research experts consider the indicators of the SDGs belonging in the third group to be less important in measuring JET processes than the business sector experts, the corresponding median values are smaller. The answers provided by the business sector experts have smaller dispersion for all the SDGs, except for 5 – Gender equality and 17 Partnerships for the goals. They also consider the indicators of SDG 4 – Quality education, to be more instrumental in measuring JET processes.
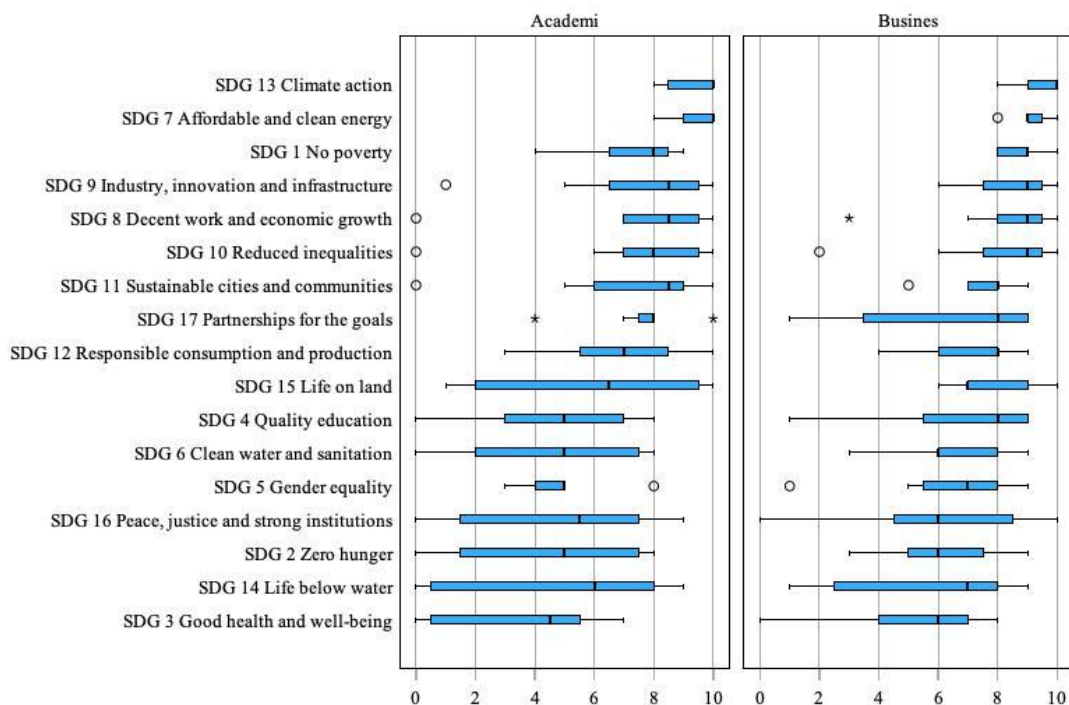
Figure 2. Helix position breakdown of the responses to whether the measuring indicators of each SDG contribute to measuring the impact of "Just Energy Transition" processes. Source: Own elaboration.

Summing up the previous analysis, the SDGs, according to our experts, can be ranked by their importance and relevance in measuring JET processes, as it is shown in Table 2.

Table 2. SDG grouped by experts' ranking whether their measuring indicators can contribute to measuring JET processes

Group 1	Group 2	Group 3
SDG 7. Affordable and clean energy	SDG 1. No poverty	SDG 15. Life on land
SDG 13. Climate action	SDG 9. Industry, innovation and infrastructure	SDG 4. Quality education
	SDG 8. Decent work and economic growth	SDG 6. Clean water and sanitation
	SDG 10. Reduced inequalities	SDG 5. Gender equality
	SDG 11. Sustainable cities and communities	SDG 16. Peace, justice and strong institutions
	SDG 17. Partnerships	SDG 2. Zero hunger

|	
for the goals	
SDG 12. Responsible consumption and production	SDG 14. Life below water
	SDG 3. Good health and well-being

Source: Own elaboration.

Our next step involves researching the results about the experts' opinion in the contribution of each SDG to the five justice dimensions, namely distributive, procedural, restorative, recognition and cosmopolitan. In Fig. 3, we visualise all the SDGs where our experts' opinions are inconclusive for at least one of the five justice dimensions. The 5-point Likert scale is quantified as follows: 1 – strong disagreement, 2 – disagreement, 3 neither disagreement nor agreement, 4 – agreement, 5 – strong agreement. The cells show the median value together with a checkmark icon if the value is greater than 3.5 (agreement) or an exclamation mark if it is between 2.5 and 3.5 (inconclusive). We can observe that, according to the results, only goal's "3 – Good health and well-being" contribution to all five justice dimensions is inconclusive. On the other hand, SDGs "7 – Affordable and clean energy", "8 – Decent work and economic growth", "9 – Industry, innovation and infrastructure", "10 - Reduced inequalities", "11 – Sustainable cities and communities", "13 – Climate action", "15 – Life on land" and "17 – Partnerships for the goal", which do not show up on Fig. 3, contribute to all five of the justice dimensions, according to our experts..

Sustainable development goals	Justice dimension				
	Distri-butive	Proce-dural	Resto-rative	Reco-gnition	Cosmo-politan
SDG 1 No poverty	✅ 4.00	🔶 3.00	✅ 4.00	✅ 4.00	🔶 3.00
SDG 2 Zero hunger	✅ 4.00	🔶 3.00	✅ 4.00	🔶 3.00	🔶 3.00
SDG 3 Good health and well-being	🔶 3.00	🔶 3.00	🔶 3.00	🔶 3.00	🔶 3.00
SDG 4 Quality education	✅ 4.00	✅ 4.00	🔶 3.00	✅ 4.00	✅ 4.00
SDG 5 Gender equality	✅ 4.00	✅ 4.00	🔶 3.00	✅ 4.00	✅ 4.00
SDG 6 Clean water and sanitation	✅ 4.00	✅ 4.00	✅ 4.00	✅ 4.00	🔶 3.00
SDG 12 Responsible consumption and production	✅ 4.00	✅ 4.00	✅ 4.00	🔶 3.00	🔶 3.00
SDG 14 Life below water	🔶 3.00	✅ 4.00	✅ 4.00	🔶 3.00	✅ 4.00
SDG 16 Peace, justice and strong institutions	🔶 3.00	✅ 4.00	🔶 3.00	✅ 4.00	✅ 4.00

Figure 3. Experts' opinion on SDGs' contribution to the five justice dimensions. Source: Own elaboration.

In Fig. 4, we use a scatterplot to examine the correlation between the SDGs contribution to JET impact measuring and their contribution to each one of the five justice dimensions. It is obvious that there is a positive correlation between these five pairs of variables. As the value of contribution to JET processes measuring rises so does the contribution to each one of the five justice dimension. The most positive correlation is with the distributive, procedural and restorative justice dimensions.
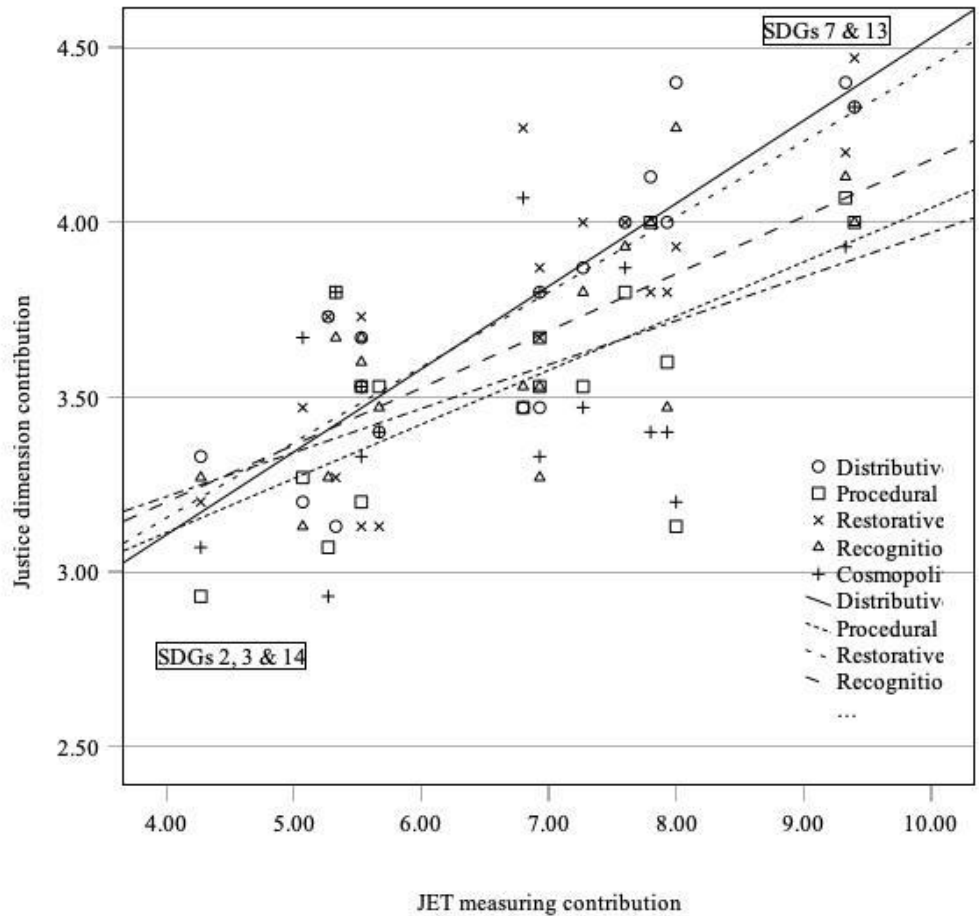
Figure 4. Scatterplot of every SDGs JET measuring contribution with their contribution to each one of the five justice dimensions. Source: Own elaboration.

3. Conclusion

As we have seen in the previous section there is a broad consensus between experts, from the academia/research and business sector alike, that the indicators used to measure most of the sustainable development goals' can be used to measure the transition to low carbon usage. It appears that the academia / research experts' responses have larger dispersion than those of the business sector experts. Follow-up research could be on the views of the other two sections of the quadruple helix, policy and society sector. The next step of the research, should dive on a much more detailed level, investigating whether specific indicators, not only goals, are the appropriate criteria on measuring low carbon transitions.

Since the opinions of the experts that participated in the current research agree on the positive correlation between the SDGs contribution to JET processes impact measuring and their contribution to the five justice dimensions, especially distributive, procedural and restorative justice, we can conclude that there exists ample evidence that the fairness of JET processes' is measurable.

Acknowledgment

References

European Commission, Annoni, P., & Bolsi, P. (2020). *The regional dimension of social progress in Europe: presenting the new EU social progress index*. https://data.europa.eu/doi/10.2776/288544

European Commission, D.-G. for R., Innovation, Vladimirov, M., Gerganov, A., & Petrova, V. (2023). *Developing alternative visions for assessing progress to sustainable development 'Beyond GDP': constructing new measurement indicator sets*. https://data.europa.eu/doi/10.2777/888071

European Commission, & Eurostat. (2022). *Sustainable development in the European Union: monitoring report on progress towards the SDGs in an EU context: 2023 edition*. https://data.europa.eu/doi/10.2785/403194

European Commission, Prevost, S., Benavente, D., & Stevenson, A. (2022). *Transitions Performance Index 2021: Towards Fair and Prosperous Sustainability*. Publications Office of the European Union. https://doi.org/10.2777/09602

García-García, P., Carpintero, Ó., & Buendía, L. (2020). Just energy transitions to low carbon economies: A review of the concept and its effects on labour and income. *Energy Research & Social Science*, *70*, 101664. https://doi.org/10.1016/J.ERSS.2020.101664

Heffron, R. J., & McCauley, D. (2017). The concept of energy justice across the disciplines. *Energy Policy*, *105*, 658–667. https://doi.org/10.1016/J.ENPOL.2017.03.018

Heffron, R. J., Merdekawati, M., Suryadi, B., & Yurnaidi, Z. (2024). Defining a 'just energy investment' for the ASEAN energy sector. *Environmental and Sustainability Indicators*, 100367.

IEA. (2023, December 31). *Energy Statistics Data Browser*. https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser

Lafortune, G., Fuller, G., Kloke-Lesch, A., Koundouri, P., & Riccaboni, A. (2024). *European Elections, Europe's Future and the SDGs: Europe Sustainable Development Report 2023/24*. SDSN and SDSN Europe and Dublin University Press. https://doi.org/10.25546/104407

Lafortune, G., Fuller, G., Moreno, J., Schmidt-Traub, G., & Kroll, C. (2018). *SDG Index and Dashboards. Detailed Methodological paper*.

McCauley, D., Ramasar, V., Heffron, R. J., Sovacool, B. K., Mebratu, D., & Mundaca, L. (2019). Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research. *Applied Energy*, *233–234*, 916–921. https://doi.org/10.1016/j.apenergy.2018.10.005

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., … Foley, J. A. (2009). A safe operating space for humanity. *Nature*, *461*(7263), 472–475. https://doi.org/10.1038/461472a

Siksnelyte-Butkiene, I. (2021). A systematic literature review of indices for energy poverty assessment: A household perspective. *Sustainability (Switzerland)*, *13*(19). https://doi.org/10.3390/su131910900

Sovacool, B. K., & Dworkin, M. H. (2015). Energy justice: Conceptual insights and practical applications. *Applied Energy*, *142*, 435–444. https://doi.org/10.1016/j.apenergy.2015.01.002

Sovacool, B. K., Martiskainen, M., Hook, A., & Baker, L. (2019). Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions. *Climatic Change*, *155*(4), 581–619. https://doi.org/10.1007/s10584-019-02521-7

Wang, X., & Lo, K. (2021). Just transition: A conceptual review. *Energy Research & Social Science*, *82*, 102291. https://doi.org/10.1016/J.ERSS.2021.102291

About the publisher

The Faculty of Economics - Prilep is a member of the University "St. Kliment Ohridski" – Bitola. The Faculty of Economics – Prilep is divided in Departments embracing a range of related disciplines that enables successful implementation of the teaching and applicative activities, as well as the scientific research. The departments mainly cover issues regarding development of the study programmes, teaching and research work and other administrative activities. The Faculty of Economics - Prilep comprises the following five departments: Management, Marketing and Business; Economics and development; Accounting, finance and audit; International economics and Business informatics. The research activities in the Faculty of Economics - Prilep are organised by the Research Centre as a separate organisational unit. The Centre has played a key role in the preparation and realisation of several international conferences on various subjects. In addition, the members of the Centre have participated in a number of international projects, the main goal of which is implementing reforms in the higher education. The Faculty of Economics - Prilep was a coordinator in some of these projects, whereas in others it was a partner together with other institutions from South-Eastern Europe and the European Union. Therefore, the Faculty of Economics - Prilep has developed itself into a modern higher education institution which represents an example of successful promoter of knowledge in the region of South-Eastern Europe