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EDITORIAL

We hereby inform the domestic and foreign academic community that the *Economic Horizons* scientific journal, which is published by the Faculty of Economics of the University of Kragujevac, has been ranked into the Q3 Category on the *SJR* (SCImago Journal Rank) List for the year 2022. The Journal has been referenced in the Scopus Base since October 2020.

After the double-blind peer review process was carried out, Issue 2 Volume 25 Year 23 of the *Economic Horizons* scientific journal contains four original scientific papers, two review papers and Acknowledgement to the reviewers of the manuscripts submitted to the Editorial Board of the Journal in the year 2022.

Starting from the fact that a large number of the states in the Sub-Saharan African region have been faced with extremely high inequality in income distribution, the author *Ibrahim Abidemi Odusanya* applies the Generalized Method of Moments so as to examine the way in which economic growth exerts an influence on income distribution in these economies. The results obtained in the research study are indicative of the fact that there is an inverted-U relationship between economic growth and income inequality. Apart from said, the results also confirm the interplay of growth and inequality, which can be presented using the S-shaped curve. The author concludes that in no way does the pronounced acceleration (spurts) in some years bring about diminution in income distribution disproportion in Sub-Saharan Africa.

Appreciating the attitude that the public governance quality is of a key importance to boosting economic growth, the coauthors *Nabil Alimi* and *Lassad Ben Dhiab* investigate the effects of governance performances, both taken together and as per individual components (corruption control, government efficiency, political stability) on economic growth in 48 developing countries during the period from 2002 to 2020. The conducted empirical analysis based upon the panel threshold regression model indicates the fact that the quality of public governance has an asymmetric (nonlinear) effect on economic growth. The direction of this influence, however, is all but expected: the results of the analysis show that the improvement of public governance in the developing countries obstructs economic growth, which is explained by the fact that, in order to raise the quality of governance, numerous resources otherwise capable of directly supporting faster economic growth need to be engaged.

Doing research in the effects of changes in income tax on the unemployment rate in the Unites States of America, the coauthors *Tuan Viet Le* and *Kyle Elliott* apply different panel regression models to indicate the presence of the positive dependence of these variables. To be more precise, an increase in natural persons' income tax, as well as an increase in corporation profit tax in the 50 American states during the period from 2006 to 2022, leads to a rise in the unemployment rate, whereas a decrease in income tax correlates with a fall in the unemployment rate. The key implication of the obtained research results reflects in the presence of a tradeoff which economic policymakers are being faced with. Namely, an increase in income tax brings about greater public income for funding different programs, but simultaneously increases unemployment. On the other hand, a reduction in the unemployment rate under the given conditions requires a reduction in income tax, thus reducing public income at the same time. The paper ends with a conclusion that directing tax income towards improving education and the infrastructure, which may attract new companies and provide support to the development of local enterprises and simultaneously also increase employment opportunities, is of key significance.

Endeavoring to investigate the connection between interest rate dynamics and the foreign exchange rate in China at the time of the breakout and expansion of the influence of the COVID-19 pandemics, the coauthors

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Muntazir Hussain, *Irfan Saleem* and *Usman Bashir* apply detrended cross-correlation to carry out an analysis of the data on a daily basis during the period from early 2019 to mid-2021. The results of the econometric analysis point to the presence of a positive cross-correlation between the interest rate and the foreign exchange rate in China, which was extremely weak at the beginning of the period of observation, only to be growing stronger and stronger over time. The growth of the interest rates is interpreted as the response made by the monetary authorities to the growth of the foreign exchange rate. Further analysis made in the paper, however, leads to the conclusion that the conventional approach to the monetary policy, according to which higher interest rates are established with the aim of defending the foreign exchange rate, can prove to be as an insufficiently good solution during pandemic-induced crises.

The coauthors *Edvard Jakopin* and *Aleksandar Gračanac* used a detailed overview of the structural performances of the economy of the Republic of Serbia, with the focus on the period after the COVID-19 pandemic-induced global recession of 2020, to point to a series of the structural issues that have remained "in the shadow" of the relatively high economic growth in the post-crisis year 2021. Having compared the macroeconomic indicators in the Republic of Serbia with the selected developed and transition economies during a longer period of time, the coauthors came to the following conclusions: every recession has the growth of the public debt as a consequence; productivity convergence in transition economies towards average productivity in the European Union's economies was faster in the years when the gross domestic product growth exceeded employment growth; investments had the key influence on economic growth in the Republic of Serbia during the periods from 2001 to 2005 and from 2015 to 2021. Supplementing the analysis with the presentation and interpretation of the indicators of the sectoral structure and the business operations of enterprises, the coauthors emphasize the fact that the sectors of the future are one of the main drivers of economic growth and that foreign companies in the Republic of Serbia have significantly contributed to the improvement of the qualitative performances of the economy. The general conclusion implies that sustainable economic growth in the Republic of Serbia is not possible without an accelerated implementation of structural reforms.

Examining the influence of the COVID-19 pandemic on the household savings volume in Republic of Slovenia's banks, the coauthors *Malči Grivec* and *Srečko Devjak* identify the macroeconomic variables whose effect on the savings dynamics is statistically significant. Among the considered variables, the EONIA reference interest rate and the price of the Bitcoin as the indicator of return on alternative investment forms had a statistically significant influence on savings during the period from June 2018 to December 2021. The coauthors came to the conclusion that the COVID-19 pandemic had led to a significant increase in the deposit volume in Slovenian banks and that the trend was present throughout the period of observation as well.

On behalf of the Editorial Board of the Journal and on my own behalf, I hereby express my gratitude to the authors of the contributions published in this Issue of the Journal. At the same time, my special gratitude goes to the reviewers whose constructive and critical comments and suggestions given to the authors of the submitted contributions have contributed to raising the level of the quality of the published papers.

Issue 2 Volume 25 Year 2023 contains the Acknowledgement to the reviewers of the manuscripts submitted to the Editorial Board of the Journal in the year 2022, of which those positively reviewed in the double-blind review process were published as the original scientific and review papers in the issues 1, 2 and 3, Volume 24, Year 2022 of the Journal.

The publishing of the *Economic Horizons* is financially supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, Decision No.: 451-03-316/2023-03, as of 7th June 2023.

Editor-in-Chief
Milena Jakšić

Milena Jakšić is a full professor teaching at the Faculty of Economics of the University of Kragujevac. She earned her PhD degree at the Faculty of Economics of the University of Kragujevac in the narrow scientific field of general economics and economic growth. The key areas of her scientific and research interests are the financial system, financial markets, financial instruments and financial institutions.

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THE EFFECT OF ECONOMIC GROWTH ON INCOME INEQUALITY IN SUB-SAHARAN AFRICA

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In this paper, the way in which economic growth influences income distribution is examined with a focus on Sub-Saharan Africa (SSA). Despite considerable growth in a number of the SSA countries, the region has been slow in reversing the rising trend of income inequality. A large proportion of countries in the region globally rank among economies with extreme income inequality. The study covers a period from 1995 to 2015, due to the limited data on the measure of income inequality, the Gini index, for the largest number of the countries of the region. The Generalized Method of Moments (GMM) system was employed in examining this paradox. The findings of this research study do not only suggest the presence of an inverted-U relationship between economic growth and income inequality, but the supposition of the S-shaped curve hypothesis in the interplay of growth and inequality was also tested and confirmed. It can be concluded that in no way do spurts in economic growth bring about diminution in income disproportion in Sub-Saharan Africa.

Keywords: economic growth, generalized method of moments, income distribution, Kuznets hypothesis, Sub-Saharan Africa

JEL Classification: C23, D33, F43, N47

INTRODUCTION

The discourse on income inequality and its defining implications has remained topical (Wong & Ribeiro, 2017), drawing the attention of economists and policymakers across regions throughout the world. Studies on the income inequality - growth nexus are mainly classified into two categories: the studies on how economic growth influences income inequality, on the one hand, and the studies assessing how income disparities exert an influence on growth, on the other. The first category of studies generally focus on the conventional tradeoff between expanding growth and plummeting inequality in line with the seminal work done by S. Kuznets in 1955, whereas the other strand relies on the framework of N. Kaldor's examination of the reverse effect of income inequality on growth. Subsequently, a bigger chunk of the extant empirical literature on the growth - inequality nexus rather focuses on the effect of income disparities

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on growth. Notable studies on the effect of growth on income distribution are not consensual in their findings. Some studies find economic growth to exert a positive influence on income inequality, whereas other studies report the presence of the negative effect of economic growth. There are but few studies that report the U-shaped relationship between growth and inequality in contrast to the general Kuznets inverted U-shaped curve. There is also the emerging evidence of the S-shaped relationship, whereas few other studies deduce that the effect could be mixed. It is also contended that the Kuznets hypothesis is more often disproved than confirmed (Lyubimov, 2017). This controversy in findings provides an impetus for the current empirical investigation. Perceptibly, the effect of economic growth on income inequality in SSA remains dimly discerned.

The interest in Sub-Saharan Africa demonstrated in this paper is pertinent indeed. The region shows to be characterized by a consistent and intriguing feature of rising income inequality amidst spurts in economic growth. The regional growth rate in SSA fluctuated between 3.37 percent in 1995 and 2.82 percent in 2015. In 2002, it reached a record rate of 6.34 percent and slumped to 3.04 percent in 2009. It rose to 5.58 percent in 2010, whereas in 2014, it stood at 4.66 percent (World Bank, 2018). Despite the robust and rapid economic growth achieved by many countries in Sub-Saharan Africa, income distribution has remained largely inequitable. In the last two decades, many Sub-Saharan African countries, including Rwanda, Nigeria, and Ethiopia, have witnessed unprecedented growth in their economies, achieving an impressive annual growth rate well above the global average (Fuje & Yao, 2022). Even with this remarkable expansion in economic activities, a very large proportion of people are still living in abject poverty, with a very negligible proportion of the population gaining riches, underscoring the magnitude of disproportionateness in income distribution in the region. The level of variations in income distribution is not only extremely high but continues to grow. The facts pertaining to the depth of income inequality in the region revealed that the incomes of the bottom 50% were roughly 30 times lower than those of the top 10%, simultaneously depicting the highest gap between these income groups globally (Chancel, Cogneau, Gethin & Myczkowski, 2019). The countries hit the worst include Nigeria, Ethiopia, Botswana, Zambia, even South Africa, the only G-20 member country in the region (Ighobor, 2018). The significant diminution recorded in regional income inequality prior to 2010 is fast being eroded, casting doubt on the gains of recent spurts in growth.

Owing to the foregoing views, this paper offers an empirical insight into the implications of growth in the economy for income inequality in the SSA region. The examination of the effect of economic growth on income inequality is also expedient in the quest of Sub-Saharan African countries in achieving the goal 10 of plummeting inequality within and among the nations under the Sustainable Development Goals (SDGs) by the year 2030. The achievement of this target seems to be unrealistic if the trend of income inequality in the region persists. Thus, the main research hypothesis in this study is as follows:

H1: Economic growth does not have a significant effect on income inequality in Sub-Saharan Africa.

Theoretically, the study mainly relies on the Kuznets inverted-U hypothesis and the conjecture of the S-curve relationship between growth and inequality. The Blundell-Bond System Generalized Method of Moments (GMM) was applied to the data on income inequality (the Gini index) for 31 SSA economies in the period from 1995 to 2015. The evidence was found that economic growth was the key factor determining gaps in income distribution in the SSA region. Apart from the introductory section, this paper also has five other sections. In the second section, a review of the relevant studies is presented. Section Three focuses on the methodology and data. In Section Four, the results and discussion are presented. The fifth section contains the conclusions of the paper.

REVIEW OF RELEVANT STUDIES

S. Kuznets (1955) analyzed a nonlinear quadratic relationship between growth and income inequality

using data on England, US, and Germany, only to find the presence of an inverted-U relationship between economic growth and income inequality. Since the seminal work done by S. Kuznets (1955) on the effect of economic development on income inequality, a number of authors have empirically investigated the link for different economies, the outcomes they have come to being of a conflicting nature. There are strands of the literature contending that the Kuznets hypothesis may not be sufficient in explaining variations in income inequality over time or across countries (Barro, 2000). This is amidst the views that economic growth tends not to have any distributional effects at all (Charles-Coll, 2010), while income inequality seems to depend more on the type of growth and institutions, not merely on the stage of the growth of the economy. The findings of these studies showed that the impact of economic growth on income inequality tended to be positive, negative, nonlinear, or mixed. R. Pagano (2004) examines the relationship between inequality and growth using data on 40 countries (both rich and poor). Economic growth exerts a positive effect on income inequality for a sample of the OECD nations (otherwise rich countries), while its effects on growth are negative for poor countries. These effects are not statistically significant. These inferences were drawn for estimation from fixed effects and the GMM models. R. Pagano (2004) also finds economic growth to Granger-cause income inequality, with a positive sign for the period from 1958 to 1998. Relying on the estimation of the panel data drawn from 125 countries with the help of the pooled OLS and the three-stage least square, M. Lundberg and L. Squire (2003) establish the fact that economic growth has a significant positive effect on income inequality. Economic growth has a statistically significant adverse effect on income inequality, which indicates that the growth of the economy exacerbates inequality. However, in spite of the statistical significance of this effect, it is considered to be quite small given its magnitude. A percentage-point rise in the growth of the economy corresponds to a higher percentage point in the Gini index. One other study that suggests a noxious effect of economic growth on income inequality is the study carried out by A. R. Cheema and M. H. Sial (2012), who find growth to have a positive and statistically significant association with income inequality in Pakistan. A percentage rise in average expenditure (a proxy used for growth) culminated into a 0.18 percent rise in income inequality. However, this effect is less pronounced in rural areas compared to urban areas. A. O. Binatli (2012) investigates the relationship between growth and income inequality for some selected countries for the periods from 1960 to 1985 and from 1985 to 1999. Volatility in economic growth initially increases income inequality, with the size of the effect dwindling later. For the period from 1960 to 1985, a one percent increase in growth volatility brings about a 1.3-percentage-point rise in the Gini coefficient. For the period from 1985 to 1999, a 0.3-percentage-point rise in the Gini coefficient is traceable to a one percent increase in growth volatility. F. Niyimbanira (2017) examines how growth affects income inequality in the South African Province of Mpumalanga. The findings suggest that growth in the economy does not reduce inequality in income distribution. Using the panel fixed effects model, S. S. Akadiri and A. C. Akadiri (2018) report a positive long-term relationship between economic growth and income inequality for 20 African countries. The estimates of the causality test are supportive of the hypothesis of neutrality between growth and inequality.

In contrast, W. A. Risso, L. F. Punzo and E. J. Senchez-Carrera (2013) find a consistent negative relationship between the GDP *per capita* and the Gini index for Mexico over the period from 1968 to 2010, based upon the estimates of the fully modified OLS (FMLOS) and dynamic OLS (DOLS). The estimates of canonical cointegration regression (CCR) indicate a negative relationship, with a one percent rise in the GDP *per capita* culminating to 0.13 reduction in income inequality. Likewise, N. F. Wahiba and M. Weriemmi (2014) explore the effect of economic growth on inequality in income in Tunisia and deduce a positive impact for the periods from 1984 to 1995, from 1996 to 2011, and from 1984 to 2011. While the impact was insignificant for the period from 1984 to 1995, it was statistically significant for the periods from 1996 to 2011 and from 1984 to 2011. Thus, the rising growth of the Tunisian economy had contributed to an increase in inequality in income distribution. For a sample

of 26 Chinese provinces, K. S. Chan, X. Zhou and Z. Pan (2014) find insignificant reduction in income inequality, even with a faster growth in its provincial economies. The results of the VAR estimation reveal that lagged growth has insignificant negative impact on income inequality. The Arellano-Bond differenced GMM estimates also indicate that lagged growth continues to have an insignificant negative effect on income inequality, i.e. as contemporaneous income inequality slightly declines due to the initially prevailing growth level. H. C. R. Huang, W. Fang, S. M. Miller and C. C. Yeh (2015) investigate how growth volatility influences income inequality in the long run in the US, spanning from 1945 to 2004. The results of the pooled mean group (PMG) estimators indicate that greater growth volatility has a significant positive association with higher income inequality. However, the effect of growth volatility is positive but insignificant for negative economic growth. E. Berisha and J. Meszaros (2016) report a positive association between economic expansion and income inequality, hinged on a negative relationship between a debt and income inequality, which is quite probable given the fact that negative growth in income inequality emanates from rising household debts, since the debt is likely to slow down growth, thereby diminishing returns to top income earners. S. Chang, R. Gupta, S. M. Miller and M. E. Wohar (2019) also confirm the fact that negative volatility in economic growth has a greater effect on income inequality than positive volatility does for the US economy between 1917 and 2015.

Contrary to the findings of the aforementioned studies, there are authors who have confirmed the Kuznets inverted-U hypothesis. R. J. Barro (2000) finds the evidence for the Kuznets inverted-U-shaped relationship for a panel of 84 countries. The real GDP *per capita* coefficient was consistently positive, while simultaneously that of the squared GDP *per capita* was negative, and they were both statistically significant and quite stable. This implies that income inequality increases initially, only to later decrease, during the periods of economic development. M. Lundberg and L. Squire (2003) also report a Kuznets-type relationship for eight countries, no relationship for 30 countries in terms of the growth - inequality nexus, and a U-shaped relationship (i.e. inverse Kuznets curves) for the 11 countries included in the sample. R. J. Barro (2008) also confirms the applicability and relevance of the Kuznets hypothesis. The results of the seemingly unrelated regression (SUR) estimations show that the GDP *per capita* exerts a positive and significant influence on the Gini coefficient, whereas the squared GDP *per capita* has a significant negative effect on income inequality.

Other notable studies beside R. J. Barro (2000) and R. J. Barro (2008) have also tested and validated the Kuznets hypothesis. They include J. A. Charles-Coll (2010), J. A. Charles-Coll (2014), and D. Hartmann, M. R. Guevara, C. Jara-Figueroa, M. Aristaran, and C. A. Hidalgo (2017). D. Hartmann *et al* (2017) confirm the validity of the Kuznets hypothesis for 150 countries using the pooled OLS and the fixed effects methods of estimation. D. Hartmann *et al* (2017) find that the GDP has a positive coefficient, whereas the squared GDP has a negative coefficient. J. A. Charles-Coll (2010) submits that the Kuznets hypothesis is an empirical regularity, as the results of all his specifications show a positive and statistically significant sign for the GDP *per capita*, and a statistically significant negative sign for its squared coefficient, which on its part clearly indicates that inequality in income distribution will grow at the initial levels of development, only to reduce at later stages. These findings were corroborated by J. A. Charles-Coll (2014), who used a comprehensive data set on 138 countries for the period from 1955 to 2005. Y. Yang and T. M. Greaney (2017) use the Error Correction Model to estimate short- and long-term relationships for South Korea, the United States, Japan and China. The results of the estimation suggest the presence of an S-shaped curve relationship between growth and income inequality for the four economies. The coefficients of the GDP *per capita* and the cubic GDP *per capita* are negative and significant, whereas the squared GDP *per capita* is positive and significant for China and the US, thereby tracing out an S-shaped curve. For Japan and Korea, the coefficients of the GDP *per capita* and the cubic GDP *per capita* are positive and statistically significant, whereas the squared GDP *per capita* coefficient is negative and statistically

significant. All the coefficients are significant at one percent in the long run, except for Korea. The results support both the Kuznets curve hypothesis and the S-curve hypothesis. G. Blanco and R. Ram (2019) revisit the growth - income inequality nexus and confirm a significant regular U-pattern relationship using the data on the US states for the period from 2006 to 2016. This relationship, however, becomes insignificant when the estimation is adjusted for cross-state spillovers. In contrast to the hypothesized Kuznets bell-shaped relationship between growth and inequality, S. Mhaka and A. Sahdev (2023) report a U-shaped relationship between economic growth and income inequality for the Middle and South African countries. The coefficients of the *per capita* GDP and the squared *per capita* GDP were negative and positive, respectively. In studying 52 African countries, M. E. Batuo, G. Kararach and I. Malki (2022) applied the concept of club convergence, involving a possible divergence of *per capita* and a possible convergence of economies into four steady states. They report that the Kuznets inverted-U relationship becomes unstable after controlling for the multiple steady states (Table 1).

METHODOLOGY AND DATA

In this paper, income inequality is expressed as a function of economic growth in the following research study baseline equation:

$$INEQ_{i,t} = a_0 + \alpha INEQ_{i,t-1} + \psi \ln y_{i.t} + Z_{i,t}\theta + \mu_i + \varepsilon_{i,t} \quad (1)$$

where *INEQ* represents income inequality, *y* is the GDP *per capita*, *Z* stands for the vector of the other variables that drive income inequality in an economy. These variables are inflation and trade openness. To test the Kuznets hypothesis, the y^2 is the squared GDP *per capita* incorporated in (1).

$$INEQ_{i,t} = a_0 + \alpha INEQ_{i,t-1} + \psi \ln y_{i.t} + \varphi \ln y_{i.t}^2 + Z_{i,t}\theta + \mu_i + \varepsilon_{i,t} \quad (2)$$

The coefficient of the GDP *per capita*, ψ, and the coefficient of the squared GDP *per capita*, φ, are theoretically anticipated to either be negative or positive. When ψ is positive and φ is negative, the hypothesized inverted-U shape based on the Kuznets analysis is valid. However, when ψ is negative (i.e. < 0) and φ is positive (i.e. > 0), then there is no such U-shaped relationship.

$$INEQ_{i,t} = a_0 + \alpha INEQ_{i,t-1} + \psi \ln y_{i.t} + \varphi \ln y_{i.t}^2 + \pi \ln y_{i.t}^3 + Z_{i,t}\theta + \mu_i + \varepsilon_{i,t} \quad (3)$$

The inclusion of the cubic GDP *per capita*, y^3, in (3) is to test for the conjecture of an S-shaped relationship in the causal effect of economic growth on income inequality, in line with Yang and Greaney (2017). When ψ (the GDP *per capita* coefficient) is positive, while the squared GDP *per capita* coefficient φ and the cubic GDP *per capita* coefficient π are negative and positive, respectively, then the relationship assumes the S-shape.

For the estimation of the model, the GMM system by R. Blundell and S. Bond (1998) is employed in order to handle the inherent problem of reverse causality in the economic growth - inequality relationship. It also allows the use of both the first differenced equation and the equations at level. Owing to these conditions, the system GMM is preferable, as it makes possible the use of more instruments than the difference GMM. In line with D. Roodman (2009), a collapsed matrix (relying on the *collapse* command in Stata) was made use of in this paper. The two-step system GMM was used because of its better precision and higher consistency over the one-step system GMM (Roodman, 2009). The Hansen test (Hansen, 1982) was used to check the over-proliferation of instruments, which was crucial to ensure that the instruments were not greater than the endogenous variables.

The data on income inequality (the Gini before tax) were retrieved from the Standardized World Income Inequality Database (SWIID). The data on the GDP *per capita*, the inflation rate, and trade openness were taken from the World Development Indicators (WDI) of the World Bank (World Bank, 2018). The data on

Table 1 The synthesis of the reviewed studies on the effect of economic growth on income inequality

S/N	Authors/Year	Sample/Data Structure	Method of analysis	Core findings
1	Kuznets (1955)	England, US and Germany	Descriptive	The inverted-U curve
2	Barro (2000)	84 countries (1965-1995)	3SLS; seemingly unrelated regression	An inverted-U curve; the Kuznets hypothesis is validated
3	Lundberg & Squire (2003)	38 countries	Pooled OLS, 3SLS	Negative
4	Pagano (2004)	40 countries (1958-1998)	Fixed effects; GMM: Granger causality	Growth Granger-causes inequality with a positive sign
5	Barro (2008)	(1960-2000) cross-section	3 SLS; seemingly unrelated regression	An inverted-U curve; the Kuznets hypothesis is validated
6	Charles-Coll (2010)	108 countries (1960-2000)	System GMM; 3SLS and seemingly unrelated regression	The inverted-U curve; the validity of the Kuznets hypothesis is confirmed
7	Cheema & Sial (2012)	Pakistan (1992-2008)	Pooled OLS, Fixed/ random effects	Positive
8	Binatli (2012)	42 countries (1960-1999)	OLS regression	Positive
9	Risso *et al* (2013)	Mexico (1968-2010)	Fully modified OLS; dynamic OLS; canonical cointegration regression	A consistent negative relationship between growth and income inequality; unidirectional causality runs from the GDP *per capita* to the Gini Index
10	Chan *et al* (2014)	China Provinces	VAR; System GMM	Growth does not reduce inequality
11	Charles-Coll (2014)	Mexican states; 138 countries (1955-2005);	SUR and 3SLS	An inverted-U curve; the Kuznets hypothesis is validated
12	Wahiba & Weriemmi (2014)	Tunisia (1984-2011)	OLS	Positive
13	Huang *et al* (2015)	48 US states (1945-2004)	Pooled Mean Group	A U-shaped relationship between growth and inequality
14	Berisha & Meszaros (2016)	Panel of US states from 2003-2012	OLS	Growth acts positively on income inequality
15	Niyimbanira (2017)	18 local municipalities in the South African Province of Mpumalanga	Pooled OLS, Fixed effects	Growth of the economy does not reduce income inequality
16	Hartmann *et al* (2017)	150 countries (1963-2008)	OLS; Fixed effects	An inverted-U relationship between growth and inequality
17	Yang & Greaney (2017)	China, Japan, South Korea & US	Engle-Granger two-step ECM	The signs of the coefficients of the GDP, squared and cubic GDP are negative, positive, and negative, respectively, for the US and China, but the same are positive, negative, and positive, respectively, for Japan and South Korea, i.e. the S-shape curve hypothesis holds for the relationship between growth and income inequality for the countries. The slopes differ at the starting portion of the curve across these economies.
18	Akadiri and Akadiri (2018)	20 African countries	Panel fixed effects (PFE) models	A positive long-term relationship between economic growth and income inequality

19	Chang *et al* (2019)	The US economy from 1917 to 2015 and from 1962 to 2014	Wavelength analysis	Negative volatility in economic growth exerts a bigger influence on income inequality than positive volatility does
20	Blanco & Ram (2019)	The panel of the US states from 2006 to 2016	OLS and fixed effects models	A significant regular U-pattern relationship between economic growth and income inequality
21	Batuo *et al* (2022)	52 African countries	The club convergence concept (the divergence of *per capita* and the convergence of economies into four steady states)	The Kuznets inverted-U relationship becomes unstable after controlling for the multiple steady states
22	Mhaka & Sahdev (2023)	Middle and South African countries (2000-2019)	Fixed effects panel regression model	A U-shaped relationship between economic growth and income inequality

Source: Author

the variables pertain to the period from 1995 to 2015. This is mainly due to the availability of the data on the Gini index for the SSA countries. This is the major limitation to extending the study beyond the year 2015. The data on the other income inequality measures are not readily available for the SSA countries.

The thirty-one (31) countries studied in the paper include Senegal, Cape Verde, Sierra Leone, Ghana, Mauritania, Guinea Bissau, Mali, Central Africa Republic, Niger, South Africa, Cote d'Ivoire, Swaziland, Guinea, Nigeria and Burkina Faso, Ethiopia, Mauritius, Botswana, Seychelles, Angola, Uganda, Namibia, Cameroon, Kenya, Malawi, Lesotho, Burundi, Tanzania, Madagascar, Rwanda, and Zambia. The twelve (12) of the countries are from West Africa, five (5) are from South Africa, three (3) are from Central Africa, and eleven (11) are from East Africa. The selection of the countries was based upon the available data on income inequality.

EMPIRICAL RESULTS AND DISCUSSION

Table 2 reveals that a highly significant positive relationship subsists between economic growth (measured by the gross domestic product *per capita*) and the Gini index, which suggests that the growth of the economy is synonymous with higher disparities in income distribution.

Table 2 The correlation matrix

	Gross Domestic Product	Gini Index	Open-ness	Inflation
Gross Domestic Product	1.000			
Gini Index	0.205 (0.000)	1.000		
Openness	-0.258 (0.000)	-0.114 (0.004)	1.000	
Inflation	-0.020 (0.614)	0.017 (0.666)	-0.022 (0.574)	1.000

Note: The values in parenthesis represent p-values.

Source: Author

It also indicates that more benefits of growth spurts tend to accrue disproportionately to the rich. Table 2 also shows that inflation has a negative relationship with economic growth, while it has a positive insignificant relationship with income inequality. This simply connotes that inflation seems to be growth stifling, while it tends to broaden the inequality gap. Trade openness seems to be unfavorable for economic expansion and equitable income distribution in the region.

The result in Column 1 of Table 3 indicates that the lagged Gini index is positive and statistically significant at a one percent significance level, that is to say inequality in income dispersal in the preceding

years exerted an influence on the contemporaneous level of income inequality. The GDP *per capita* coefficient is positive and statistically significant at a five percent significance level, with a 0.18 percent increase in the Gini index traceable to the one percent increase in the GDP *per capita*. The inflation rate is negative and statistically significant at a 10 percent significance level. This implies that inflationary pressure does not really exacerbate inequality in income, which, however, is contrary to the expectation since inflation is anticipated to increase income inequality. In testing the rationality of the Kuznets hypothesis, the inclusion of the squared GDP *per capita* in the inequality model becomes necessary.

The results of the estimation of this model are given in the columns 2 and 3 of Table 3, and they results suggest that the GDP *per capita* is positive and statistically significant at a five percent significance level, with a one percent increase in the GDP *per capita* translating to the initial 0.14 percent increase in income inequality. On the contrary, the squared GDP *per capita* is negative and statistically significant at a 10 percent significance level. These findings suggest that growth in the economy initially promotes income inequality. Further growth in the economy, however, has a reversed or inverse relationship with income inequality, possibly owing to structural changes in the economy. This is in tandem with the postulation of S. Kuznets (1955). By controlling inflation, the coefficients of both the contemporaneous and squared GDP *per capita* maintain their signs. They equally remain statistically significant at a five percent and 10 percent significance levels, respectively. These results still trace out an inverted-U relationship between growth and inequality for the SSA region.

Table 3 The effect of economic growth on income inequality

Dependent Variable	Gini index (Model 1)	Gini index (Model 2)	Gini index (Model 3)
Lagged Gini index	1.0411*** (0.0266)	1.0147*** (0.0162)	1.0821*** (0.0512)
Gross domestic product	0.1793** (0.0747)	0.1419** (0.0534)	3.1047*** (1.1177)
Squared gross domestic product		-0.0028* (0.0017)	-0.4226*** (0.1538)
Cubic gross domestic product			0.0195** (0.0069)
Inflation	-4.60e-07* (2.41e-07)	0.0004** (0.00002)	0.0003 (0.0014)
Openness		0.0002 (0.0008)	
Constant	-0.1789 (0.0983)	-0.2119 (0.0807)	-7.3731 (2.8634)
Instruments	25	30	29
Countries	31	31	31
Hansen Test	0.333	0.428	0.404
AR (1)	0.045	0.039	0.389
AR (2)	0.817	0.727	0.670

Notes:***, **, * denote a 1%, 5% and 10% significance level, respectively. The standard errors are in brackets.

Source: Author

In line with Y. Yang and T. M. Greaney (2017), the hypothesized S-shaped relationship was tested while researching the growth - inequality nexus. To test the likelihood of such a relationship, the cubic GDP *per capita*, i.e. y^3, was included in the income inequality model. The results are accounted for in Column 3 of Table 3. The GDP *per capita* is positive and statistically significant at a one percent significance level, i.e. as the economy grows, income inequality rises initially. On the other hand, the squared GDP *per capita* is negative and statistically significant at a one percent significance level, depicting an inverse relationship between economic growth and income inequality, whereas the cubic GDP *per capita* coefficient is positive and statistically significant at a one percent significance level.

These findings suggest the validity of the S-shape hypothesis as conceptualized by Y. Yang and T. M. Greaney (2017). The statistically insignificant probability values of AR (2) indicate that all the models in this study were specified well and that there are no second order serial correlation issues in them. Likewise, the instruments do not exceed the cross-sections in all the estimated models. The instruments used in this research study are quite consistent based on the probability values of the respective Hansen statistics.

The estimates of our models consistently indicate the presence of a positive effect of the contemporaneous growth of the economy on income inequality in SSA, which surmises that growth spurts do not actually whittle down disparities in income distribution. The finding is congruent with M. Lundberg and L. Squire (2003), R. Pagano (2004), A. O. Binatli (2012), N. F. Wahiba and M. Weriemmi (2014), E. Berisha and J. Meszaros (2016), among others. However, W. A. Risso *et al* (2013) and K. S. Chan *et al* (2014), among others, reported a negative effect of economic growth on income inequality. With the contemporaneous GDP *per capita* being positive in relation to income inequality, it implies that economic growth will originally promote income inequality in the economy, which conforms to Kuznets' postulate that growing income *per capita* will initially lead to a rise in income inequality. By implication, the pattern of the interaction between growth and income inequality unfolds as the structure of the economy changes. The inclusion of the squared GDP *per capita* in the model gave rise to a significant inverted-U relationship between economic growth and inequality, which is as result of the positive coefficient of the contemporaneous GDP *per capita* and the negative squared GDP *per capita*, which confirms the rationality of the Kuznets inverted-U hypothesis for the Sub-Saharan African region. The studies that have confirmed this hypothesis include R. J. Barro (2000), R. J. Barro (2008), J. A. Charles-Coll, (2010), J. A. Charles-Coll (2014) and Hartmann *et al* (2017). Y. Yang and T. M. Greaney (2017) confirmed applicability of the Kuznets inverted-U hypothesis for Japan and South Korea but did not find the evidence for this hypothesis for China and the US. It is quite apt to note that none of the aforementioned studies focused on Sub-Saharan Africa. The consistency of the results obtained in this paper with the Kuznets hypothesis has certain implications. It indicates that sectoral or structural shifts in the economic development process are crucial in explaining variations in income inequality in Sub-Saharan Africa. That is to say income inequality within and between sectors is traceable to the level of the growth and development of the economy, simultaneously showing that the economies of the SSA region are bound to experience both negative and positive causal relationship from economic growth to income inequality in the process of their development. Likewise, growth spurts are likely to be increasing income inequality while the periods of growth trough are likely to be associated with income inequality. It also depicts a trade-off between income equality and growth. Therefore, when higher equality in income distribution is desired, there is likely to be an opportunity cost of lower economic growth. Apparently, when higher growth is desired, there tends to be an inevitable increase in income inequality.

An attempt to test the conjecture of the S-shaped curve hypothesis (in terms of the effect of growth on inequality) by Y. Yang and T. M Greaney (2017) proved to be valid for the SSA region. This emanates from the statistical significance of the positive GDP *per capita*, negative squared GDP *per capita* and positive cubic GDP *per capita* coefficients for the sampled period.

This traced out the S-shaped causal link between growth and income inequality i.e. the economy initially experiences the hypothesized Kuznets relationship followed by the U-shaped relationship between growth and inequality. It is, however, apt and vital to note that the S-shaped curve hypothesis is likely to be a long-term phenomenon and the same could be tested better using data covering a very long period at the country level. The study by Y. Yang and T. M. Greaney (2017) employed data on China (for the period from 1964 to 2013), Japan (for the period from 1960 to 2010), South Korea (for the period from1963 to 2013) and the US (for the period from 1960 to 2012) and did not obtain the same results for the four economies. For instance, there are differences in the slope of the S-curve of South Korea and Japan. This shows that structural differences across these economies are likely to be the underlying determinants of this postulated relationship.

CONCLUSION

The extant empirical studies have failed to produce consensual findings on the implications of the growth of the economy on income inequality due to a lack of reliable and adequate data and the use of an inappropriate methodology. Taking cognizance of these issues, the Blundell-Bond GMM was applied to income inequality data on SSA in this paper and economic growth is found to play the crucial role in income distribution. It is specifically inferred that in no way do spurts in economic growth bring about reduction in income gaps, as income accruals or economic gains ostensibly benefit only a few in the region. The evidence of the analysis of the effect of economic growth on income inequality also supports the Kuznets inverted-U hypothesis. It is also very apposite to note that the Government seems to be pursuing growth-promoting policies without prejudice to reducing income inequality or achieving an effective income redistribution, since positive growth is recorded to the detriment of an equitable income distribution. An unabated increase in income inequality could impede economic growth in the long run, especially through unequal access to investment opportunities. This effect is likely to have pronounced implications for the informal sector, a relatively larger employer of labor in the SSA region, through a lack of access to credit or investible funds. Persisting income inequality could also have eventual reversed dampening effect on economic growth via low human capital investment by disproportionately poor households. Given the long-term consequences of the subsisting relationship between growth and inequality in the region, policymakers need to advocate growth-enhancing strategies that will simultaneously stem rising income inequality in SSA. This paper provides an empirical proof of the effect of economic growth on income inequality in Sub-Saharan Africa, substantially contributing to the extant literature at the same time. However, there is the need for country-specific studies in drafting effective policies for reducing the gap between the rich and the poor, given the differences in the growth profiles of the countries. Likewise, the studies of this nature are necessary for the accurate documentation of the evidence of the S-curve supposition at various national levels.

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GOVERNANCE AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES: A PANEL THRESHOLD REGRESSION ANALYSIS

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This study is aimed at analyzing the effect of the governance index and the governance components index on economic growth in 48 developing countries over the period 2002-2020. Corruption control, the effectiveness of the government, political stability, and regulatory quality are but a few of the many variables taken into account by the governance components index. The findings of the study show that governance has an asymmetric effect on economic growth. Moreover, the results indicate that enhancing governance in developing countries can obstruct economic growth in them. This outcome should not surprise and cast doubt on the positive effects of sound governance on economic growth, as improving governance requires numerous resources currently lacking in these countries. Therefore, policymakers must boost economic growth at the initial stage so that they can identify resources for improving governance and capitalize on them as well.

Keywords: economic growth, governance, governance components, panel threshold regression model

JEL Classification: O43, D72, C24

INTRODUCTION

For developing countries struggling with numerous economic and social issues, improving governance effectiveness is crucial to fostering economic growth. Effective governance is often regarded as the most important factor able to transform economies, draw in investments, and consequently encourage economic growth (Gani, 2011). Furthermore, M. Jr. Olson (1996) noted that an increase in governance quality could have a significant influence on the ability of the poorest nations to sustain long-term economic growth and raise their living standards and wellbeing. According to M. Jr. Olson (1996), developing nations do not appear to have reached their full potential for growth because they lack the structures of the incentives needed to encourage productive cooperation, such as fair legal systems capable of upholding contracts and protecting property rights.

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According to the literature, bad governance has a detrimental impact on development and economic growth. Therefore, governance plays a crucial role in illuminating the reason why the majority of developing nations have been lagging behind while some have experienced the growth that is significantly faster than the growth of high-income countries.

According to N. Rosenberg and L. E. Birdzell (1986) and J. Mokyr (1992), differences in governance and institutions are essential in describing why innovation, the industrial revolution and modern economic growth took place in the West, as opposed to the other regions of the world. According to M. P. Mauro (1995), governance can account for the success or failure of some development policies, to which J. G. Castañeda (2003) and M. Wolf (2005) added that corrupt practices and poor governance were to blame for economic failure in developing countries.

Developing countries have taken major steps towards reforming their economies and they have invested heavily in improving the quality of their governance systems, realizing how crucial good governance is to the achievement of sustainable growth. Despite these efforts, results for most of these countries have fallen short of expectations. D. Rodrik (2006) and R. Hausmann, D. Rodrik and A. Velasco (2008) stressed the fact that improved governance does not always have to translate into an increase in the country's growth rate. In this sense, K. P. Huynh and D. T. Jacho-Chávez (2009) disproved the notion that there was a causal connection between decent governance and economic growth.

In light of this divergence pertaining to the effect of governance, as well as their six components, on economic growth, it seems possible that this effect is nonlinear, so there are thresholds which it is reversed at. Therefore, the research hypotheses tested in this paper can be formulated as follows:

H1: The effect of governance on economic growth in the observed developed economies is nonlinear, i.e. there is a threshold effect.

H2: There is an asymmetric (nonlinear) impact of the governance components on the economic growth in the observed developed economies.

To verify this hypothesis, the panel threshold regression (PTR) model defined by B. E. Hansen (1999) was used for the purpose of investigating the way how the governance index (at the first level) and the governance components (at the second level) affect the economic growth of 48 developing countries between 2002 and 2020.

This study substantially contributes to the already existing body of the knowledge of governance improvement. To start, the empirical evidence demonstrates that this effect is nonsymmetrical. Secondly, this research study demonstrates how the efforts made by the developing countries in order for them to improve their governance blocked economic growth. This result can be argued by the fact that, to improve governance, governments have to invest a lot of resources that could be committed to boosting economic growth.

The remaining part of this paper is structured into sections. Section 2 presents the relevant literature on the influence governance exerts on economic growth. In section 3, the data and methodology used in the study are defined. Section 4 is the discussion of the empirical findings. Finally, Section 5 gives the conclusion.

LITERATURE REVIEW

The relationship between governance and economic growth

The influence of governance on the economic growth process has been the subject matter of much reflection and discussion. Therefore, a broad range of theoretical and empirical studies have focused on the success or failure of development policies in developing countries. Several studies were carried out on the liaison between governance and economic growth based on the World Bank's (WB) World Governance Indicators (Kaufmann & Kraay, 2002; Bađun, 2005; Beck & Laeven, 2006; Fayissa & Nsiah, 2013). Some of them showed through a variety of methods how good governance assisted to stimulating economic growth

and led to a nation's effective and efficient growth (Al-Naser, 2019; Duan, Zhou, Cai, Gong, Zhao & Ai, 2022). There are those such as D. Rodrick (2006), however, who argued that the relationship between governance and growth was tenuous and should be treated with caution.

M. Jr. Olson, N. Sarna and A. V. Swamy (2000) demonstrated that the effectiveness of governance had a significant positive influence on economic growth, so that the countries with improved governance had higher productivity for that reason. According to the authors, innovation, which can boost economic growth, depends on effective governance. D. Kaufmann and A. Kraay (2002) revealed a strong positive relationship between good governance and higher income *per capita* by using an instrumental variable method.

W. Easterly and R. Levine (2003), as well as H. Jalilian, C. Kirkpatrick and D. Parker (2007), demonstrated how effectively governance accounted for economic growth. W. Easterly and R. Levine (2003) also recognized that enhancing governance could help reduce the gap in the GDP *per capita* between developing and developed nations.

Between the years 1992 and 2004, T. Beck and L. Leaven (2006) used panel regression to investigate the connection between governance and economic growth in 24 transition economies and found that a strong positive influence was exerted on economic growth by effective governance. In addition, B. Fayissa and C. Nsiah (2013) used the same methodology to examine the connection between economic growth and governance in Sub-Saharan African countries between the years 2002 and 2009, and 1995 and 2005, concluding that governance had influenced economic growth in a favorable way. According to B. Fayissa and C. Nsiah (2013), the effect of governance on economic growth varies with income levels.

Additionally, M. H. Khan (2007) showed that good governance confirmed the effectiveness of the market by upholding property rights. On a sample of 71 countries in the period 1996-2003, A. Cooray (2009) discovered that the effectiveness of governance had a favorable effect on economic growth. This conclusion was supported by M. Petreski (2014), who demonstrated that economic growth in 30 transition economies was positively influenced by good governance in the period from 2005 to 2011.

According to D. Rodrik (2006), the cross-national literature was not able to conclusively prove a strong causal relationship between strong governance and economic development. The results of the study by J. Sachs, J. W. McArthur, G. Schmidt-Traub, M. Kruk, C. Bahadur, M. Faye and G. McCord (2004) are supported by Rodrik's findings, which show a weak correlation between growth and advancement in good governance.

The relationships between the governance components and economic growth

It is possible that the study of the effect of the governance index on economic growth can hide a specific effect of different governance components on economic growth. Thus, some studies focused on how the governance components affected economic growth (Manasseh, Abada, Okiche, Okanya, Nwakoby, Offu & Nwonye, 2022).

Corruption control and economic growth

M. P. Mauro (1995) examined the connection between corruption and investment in 58 different nations introducing the fact that it significantly decreased the investments to the GDP ratio. Using cross-country regressions similar to those of M. P. Mauro (1995), M. P. Mauro (1996) demonstrated that improvements in the standard deviation of the corruption index were correlated with both the increases in the investment rate and the annual growth rate of the GDP *per capita*.

According to N. A. Lash (2004), corruption reduces economic efficiency, which decreases capital formation and eventually slows economic growth. Also, B. Podobnik, J. Shao, D. Njavro, P. C. Ivanov and H. E. Stanley (2008) demonstrated that the annual GDP *per capita* growth rate increased by 1.7 percent for all nations globally from 1999 to 2004 for every unit increase in the corruption index. P. Karnane and

M. A. Quinn (2019), who showed that corruption had had a detrimental effect on the economic growth of 157 countries between 1996 and 2014 for the reason of political instability, which nevertheless had had a little direct influence on it, supported this conclusion.

Good quality governance and economic growth

C. J. Huang and Y. H. Ho (2017) examined Granger causality, which links governance to economic growth in 12 Asian nations between 1996 and 2014. They applied the frequency domain approach. With the exception of South Korea, they found that the "free" countries did not exhibit any discernible causality linking the majority of the governance-related factors to economic growth. The Granger theory of the rule of law drives economic growth in the "partly free" countries (apart from Indonesia and Thailand). There are several aspects of governance, particularly the government efficiency and the rule of law, contribute significantly more to economic growth in the "not free" countries.

There is also considerable disagreement over the contribution an effective government makes to economic expansion. M. J. Kurtz and A. Schrank (2007) showed that economic growth was unaffected by the effectiveness of the government. In contrast, M. R. Alam, E. Kitenge and B. Bedane (2017) found a significant positive influence of the government effectiveness on economic growth for 81 countries for the years 1996, 1998, and 2000, as well as for the period from 2002 to 2011. Specifically, the economic growth rate increased by 0.68 percentage points for every unit increase in the government efficiency.

Political stability and economic growth

A. Aisen and F. J. Veiga (2013) showed that political instability adversely affected economic growth by slowing down the productivity growth rates in a sample of 169 countries in the period from 1960 to 2004 using the generalized method of moments (GMM). This finding supported those of Y. Feng (1997), who demonstrated that political instability hindered economic growth in 69 nations in the period 1960-1980. Additionally, it backed up the findings of A. Alesina, S. Özler, N. Roubini and P. Swagel (1996), who found that political instability characterized by a high propensity for the failure of the state was significantly associated with lower economic growth in 113 countries for the period 1950-1982.

R. J. Barro (1991) also demonstrated that, for 98 countries in the period 1960-1985, the growth rate of the real GDP *per capita* was positively correlated with political stability. A. K. Fosu (1992) argued that, in the period 1960-1986, political trouble and economic growth were positively correlated in 31 Sub-Saharan African countries. According to the research done by P. McGowan and T. H. Johnson (1984) the 39 Sub-Saharan African nations with the fastest-growing economies experienced fewer military coups d'état than the slower-growing (or worse-performing) nations in the period 1960-1981.

The long-term effect of political instability on the economic growth, however, was demonstrated by N. F. Campos and J. B. Nugent (2002). The short-term effect is the only extent evidence. In addition, J. M. Mbaku (1988) discovered a negligible correlation between the annual growth of the GNP *per capita* and political instability for 35 Sub-Saharan countries in the period 1960-1981. Furthermore, A. K. Fosu (2001) found a connection between political disturbance and economic expansion for 31 countries in Sub-Saharan Africa in the period 1960-1986. According to A. K. Fosu (2001), there was a misspecification issue that had led to the findings indicative of a negative relationship.

Regulatory effectiveness and economic growth

Regressions across a cross-section of 135 nations in the period 1993-2002 were used by S. Djankov, C. McLiesh and R. M. Ramalho (2006), who demonstrated that the countries with better regulations experienced faster economic growth. The authors concluded that improving corporate regulation could boost economic growth. C. Kirkpatrick, D. Parker and Y. F. Zhang (2006) argued that improving the capital formation environment could boost economic growth.

In addition, M. Jr. Olson *et al* (2000) found that countries with better institutions had advanced productivity levels. These results were supported by D. Kaufmann and A. Kraay (2002), who also stressed the importance of governance in the economic growth process.

H. Jalilian *et al* (2007) showed that regulatory quality had a greater influence on economic growth than the other governance indicators did for a total of 117 countries in the period 1980-1999. The authors specifically noted the fact that a one-unit change in regulatory quality and effectiveness correlated with an average 0.6 to 0.9 increase in economic growth.

DATA AND METHODOLOGY

Data

The GDP *per capita* growth rate is the dependent variable in this study, and the study sample consists of 48 developing nations in the period between 2002 and 2020 (Appendix A). The Governance Index (GOV), defined as the average of the six governance components (Corruption Control (CC), Government Effectiveness (GE), Political Stability and Nonviolence (PS), Regulatory Quality (RQ), Rule of Law (RL), and Voice and Accountability (VA)) (Appendix A) is the variable of interest (Easterly & Levine, 2003). The logarithm of the GDP *per capita* (GDP_{2002}) taking into account the convergence hypothesis of the neoclassical growth model, the bank credit granted to the private sector taking into account the development of the financial sector (CPS), the growth rate of gross fixed capital formation taking into account investment growth (GFCF), the total trade of goods and services taking into account the degree of openness (OPEN) and the population growth rate adjusting for demographics development (POP) are the control variables. All the variables and the data sources are presented in Table 1. Table 2 accounts for descriptive statistics on the three variables considered in the analysis.

Table 1 The variables and the data sources

Variables	Sources
The output *per capita* growth rate (Y)	The World Bank (2022a)
Banking credit to the private sector (CPS)	The World Bank (2022a)
The growth rate of the investment fraction of the GDP (GFCF)	The World Bank (2022a)
The inflation rate (INF)	The World Bank (2022a)
The trade fraction of the GDP(OPEN)	The World Bank (2022a)
The population growth rate (POP)	The World Bank (2022a)
Governance components (CC, GE, PS, RL, RQ, VA)	The World Bank (2022b)

Source: Authors

Table 2 The descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
GDP	912	4.345	3.448	-14.800	14.441
GDP_{2002}	912	24.679	1.701	20.720	28.516
DCPS	912	41.491	28.918	0.185	160.125
GFCF	912	6.133	17.633	-249.570	113.403
INF	912	5.437	5.141	-3.648	51.460
OPEN	912	80.515	36.717	22.106	210.373
POP	912	1.492	1.017	-0.993	4.260
GOV	912	-0.125	0.533	-0.994	1.603
CC	912	-0.227	0.643	-1.231	1.572
GE	912	-0.077	0.621	-1.604	1.285
PS	912	-0.244	0.807	-2.806	1.202
RL	912	-0.184	0.642	-1.251	1.418
RQ	912	0.031	0.608	-1.279	1.674
VA	912	0.024	0.646	-1.470	1.243

Source: Authors

Methodology

To examine the relationship between governance and economic growth, the panel threshold regression model (PTR) developed by B. E. Hansen (1999) was

employed, the application of which was supported by the context of the locally weighted scatterplot smoothing (LOWESS) method. It revealed that the relationship between economic growth and the governance index, on the one hand, and between economic growth and each component of governance, on the other, is nonlinear (Figures 1 and 2).

The data observed were generated from a balanced panel y_{it}, q_{it}, x_{it} : $1 \le i \le n$. The index i indicates the individual, and the index t indicates the time. The dependent variable y_{it} (the GDP *per capita* growth rate) is scalar, the threshold variable q_{it} (the governance index) is scalar, and the regressor x_{it} is a k-vector (GDP_{2002}, GOV, DCPS, GFCG, INF, OPEN and POP). The structural equation of interest reads as follows:

$$y_{it} = \mu_{it} + \beta_1' x_{it} I(q_{it} \le \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \quad (1)$$

where I(.) is the indicator function. An intuitive alternative to the equation (1) is as follows:

$$\begin{cases} \Delta Y_{it} = \beta_1' x_{it} + e_{it}, q_{it} \le \gamma \\ \Delta Y_{it} = \beta_2' x_{it} + e_{it}, q_{it} > \gamma \end{cases} \quad (2)$$

$\beta = (\beta_1' \beta_2')'$ so (1) equals:

$$y_{it} = \mu_{it} + \beta x_{it}(\gamma) + e_{it} \quad (3)$$

Depending on whether the threshold variable q_{it} is lesser or greater than the threshold, the observations are divided into two ranges. The regression slopes β_1 and β_2 that differ between the regimes allow for a differentiation. It is necessary that the components of x_{it} be not time-invariant in order to identify β_1 and β_2. The threshold variable q_{it} is also assumed to be not time-invariant.

The error e_{it} is considered to have an independent and identical distribution (*iid*), the mean of zero, and a finite variance. The lagged dependent variables are excluded from x_{it} by the *iid* assumption.

According to the literature, two principal models are outlined: the first one studies the relationship between economic growth and governance as an overall index that is the average of the six governance components mentioned above, whereas the second model examines the impact of each governance component on economic development.

$$\begin{cases} \Delta Y_{it} = \alpha_0 + \alpha_1 GOV_{it} + \alpha_2 CPS_{it} + \alpha_3 GDP_{2002} + \alpha_4 GFCF_{it} + \alpha_5 INF_{it} + \alpha_6 OPEN_{it} + \alpha_7 POP_{it} + e_{it}, q_i \le \gamma \\ \Delta Y_{it} = \alpha_0' + \alpha_1' GOV_{it} + \alpha_2' CPS_{it} + \alpha_3' GDP_{2002} + \alpha_4' GFCF_{it} + \alpha_5' INF_{it} + \alpha_6' OPEN_{it} + \alpha_7' POP_{it} + e_{it}', q_i > \gamma \end{cases} \quad (4)$$

$$\begin{cases} \Delta Y_{it} = \alpha_0 + \alpha_1 GOVCOMP_{it} + \alpha_2 CPS_{it} + \alpha_3 GDP_{2002} + \alpha_4 GFCF_{it} + \alpha_5 INF_{it} + \alpha_6 OPEN_{it} + \alpha_7 POP_{it} + e_{it}, q_i \le \gamma \\ \Delta Y_{it} = \alpha_0' + \alpha_1' GOVCOMP_{it} + \alpha_2' CPS_{it} + \alpha_3' GDP_{2002} + \alpha_4' GFCF_{it} + \alpha_5' INF_{it} + \alpha_6' OPEN_{it} + \alpha_7' POP_{it} + e_{it}', q_i > \gamma \end{cases} \quad (5)$$

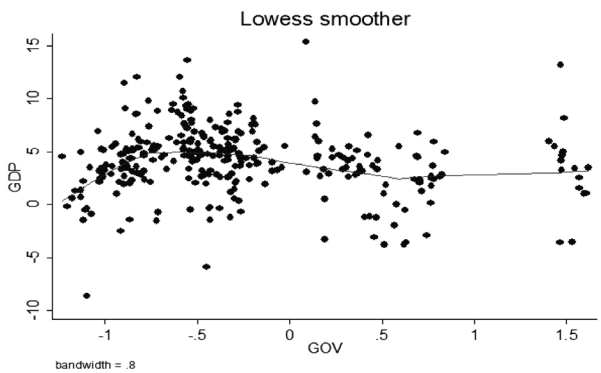

Figure 1 The relationship between economic growth and governance for developing countries

Source: Authors

The notation is as follows: ΔY_i - the growth rate of the GDP *per capita* for the country *i*; *GOV* - the governance index; *GOVCOMP* - the governance components (Corruption Control (CC), Government Efficiency (GE), Political Stability and the Absence of Violence (PS), Regulatory Quality (RQ), Rule of Law (RL), Voice and Accountability (VA)); *GFCF* - the gross fixed capital formation; *INF* - the inflation rate; *OPEN* - the openness rate, and *POP* - the population growth rate.

EMPIRICAL RESULTS AND DISCUSSION

Unit root analysis

The stationarity of the variables used in the analysis should be checked prior to estimating the panel threshold regression model. For the unit root test, the Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) panel data stationarity tests were used. All the variables of x_{it} are stationary, as is shown in Table 3.

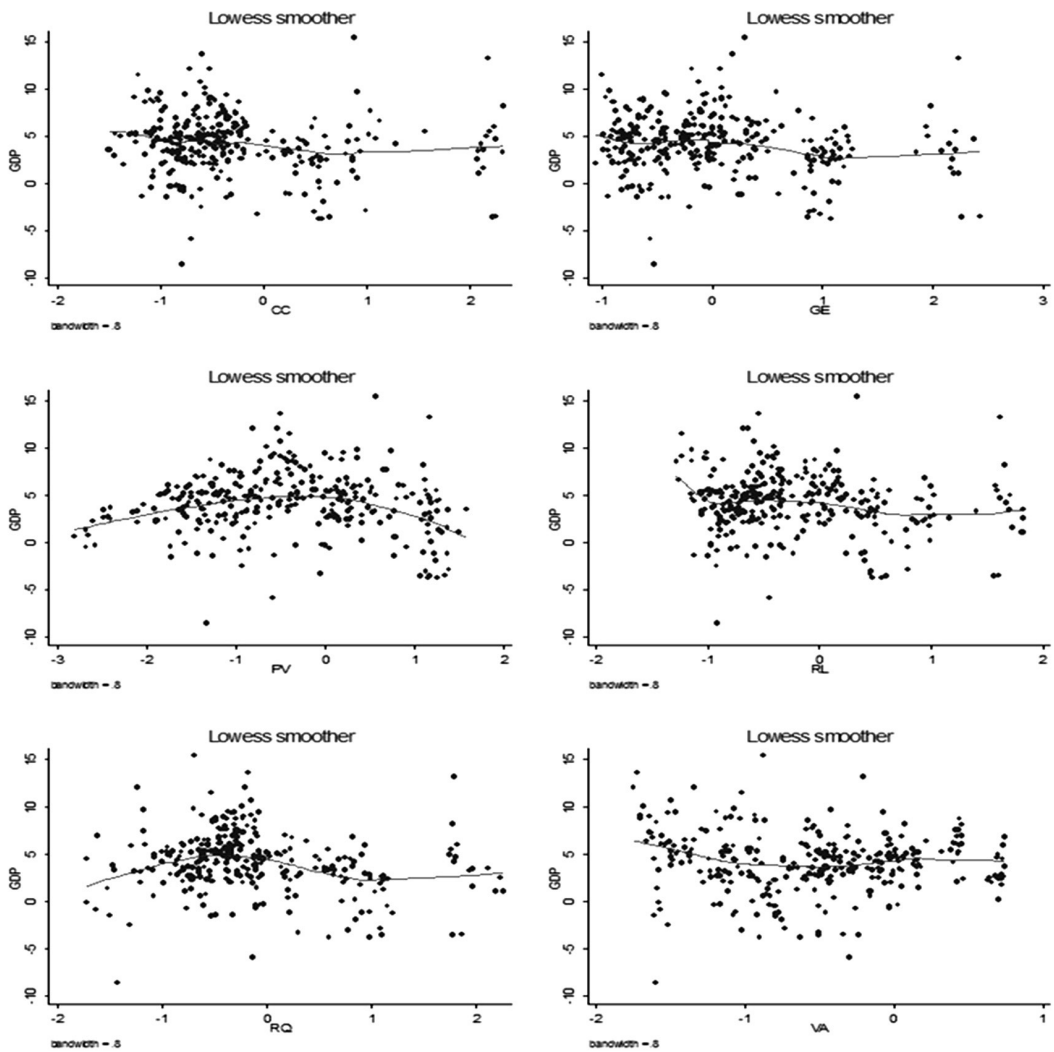

Figure 2 The relationship between economic growth and governance for developing countries

Source: Authors

Table 3 The stationarity test

Variables	LLC	p-values	IPS	p-values
GDP	-21.314	(0.000)	-10.607	(0.000)
CPS	-1.759	(0.039)	-3.386	(0.000)
GFCF	-3.515	(0.000)	-1.868	(0.000)
GOV	-6.268	(0.000)	-2.030	(0.021)
INF	-13.963	(0.000)	-11.032	(0.000)
OPEN	-4.731	(0.000)	-2.225	(0.013)
POP	-2.154	(0.015)	-5.615	(0.000)
GOV	-6.268	(0.000)	-2.030	(0.021)
CC	-2.768	(0.002)	-5.660	(0.000)
GE	-6.906	(0.000)	-6.233	(0.000)
PS	-6.661	(0.000)	-6.471	(0.000)
RL	-7.830	(0.000)	-4.876	(0.000)
RQ	-6.030	(0.000)	-4.877	(0.000)
VA	-6.848	(0.000)	-5.497	(0.000)

Source: Authors

Table 4 The governance index - economic growth: The threshold estimations

	Regime 1 $\sigma_i \leq \gamma = 0.222$		Regime 2 $\sigma_i > \gamma = 0.222$	
Variables	Coef.	St. Error	Coef	St. Error
C	3.093	2.225	3.718	11.070
GOV	0.391	0.613	-3.479***	0.858
CPS	-0.014**	0.007	-0.047	0.011
GDP_{2002}	-0.063	0.096	-0.649	0.422
GFCF	0.167***	0.023	0.099***	0.116
INF	-0.030	0.034	-0.190	0.131
OPEN	0.002	0.011	0.037***	0.009
POP	-0.116	-0.314	0.109	0.444
Observations	492		420	
R^2	35.42%		46.43%	
Hetero-skedasticity Test (P-Value)	0.039			

Note: The coefficients are significant at the *10%, **5%, and ***1% levels.

Source: Authors

The relationship between the governance index and economic growth

The threshold estimations used make it possible to determine whether the governance index has an effect on economic growth or not. The findings are presented in Table 4.

First of all, according to the foregoing findings, relationship between the governance index and economic growth is nonlinear, which indeed is below the threshold level of 0.222; the relationship between the governance index and economic growth is positive but not significant (Regime 1). However, the effect of governance on economic growth above this level is negative and significant (Regime 2), which means that an improvement in governance in developing nations may be able to restrain economic expansion.

This result can be explained by the fact that governments must spend a lot of resources on governance improvements, the resources that could be spent in a better way on promoting economic growth. The same model is used to estimate the relationship between governance and economic growth in order to answer the fundamental question of whether there is a threshold above which effective governance results in increased economic growth. The findings of this research study demonstrate that, when the growth rate is below 6.3 percent, it exerts a negative influence on the governance index; above this point, however, economic growth enhances governance. These findings complement B. Fayissa and C. Nsiah's (2013) result of the irregularity of the governance effect on economic growth according to the income level. It also follows the same line of thought as that of M. H. Khan's (2004) argument that it is difficult to conclusively show that growth

promotes good governance, rather than the reverse, that growth and the rising of income *per capita* are necessary for long-term improvements in good governance. It also corroborates the conclusion made by E. Jakopin (2018), who concluded that the influence of institutions on transition economic growth in Serbia was insignificant, which is not the case when the impact of economic growth on the development of institutions was subjected to analysis.

These findings are important for the policymakers who, first, endeavor to increase economic growth in order to find resources for setting up an effective governance system, and later for obtaining the beneficial effects of governance on overall economic growth.

Since investment is a major driver of economic growth in developing countries, the evolution rate of the gross fixed capital formation (GFCF) meaningfully boosts overall economic growth. Furthermore, it can be observed that the influence of the GFCF in Regime 1 is greater than the influence it has in Regime 2. These findings are consistent with the argument expressed here that, in Regime 2 (above the threshold level of governance), there is a negative relationship between government and economic growth. To put it another way, the impact of investment on economic growth in Regime 2 is smaller than it is in Regime 1, because the government will prioritize the improvement of governance over investment when allocating resources.

The GDP *per capita* for the year 2002 (GDP_{2002}) was significant and shows the expected sign, which is consistent with the neoclassical theory of economic growth. Furthermore, the increased openness of trade (OPEN) boosts expansion in developing nations.

As a measure of the soundness and development of financial systems, the lending of the banking system to the private sector is negative. This result can be attributed to the weak financial sector in most developing nations, these loans additionally not being used for productive purposes.

The governance components and economic growth: The threshold estimations

To examine the influence of the governance components on economic growth, the model is estimated by regressing on each component individually (the specifications 1 to 6 in the tables 5 and 6). The regression results for each specification are presented in the tables 5 and 6 for Regime 1 and Regime 2, respectively.

The results obtained and accounted for first point to the nonlinear link between economic growth and the six pillars of governance. For GE, CC, PS, RL, RQ, and VA, the threshold effects are -0.142, -0.446, -0.244, -0.642, -0.290, and -0.168, respectively.

The findings empirically demonstrate the fact that good governance does in fact matter for economic growth in developing countries, as is shown by the regression results reported in Table 4 (Regime 1). According to the empirical data, increases in regulatory quality, voice and accountability, and the government effectiveness all significantly boost economic growth when they are below their threshold levels of -0.142, -0.290, and -0.168, respectively.

The GE coefficient is statistically significant and positive. These findings contribute to the belief that improving public services, the civil service and its degree of independence of political densities increases economic growth in developing nations. Such a result is in agreement with that obtained by T. Pushak, E. R. Tiongson and A. Varoudakis (2007) and M. R. Alam *et al* (2017), who showed that, in the countries with relatively better public sector governance, macroeconomic stability and public spending could lead to higher growth payouts.

The positive and statistically significant RQ coefficient indicates that improving the ability of the government to develop and put into effect sensible regulations and policies and fostering the private sector growth as well are likely to help boost economic growth in developing nations, corroborates the results obtained by D. Kaufmann and A. Kraay (2002), S. Djankov *et al* (2006), H. Jalilian *et al* (2007), and J. O. Afolabi (2019).

Table 5 The governance components and economic growth: The threshold estimations (Regime 1)

	Regime 1					
	Specification 1 $\sigma_i \le \gamma = -0.446$	Specification 2 $\sigma_i \le \gamma = -0.142$	Specification 3 $\sigma_i \le \gamma = -0.244$	Specification 4 $\sigma_i \le \gamma = -0.642$	Specification 5 $\sigma_i \le \gamma = -0.290$	Specification 6 $\sigma i \le \gamma = -0.168$
c	5.216***	7.016***	4.415***	2.244*	7.412***	5.860***
	[4.568]	[8.144]	[6.305]	[1.358]	[5.161]	[6.135]
GDP_{2002}	-0.057	-0.007	-0.083	-1.263***	-0.379	0.759***
	[-0.548]	[-0.045]	[-0.697]	[-2.239]	[-0.783]	[2.232]
CPS	-0.033***	-0.083***	-0.020***	-0.069***	-0.047***	-0.029***
	[-2.171]	[-4.821]	[-3.353]	[-2.502]	[-2.471]	[-3.086]
GFCF	0.124***	0.013	0.151***	-0.0002	0.001	0.004
	[6.334]	[0.819]	[10.586]	[-0.018]	[0.134]	[0.283]
INF	-0.072***	-0.062	-0.073*	-0.004	-0.052	-0.033
	[-3.025]	[-1.613*]	[-2.870]	[-1.432]	[-0.937]	[-0.857]
OPEN	0.002	0.028***	0.004	0.028***	0.006	0.012**
	[0.456]	[3.767]	[0.732]	[3.544]	[0.864]	[1.816]
POP	-0.083	0.194	0.121	0.588*	0.204	0.072
	[-0.357]	[0.833]	[0.672]	[1.430]	[0.565]	[0.265]
CC	0.173		-	-	-	-
	[0.205]					
GE	-	3.667***	-	-	-	-
		[4.434]				
PS	-	-	0.040	-	-	-
			[0.156]			
RL	-	-	-	-1.540	-	-
				[-1.050]		
RQ	-	-	-	-	3.590***	-
					[3.471]	
VA	-	-	-	-	-	1.486***
						[2.685]
Obs.	489	419	393	366	414	480
R^2	0.37	0.33	0.45	0.28	0.27	0.37

Source: Authors

The voice and accountability (VA) coefficient is statistically both significant and positive. This result proves the importance of democracy, the freedom of speech, access to the media, and the right to association in fostering economic growth in developing countries. This result is consistent with the findings of R. C. Kormendi and P. G. Meguire (1985), and D. Kaufmann and A. Kraay (2002), who discovered that the nations with greater civil liberties typically had higher prosperity levels.

According to the results of the control variables, investment (GFCG/GDP) and the openness level (TRADE/GDP) both contribute to economic growth. However, the banking system's lending to the private sector and inflation have a negative influence on economic growth. In fact, these credits are not invested in fruitful and productive activities and may be the cause of the CPS's detrimental influence on economic growth.

The empirical results presented in Table 6 (Regime 2) revealed that, above the threshold levels, all the other aspects of governance, apart from voice and accountability (VA), are negatively and statistically significantly correlated with economic growth, which is implicative of the fact that improving these aspects of governance would block economic growth in these developing countries.

Table 6 The governance components and economic growth: The threshold estimations (Regime 2)

	Regime 2					
	Specification 1 $\sigma_i > \gamma = -0.446$	Specification 2 $\sigma_i > \gamma = -0.142$	Specification 3 $\sigma_i > \gamma = -0.244$	Specification 4 $\sigma_i > \gamma = -0.642$	Specification 5 $\sigma_i > \gamma = -0.290$	Specification 6 $\sigma_i > \gamma = -0.168$
c	3.784***	3.250***	2.538***	4.205***	4.013***	3.904***
	[5.580]	[5.865]	[2.448]	[7.972]	[7.556]	[6.682]
GDP_{2002}	-0,070	-0.094	-0.336	0.055	-0.014	-0.099
	[-0.679]	[-0.606]	[-1.607*]	[0.647]	[0.152]	[-0.908]
CPS	-0.021***	-0.008**	-0.020***	-0.015***	-0.017***	-0.017***
	[-4.281]	[-1.983]	[-3.234]	[-4.058]	[-4.001]	[-3.995]
GFCF	0.020	0.142***	0.021***	0.116***	0.131***	0.130***
	[1.054]	[6.872]	[1.125]	[7.248]	[7.150]	[8.388]
INF	0.103**	0.028**	0.209***	0.023*	-0.012	-0.035
	[1.891]	[1.965]	[2.556]	[-1.432]	[-0.492]	[-0.884]
OPEN	0.005	0.007*	0.014***	0.0009	0.005*	0.001
	[1.221]	[1.379]	[2.466]	[0.209]	[1.154]	[0.319]
POP	0.397***	0.093	0.311*	-0.017	0.081	0.204*
	[2.234]	[0.465]	[1.450]	[-0.121]	[0.518]	[1.284]
CC	-0.492**	-	-	-	-	-
	[-1.900]					
GE	-	-1.127***	-	-	-	-
		[-2.842]				
PS	-	-	-1.095***	-	-	-
			[-2.544]			
RL	-	-	-	-0.471**	-	-
				[-1.719]		
RQ	-	-	-	-	-0.650***	-
					[-2.259]	
VA	-	-	-	-	-	-0.177
						[-0.508]
Obs.	489	419	393	366	414	480
R^2	0.26	0.3	0.44	0.32	0.35	0.38

Source: Authors

Economic growth is hampered by an increase in the corruption control index (CC), which is in line with S. P. Huntington's (1968) assertion that a rigid, centralized, and dishonest bureaucracy is worse for a society's ability to economically grow than a rigid, centralized, and honest bureaucracy. Furthermore, F. T. Lui (1985) showed how corruption could effectively reduce the time people spend in lines. According to P. G. Méon and K. Sekkat (2005), corruption can cover up for a number of bureaucratic dysfunctions. Slowness is the first one. The results of S. Haggard and L. Tiede (2011) demonstrated a positive connection between corruption and economic growth for developing countries between 1985 and 2004, which is also in agreement with these findings.

Economic growth tends to be significantly harmed by improvements in the government effectiveness (GE) and regulatory quality (RQ), the reason for which lies in the fact that these countries do not have sufficient resources to improve the quality of their public services, civil service, policy formulation, and policy implementation, and that, even if they did have sufficient resources, that would be at the expense of economic growth.

According to the political stability coefficient, which is negative and statistically significant, political instability in developing countries did not harm economic growth between 1996 and 2015. This conclusion is in line with the research study carried

out by A. K. Fosu (2001) and may be supported by the observation that investment declines and savings increase during periods of political unpredictability and instability, which has the effect of slowing down both short- and long-term economic growth.

It is statistically significant that the rule of law (RL) coefficient is negative. Since corruption control (CC) has a favorable influence on economic growth, this result is consistent with those findings. The introduction of the rule of law will limit corruption, which seems to be advantageous to developing countries at the present stage of development.

CONCLUSION

The relationship between appropriate governance and economic growth is considered to be one of the more active areas of theoretical and empirical debate in the literature. Using a threshold regression model, this paper was initially aimed at examining the relationship between economic growth and governance in 48 developing countries between the years 2002 and 2020.

In reference to the first hypothesis of this paper (H1), first, the results obtained herein do confirm the nonlinear relationship between economic growth and the governance index. This relationship is indeed characterized by the presence of the threshold effect. Second, economic growth in developing countries slows down when governance improves. In fact, the relationship between economic growth and governance is negative and significant (Table 4, Regime 2). Despite these findings, the positive effects of sound governance on economic growth should not be cast a doubt on. Numerous resources needed for improving governance, however, should be provided by boosting economic growth at the initial stage, which could in turn enable good governance to support further economic growth.

When speaking about the second research hypothesis (H2), the findings presented herein are also supportive of the idea that the relationships between economic growth and the governance components, such as corruption control (CC), the government efficiency (GE), political stability (PS), the rule of law (RL), regulatory quality (RQ), and voice and accountability (VA) are nonlinear. Indeed, CC, PS and RL are not significant below their threshold level. Above their threshold levels, however, these components are negatively significant. In addition, the relationships between economic growth and GE, RQ and VA are positive and significant. Nonetheless, these components exert a negative influence on economic growth, except for VA.

By way of conclusion, the implications of the findings presented herein and pertaining to developing economies are thus profound. In spite of the positive effect of corruption as long as it is below its threshold level, its effect is negative when the same is above this cutoff point. Thus, developing economies are suggested to build a strong institution to limit corruption and keep it at a supportable level.

In addition, as long as their indices are below their cutoff points, regulatory quality (RQ) and the government effectiveness (GE) have a positive influence on economic growth. However, the effects are reversed when these aspects of governance, as well as political stability (PS) and the rule of Law (RL), improve.

Therefore, it is recommended that developing countries should ensure the economic growth that will then guarantee them means to establish the governance system that will sustain this growth in the long run. They are simultaneously called upon to build the strong institutions that promote accountability, limit corruption and facilitate the functioning of the rule of law.

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APPENDIX

Table A1 The list of the developing countries

Argentina	El Salvador	Peru
Armenia	Estonia	Philippines
Bahamas, The	Gabon	Senegal
Belize	Honduras	Slovak Republic
Benin	India	Slovenia
Bolivia	Indonesia	South Africa
Botswana	Jordan	Sri Lanka
Brazil	Kenya	Tanzania
Burkina Faso	Malaysia	Thailand
Cambodia	Mali	Togo
Chile	Mauritius	Trinidad and Tobago
Colombia	Mexico	Tunisia
Czech Republic	Morocco	Turkey
Dominican Republic	Mozambique	Uganda
Ecuador	Nicaragua	Ukraine
Egypt	Pakistan	Uruguay

Source: Authors

Table A2 The governance components

1. Corruption control
It captures the perceptions of the extent to which public power is exercised private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
2. Government effectiveness
It captures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence of political pressures, the quality of the policy formulation and implementation, and the credibility of the government's commitment to such policies.
3. Political stability
It measures the perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.
4. Regulatory quality
It captures the perceptions of the government's ability to formulate and implement sound policies and regulations permitting and promoting the private sector development.
5. The rule of law
It captures the perceptions of the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, property rights, the police, and courts, as well as the likelihood of crime and violence.
6. Voice and accountability
It captures the perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as the freedom of expression, the freedom of association, and the free media.

Source: The World Bank (2022b)

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THE EFFECTS OF INCOME TAX ON THE UNEMPLOYMENT RATE IN THE UNITED STATES

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This study investigates the correlation between state income tax and unemployment rates across the United States. Using panel data in 50 states pertaining to the period from 2006 to 2022 with different regression models, the results suggest that the state corporate and personal income tax rates are positively correlated with the state unemployment rate. Specifically, a 1% decrease in the personal income tax rate may lead to a 0.712% decrease in the state unemployment rate, and a 1% decrease in the corporate income tax rate may cause a drop of 0.328% in the state unemployment rate. In addition, the results show that a personal income tax hike is associated with an increase of 1.532% in the state unemployment rate, and a corporate income tax hike may increase the state unemployment rate by 0.78%. The results of this study are relevant in the context of increasing government spending in the US and the world. Policymakers and government officials may not want to abuse the tax policy to fund the budget deficits.

Keywords: unemployment rates, personal income tax, corporate income tax, fixed-effects model, dynamic panel data

JEL Classification: H71, E24, J2

INTRODUCTION

In the United States, each state has the right to govern its local economy as long as it complies with federal government laws and regulations. As a result, there is obvious heterogeneity in terms of economic policies and performances across the states. A part of it stems from the fact that the states compete with one another in order to attract more firms. A large state can use its fiscal policy (i.e. tax policy) so as to give out-of-state big corporations financial incentives to move in. For example, in 2018, California had a personal income tax rate of 12.3%, whereas Texas had a tax rate of 0%. Although these two states have comparable populations, locations, and the economic size, they have completely opposite tax policies in place. This competition among the states is not likely to end in the future.

There is a rich literature on the impact of the tax policy on economic growth in the United States and

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in the world as well. T. J. Bartik (1994) estimated that the average elasticity for the tax responsiveness for economic growth was - 0.3 across the United States. According to F. Daveri and G. Tabellini (2014), higher labor taxes are associated with a higher unemployment rate. In particular, they estimated that the increase of 14 percent in labor tax rates from 1965 to 1995 in the EU could account for the increase of around 4 percent in the unemployment rate. Nonetheless, there is no ultimate answer to the question, how much does a tax policy affect the economic performance of a state? The argument can go both ways. There are those who may argue that tax revenue provides the state with funds that go towards public education, infrastructure, and other economic development projects. These projects, if the same ultimately show to be successful, may create well-paying jobs and help promote economic growth.

Yet, one may also be doubtful about the efficiency of those projects. According to the data, several US states manage to provide public welfare to their citizens without imposing high tax rates. In the states with lower personal income tax rates, it can be argued that workers have more financial incentives to stay in their jobs. Additionally, households may be able to keep more disposable income and spend more on goods and services. Consequently, high demand for goods and services in these states may create more local jobs. Apart from said, the states with relatively low-income tax rates may have the advantage of attracting more companies and businesses from other states. Therefore, the unemployment rate in these states tends to be lower than in those with higher tax rates.

The differences in the statewide tax policy across the US can be seen in the other parts of the world, including the powerhouse economies such as China, Japan, Germany, France, India, and so on. The findings of this study may be useful for local policymakers in the other countries that share some common government-related characteristics with the US.

Given the fact that the empirical findings in the literature are not robust and consistent, this paper aims to provide more evidence to the debate. In this study, two specific questions are addressed and discussed, namely:

1. Do the states with lower personal or/and corporate income tax rates tend to have lower unemployment rates?

2. Do income tax rate hikes in the US affect the unemployment rate?

The research study conducted in this paper differs from previous research studies from several points of view. First, while the largest number of the papers in the literature have used cross-sectional or pooled time-series data, a panel data set allowing us to take care of heterogeneity issues across the states and lessen the omitted variable bias is used in this paper. Second, different empirical approaches are applied in this paper so as to analyze the impacts of the tax on the unemployment rate. Finally, the data set of this paper is more up-to-date.

The rest of the paper is structured into a few sections. In Section 2, the literature is discussed in the literature review. Section 3 explains the econometric methodology and data. Section 4 deals with the empirical results and discussion and Section 5 includes the concluding remarks.

LITERATURE REVIEW

Although there are voluminous studies on the impact of tax on economic performance, the answers are inconclusive. Most researchers agree that a tax policy influences firms' decisions to open, expand, or leave a region. Specifically, if the corporate tax rate drops, firms may be able to expand their business as they might receive bigger profits. If firms increase their economic activities, they might create more jobs and spur economic growth in the area. In addition, if personal income taxes fall, households may receive higher disposable incomes and spend more. Therefore, aggregate demand for goods and services might increase, which will lead to higher economic and job growth. C. D. Romer and D. H. Romer (2010) found that federal tax hikes might negatively affect

the output and the unemployment rate. O. M. Zidar (2015) concluded that a 1% tax cut would lead to a 3.4% increase in state employment. Earlier studies had also found connections between state taxes and economic growth. T. J. Bartik (1992) provided a detailed review of the impact of state and local taxes on employment and economic growth. He postulated that an increase in state and local tax rates might lead to a decrease in employment and economic growth. E. Borchers, J. Deskins and A. Ross (2016) found that higher state tax rates and corporation income tax rates might impede small business growth. In another study, T. J. Bartik (1994) estimated the average elasticity of tax responsiveness ranges, moving from -0.1 to -0.6. Other researchers had found similar results using different sets of data and methods (Wasylenko & McGuire, 1985; Munnell & Cook, 1990; McConnell & Schwab, 1990; Papke, 1991). Using data for the OECD countries, B. Heitger (2002) found that tax reduction might lead to an increase in short-term unemployment but a decrease in long-term unemployment.

Nonetheless, the results are inconclusive. Several studies showed that the impact of taxes on job and economic growth was either small or statistically insignificant (Romans & Subrahmanyam, 1979; Carlton, 1983; Tannenwald, 1996). J. Helms (1985) found that an increase in state and local taxes was associated with a lower economic growth rate if tax review was used for transfer payments. On the other hand, if tax money is used to improve public services, it may support economic growth. In an interesting study, R. Carroll and M. Wasylenko (1994) used data from 1967 to 1988, and found that state and local taxes had had a bigger impact on employment and economic performances before 1982 than they did after that year. E. P. Goss and J. M. Phillips (1994) provided mixed evidence on the matter, having found that the higher personal income taxes of the state were statistically associated with lower job growth, whereas the impact of corporate tax rates was insignificant. A. Estache and B. Gersey (2018) studied the effect of the corporate tax rate policy on the unemployment rate in Europe between 1999 and 2014. They showed that a 1% decrease in the corporate tax rate might lead to a 0.34% increase in the unemployment rate.

R. J. Pjesky (2006) argued that the empirical findings of prior studies were subject to the data and methodologies used. Most of them are sensitive to empirical strategies and time. More recently, C. A. Pissarides (1998) has studied the impact employment tax cuts have on unemployment rates in Europe. He could not conclude that employment tax cuts had an impact on unemployment rates at a significant level. T. Turner and B. Blagg (2018) used the difference-in-differences approach to examine the impact of a personal income tax cut on private-sector employment in the state of Kansas. They found no evidence for the subject-matter relationship.

Although there is a rich literature on the impact of taxes on economic growth, there is no definitive answer. In addition, there are not many studies that examine the impact of personal and corporate income tax rates on unemployment in the United States. This research study contributes to the literature in several ways. First, a more up-to-date data set is used, covering the period of pre- and post-Great Recession of 2008. Second, different impacts of personal income and corporate income taxes on unemployment rates are presented. Finally, Fixed-Effects and Dynamic Panel Data models are used in order to limit the heterogeneity and autocorrelation issues across the states and lessen the omitted variable bias.

ECONOMETRIC METHODOLOGY AND DATA

Empirical strategies are discussed in this section. This study aims to examine the relationship between income tax rates and the unemployment rate across different states in the US. In addition, the study also aims to evaluate the impact of the income tax hike on the unemployment rate. In most studies in the literature, cross-sectional data are used to analyze the impact of state and local taxes on economic growth. There may be two potential issues to this approach. First, it does not capture the relevant importance of the characteristics of each individual state. Second, the nationwide macroeconomic factors subject to change overtime, such as the business cycle, the federal fiscal

and monetary policy/policies, and so on, may be missed. Therefore, the panel data of all 50 states in the United States from the year 2006 to the year 2022 are included herein so as to avoid the aforementioned potential problems. Regarding the use of the panel data, another question is, what kind of specifications to use (i.e. the fixed-effect or random-effect models). Following J. Helms (1985) and R. Carroll and M. Wasylenko (1994), the estimation of the fixed-effect (FE) model was used as the main results given the fact that it accounts for the heterogeneity issue across the states and lessens the omitted variable bias.

Four different models were used to address the two questions in this study. In the first model, the impact of the state personal income tax rate on the state unemployment rate is examined. The first model is as follows:

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1 (Personal\ Income\ Tax\ Rate)_{it} + \beta_2 (Bachelor's\ Degree)_{it} + \beta_3 (Minimum\ Wage)_{it} + \beta_4 Log(State's\ Population)_{it} + \beta_5 (SNAP\ Benefits)_{it} + \beta_6 (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where $Unemployment\ Rate_{it}$ is the official unemployment rate in the state i at the time t. $Personal\ Income\ Tax\ Rate_{it}$, $Bachelor's\ Degree_{it}$, $State's\ Population_{it}$, $SNAP\ Benefits_{it}$, $Minimum\ Wage_{it}$, $Union\ Workers_{it}$, are the rate of personal income tax, the ratio of the population who has graduated with a bachelor's degree or a diploma above that degree, the size of the population, the number of the SNAP benefits recipients, the minimum wage level, and the number of the unionized workers in the state i at the time t, respectively. θ_i is used to control the time-invariant unobserved characteristics of the state i. λ_t is used to control the state-time trends that may affect the unemployment rate in all the states.

In the second model, the relationship between the state corporate tax rate and the state unemployment rate is investigated. The second model is as follows:

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1 (Corporate\ Income\ Tax\ Rate)_{it} + \beta_2 (Bachelor's\ Degree)_{it} + \beta_3 (Minimum\ Wage)_{it} + \beta_4 Log(State's\ Population)_{it} + \beta_5 (SNAP\ Benefits)_{it} + \beta_6 (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where $Unemployment\ Rate_{it}$ is the official unemployment rate in the state i at the time t. $Corporate\ Income\ Tax\ Rate_{it}$, $Bachelor's\ Degree_{it}$, $State's\ Population_{it}$, $SNAP\ Benefits_{it}$, $Minimum\ Wage_{it}$, $Union\ Workers_{it}$, are the rate of corporate income tax, the ratio of the population who have received bachelor's degrees or a diploma above that degree, the size of the population, the number of the SNAP benefits recipients, the minimum wage level, the number of the unionized workers in the state i at the time t, respectively. θ_i is used to control the time-invariant unobserved characteristics of the state i. λ_t is used to control the state-time trends that may affect the unemployment rate in all the states.

In the third model, both the state personal income tax rate and the state corporate tax rate are included as the explanatory variables. The third model is as follows:

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1 (Personal\ Income\ Tax\ Rate)_{it} + \beta_2 (Corporate\ Income\ Tax\ Rate)_{it} + \beta_3 (Bachelor's\ Degree)_{it} + \beta_4 (Minimum\ Wage)_{it} + \beta_5 Log(State's\ Population)_{it} + \beta_6 (SNAP\ Benefits)_{it} + \beta_7 (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (3)$$

In the fourth model, whether state income tax hikes affect state unemployment rates or was the subject matter of investigation. Dummy variables were used for the tax hikes. The dummy variables have the value 1, if the state increases taxes on personal income or corporate income by more than 2%, or the value is 0 otherwise. The fourth model is as follows:

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1 (Personal\ Income\ Tax\ Hike)_{it} + \beta_2 (Corporate\ Income\ Tax\ Hike)_{it} + \beta_3 (Bachelor's\ Degree)_{it} + \beta_4 (Minimum\ Wage)_{it} + \beta_5 Log(State's\ Population)_{it} + \beta_6 (SNAP\ Benefits)_{it} + \beta_7 (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (4)$$

The data were retrieved from different sources, as described in Table 1. The variables used for the purpose of conducting this study are the minimum wage, the average state personal income tax rate, the bachelor's degree attainment, the state's population, the labor union members, the supplemental nutrition assistance program (SNAP) benefit recipients, and the unemployment rate. The dataset includes as many as 850 observations.

Table 1 The variables and the sources

Variables	Sources
State Unemployment Rate	US Bureau of Labor Statistics
State Minimum Wage	US Department of Labor
Bachelor's degree Completion Rate	US Census Bureau
State Population	US Census Bureau
SNAP Benefits Recipients	US Census Bureau
State Personal Income Tax Rate	Federation of Tax Administrators
State Corporate Income Tax Rate	Tax Policy Center
Number of Union Employees	US Bureau of Labor Statistics

Source: Authors

The state unemployment rate is the dependent variable in this study. The main independent variables are the state personal income and corporate income tax rates. The control variables are supposed to affect the supply of and demand for jobs on the market. Specifically, the state minimum wages might affect the equilibrium of the job market. If the minimum wage is higher than the equilibrium wage in a certain industry, it may create involuntary unemployment amongst unskilled workers. The bachelor's degree attainment ratio measures the state's level of human capital. It can be argued that, if the level of human capital in a state is higher, demand for labor in that state higher as well. The number of the labor union members in each state measures how strong the labor union in that particular state is. A stronger union may scare employers out of the state and negatively affect demand for labor. The SNAP benefits recipients variable reflects how comprehensive a state's welfare program is. A more generous welfare program may reduce unemployed workers' incentives to find new jobs, which as a result may lead to a higher unemployment rate. Ultimately, the state's population may affect the supply of labor.

The data for all 50 states in the US were collected for the period from 2006 to 2022. Unfortunately, the data for some variables are not available for the period preceding the year 2006.

EMPIRICAL RESULTS AND DISCUSSION

Table 2 gives the correlation matrix, and Table 3 provides the summary statistics of all the variables used in this study.

The baseline OLS regression results are the starting point. Table 4 provides the empirical results for the OLS regressions for all the four models discussed in the previous section. According to the third column of Table 4, one of the main variables of interest (the personal income tax rate) has a coefficient 0.710 and is statistically significant at a 10% level. The other variable, i.e. the corporate income tax rate, has a coefficient 0.551 and is also statistically significant at a 10% level. This result suggests that a 1% increase in the personal income tax rate is on average associated with an increase of 0.71% in the state unemployment rate. In addition, a 1% increase in the corporate income tax rate is correlated with an increase of 0.551% in the state unemployment rate. Furthermore, the bachelor's degree completion rate has a coefficient of -0.115 and is statistically significant at a 1% level, which on its part suggests that a 1% increase in the bachelor's degree completion rate may lead to a decrease of 0.115% in unemployment. The minimum wage variable has a coefficient of 0.115 and is statistically significant at a 10% level, which suggests that a dollar increase in the state's minimum wage is associated with a 0.115% increase in the state unemployment rate. The state's population coefficient is -0.021 and is statistically significant at a 1% level, which indicates that a 10% increase in the state's population is associated with a 0.0086% decrease in the state unemployment rate. SNAP's coefficient is 0.022, the number of the union employees coefficient is 0.12, and both are statistically significant at a 1% level, which suggests that an increase of 1,000 people in the SNAP program and the union is associated with an increase of 0.022% and 0.12% in the unemployment rate, respectively. The results of the models 1 and 2 are consistent with those of the model 3.

The results given in the fourth column of Table 4 suggest that a personal income tax hike from the year before is associated with an increase of 1.418% in the state unemployment rate. In addition, a hike in the

Table 2 The correlation matrix

	Minimum wage	Bachelor's degree completion rate	State's population	SNAP benefits recipients	Personal income tax rate	Number of union employees	Unemployment rate	Corporate income tax rate
Minimum wage	1							
Bachelor's degree Completion Rate	0.462	1						
State's population	0.102	0.127	1					
SNAP benefits recipients	0.119	0.042	0.935	1				
Personal income tax rate	0.077	0.162	0.035	-0.033	1			
Number of Union Employees	0.214	0.233	0.843	0.732	0.209	1		
Unemployment rate	0.020	-0.226	0.193	0.286	0.016	0.180	1	
Corporate income tax rate	0.040	0.177	-0.054	-0.104	0.506	0.079	0.018	1

Source: Authors

Table 3 The summary statistics

	Observations	Mean	S.D.	Minimum	Maximum
Minimum wage	850	7.31	1.20	2.65	11.5
Bachelor's degree completion rate	850	28.62	5.14	16.5	44.5
Log(State's population)	850	62.26	69.61	52.66	394.46
SNAP benefits recipients	850	79.41	86.33	2.25	441.65
Personal income tax rate	850	5.24	3.04	0	12.3
Number of Union Employees	850	298.35	449.33	15	2740
Unemployment rate	850	5.91	2.19	2.4	13.6
Corporate income tax rate	850	6.34	2.82	0	12

Source: Authors

corporate income tax is correlated with an increase of 0.415% in the state unemployment rate.

To sum up, all the variables have coefficient values and signs as expected. The OLS regression results, however, are subject to methodological concerns. As pointed out in J. Helms (1985), OLS regression might produce biased results because it does not take into account the unobserved heterogeneous characteristics across states in the nation. Therefore, the nature of the panel data set was taken advantage of so as to minimize the potential bias of the OLS regressions. The random-effect and fixed-effect regressions were applied to all the four aforementioned models for the purpose of robustness checks. In addition to that, the J. Hausman (1978) specification test was done in order to identify which regression procedure is more appropriate.

Table 4 The OLS regression results
(Dependent variable = State unemployment rate)

Independent variables	Model 1	Model 2	Model 3	Model 4
Intercept	7.607	7.424	7.403	6.915
	(0.514)	(0.524)	(0.534)	(0.537)
Personal income tax rate/hike	0.875*		0.710*	1.418*
	(0.446)		(0.362)	(0.723)
Corporate income tax rate/hike		0.653*	0.551*	0.415*
		(0.343)	(0.306)	(0.223)
Bachelor's degree completion rate	-0.111***	-0.115***	-0.115***	-0.113***
	(0.017)	(0.017)	(0.017)	(0.017)
Minimum wage	0.107***	0.115*	0.115*	0.119*
	(0.069)	(0.068)	(0.068)	(0.067)
Log(State's population)	-0.025***	-0.024***	-0.021***	-0.025***
	(0.0039)	(0.0048)	(0.0051)	(0.0049)
SNAP benefits recipients	0.021***	0.019***	0.022***	0.023***
	(0.0031)	(0.0029)	(0.0030)	(0.0031)
Number of union employees	0.11***	0.14***	0.12***	0.15***
	(0.04)	(0.041)	(0.038)	(0.042)
State fixed effects	No	No	No	No
State time trends	No	No	No	No
R^2	0.39	0.42	0.48	0.45
N	850	850	850	850

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1; the numbers in parentheses are robust standard errors.

Source: Authors

Robustness Checks

Random-effect models

Before using the panel data models to estimate the impact of state income taxes on unemployment rates, unit root tests had been done in order to check if the panels were stationary or not. The Levin-Lin-Chu, Harris-Tzavallis, and Im-Pesaran-Shin tests were performed. Table 5 shows the results of these tests, which suggest that the panels are stationary. Therefore, the panel data models can be used for estimations.

Table 6 shows the estimation results obtained by performing the random-effect regressions. According to Table 6, most coefficients have the same signs and significance levels, as is shown in Table 4. Specifically, the personal income tax rate, the corporate income tax rate, the personal income tax hike, and the corporate income tax hike have positive coefficients and are statistically significant at a 10% level across all the models.

Fixed-effect models

Table 7 provides the results obtained from the fixed-effect regressions performed. This specification includes the year and state-fixed effects. These results are in line with what is presented in the tables 4 and 6. In particular so, the personal income tax rate and the corporate income tax rates have positive coefficients and are statistically significant at a 1% level across all the models. According to the third column of Table 7, a 1% increase in the personal income tax rate is associated with a 0.712% increase in the state

Table 5 The panel unit root tests

Variable	Levin-Lin-Chu		Im-Pesaran-Shin	
	Adjusted t*	p-value	t-bar	p-value
Personal income tax rate	-4.366	0.000	-3.615	0.000
Corporate income tax rate	-2.96	0.002	-2.521	0.000
State unemployment rate	-2.734	0.003	-2.815	0.000
State minimum wage	-5.551	0.000	-1.987	0.0057
Bachelor's degree completion rate	-6.257	0.000	-2.322	0.000
State's population	-12.478	0.000	- 2.447	0.000
SNAP benefits recipients	-9.462	0.000	-2.825	0.000
Number of the union employees	-8.124	0.000	-2.953	0.000

Source: Authors

Table 6 The random-effect GLS regression results
(Dependent variable = State unemployment rate)

Independent variables	Model 1	Model 2	Model 3	Model 4
Intercept	12.097	11.727	11.688	11.289
	(0.782)	(0.805)	(0.816)	(0.881)
Personal income tax rate/Hike	0.417*		0.481*	0.543*
	(0.212)		(0.245)	(0.291)
Corporate income tax rate/Hike		0.329*	0.302*	0.945*
		(0.176)	(0.167)	(0.506)
Bachelor's degree completion rate	-0.287***	-0.284***	-0.293***	-0.267***
	(0.032)	(0.031)	(0.0032)	(0.0311)
Minimum wage	0.122	0.129	0.134	0.112
	(0.084)	(0.084)	(0.084)	(0.084)
Log(State's population)	-0.041***	-0.038***	-0.043***	-0.046***
	(0.006)	(0.0055)	(0.0061)	(0.0063)
SNAP benefits recipients	0.029***	0.030***	0.030***	0.030***
	(0.003)	(0.003)	(0.003)	(0.003)
Number of the union employees	0.21***	0.24***	0.22***	0.28***
	(0.07)	(0.06)	(0.063)	(0.066)
State fixed effects	No	No	No	No
State time trends	No	No	No	No
R^2	0.449	0.458	0.559	0.54
N	850	850	850	850

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; the numbers in parentheses are robust standard errors.

Source: Authors

unemployment rate. Additionally, a 1% increase in the corporate income tax rate is associated with a 0.328% increase in the state unemployment rate. The other explanatory variables have the same signs and significance levels, as is given in the tables 4 and 6.

In addition to the foregoing, whether the random-effect specification is more appropriate than the fixed-effect one or not was checked. The Hausman (1978) specification test was used to do the task. The result is $\chi^2(7) = 175.54$ and Prob. > $\chi^2 = 0.000$; the random-effect specification is thus rejected. So, it can be argued that fixed-effect regressions might provide appropriate results.

Dynamic panel data models

Since a panel data set containing a large number of groups (N=50) and a small period (T=13) are used in this research study, a concern may rise about the autocorrelation issue with respect to the fixed-effect model estimations. The one way to address the issue is to use dynamic panel data (DPD) models. P. Balestra and M. Nerlove (1966), M. Nerlove (1971), and G. Maddala (1971) are the first to have proposed the use of such models. The papers by M. Arellano and S. Bond (1991), M. Arellano and O. Bover (1995), R. Blundell and S. Bond (1998), and D. Roodman (2009) provide more insights into how DPD can be used to address the autocorrelation issue in a panel data set with a large N and a small T. The System GMM approach suggested by M. Arellano and O. Bover (1995) was applied in this study and the following four specifications were estimated, namely:

$$\begin{aligned} Unemployment\ Rate_{it} &= \beta_0 + \beta_1 (Unemployment\ Rate)_{i(t-1)} + \\ &\beta_2 (Unemployment\ Rate)_{i(t-2)} + \beta_3 (Personal\ Income\ Tax\ Rate)_{it} + \\ &\beta_4 (Bachelor's\ Degree)_{it} + \beta_5 (Minimum\ Wage) + \\ &\beta_6 Log(State's\ Population)_{it} + \beta_7 (SNAP\ Benefits)_{it} + \\ &\beta_8 (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \end{aligned} \quad (5)$$

Table 7 The fixed-effect regression results
(Dependent variable = State unemployment rate)

Independent variables	Model 1	Model 2	Model 3	Model 4
Intercept	28.278	28.999	28.026	27.743
	(0.782)	(1.526)	(1.557)	(1.765)
Personal income tax rate/Hike	0.815***		0.712***	1.532***
	(0.075)		(0.076)	(0.569)
Corporate income tax rate/Hike		0.445*	0.328*	0.780*
		(0.246)	(0.182)	(0.445)
Bachelor's degree completion rate	-0.817***	-0.816***	-0.815***	-0.832***
	(0.054)	(0.055)	(0.055)	(0.055)
Minimum wage	0.80***	0.803***	0.799***	0.8***
	(0.092)	(0.0935)	(0.093)	(0.092)
Log(State's population)	-0.12***	-0.116***	-0.125***	-0.128***
	(0.023)	(0.021)	(0.022)	(0.023)
SNAP benefits recipients	0.038***	0.039***	0.038***	0.039***
	(0.003)	(0.003)	(0.0029)	(0.0031)
Number of the union employees	- 0.42**	- 0.45**	- 0.47**	- 0.43**
	(0.19)	(0.18)	(0.17)	(0.20)
State fixed effects	Yes	Yes	Yes	Yes
State time trends	Yes	Yes	Yes	Yes
R^2	0.562	0.555	0.593	0.564
N	850	850	850	850

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1; the numbers in parentheses are robust standard errors.

Source: Authors

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1\ (Unemployment\ Rate)_{i(t-1)} + \beta_2\ (Unemployment\ Rate)_{i(t-2)} + \beta_3\ (Corporate\ Income\ Tax\ Rate)_{it} + \beta_4\ (Bachelor's\ Degree)_{it} + \beta_5\ (Minimum\ Wage) + \beta_6\ Log(State's\ Population)_{it} + \beta_7\ (SNAP\ Benefits)_{it} + \beta_8\ (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (6)$$

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1\ (Unemployment\ Rate)_{i(t-1)} + \beta_2\ (Unemployment\ Rate)_{i(t-2)} + \beta_3\ (Personal\ Income\ Tax\ Rate)_{it} + \beta_4\ (Corporate\ Income\ Tax\ Rate)_{it} + \beta_5\ (Bachelor's\ Degree)_{it} + \beta_6\ (Minimum\ Wage) + \beta_7\ Log(State's\ Population)_{it} + \beta_8\ (SNAP\ Benefits)_{it} + \beta_9\ (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (7)$$

$$Unemployment\ Rate_{it} = \beta_0 + \beta_1\ (Unemployment\ Rate)_{i(t-1)} + \beta_2\ (Unemployment\ Rate)_{i(t-2)} + \beta_3\ (Personal\ Income\ Tax\ Hike)_{it} + \beta_4\ (Corporate\ Income\ Tax\ Hike)_{it} + \beta_5\ (Bachelor's\ Degree)_{it} + \beta_6\ (Minimum\ Wage) + \beta_7\ Log(State's\ Population)_{it} + \beta_8\ (SNAP\ Benefits)_{it} + \beta_9\ (Union\ Workers)_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (8)$$

where $Unemployment\ Rate_{it}$, $Unemployment\ Rate_{i(t-1)}$, and $Unemployment\ Rate_{i(t-2)}$ are the official unemployment rates in the state *i* at the time *t*, *t-1* and *t-2*, respectively.

Table 8 shows the results obtained by applying the System GMM approach. According to the third column of Table 8, a 1% decrease in the personal income tax rate is associated with a 1.595% decrease in the state unemployment rate. In addition, a 1% decrease in the corporate income tax rate is associated with a 0.917% decrease in the state unemployment rate, the results being similar to those obtained from the other fixed-effect models in terms of the coefficient signs and significance levels.

One of the concerns with this approach is the condition of no correlation in the error terms. The Arellano and Bond test was used for the zero autocorrelation in the first-differenced errors so as to check this requirement. Table 9 reports the test results. According to Table 9, the null hypothesis cannot be rejected at the second order. It indicates no serial correlation in the error terms and the estimates are consistent.

To sum up, the results obtained upon performing all the regressions are indicative of the fact that an increase in the personal income tax rate is associated with an increase in the state unemployment rate in the US In addition, an increase in the corporate income tax rate may not affect the state unemployment rate.

CONCLUSION

State income tax rates are different from one state to another in the US. Yet, there has not been much research on how they affect the state unemployment rate. This study investigates the way how the state personal and corporate income tax rates correlate with the state unemployment rate. A panel data set that covers all 50 states in the period from 2006 to 2022 was used.

The empirical results suggest that the state personal and corporate income tax rates are positively correlated with the state unemployment rates, which is the answer to the first research question. More precisely, the results suggest that a 1% decrease in the personal income tax rate is associated with a 0.712% decrease in the state unemployment rate, and a 1% decrease in the corporate income tax rate may cause the state unemployment rate to drop by 0.328%. When the second research question is concerned, the results show that a personal income tax hike in the USA may lead to an increase of 1.532% in the unemployment rate, and a corporate income tax hike in the USA may raise the unemployment rate by 0.78%.

This finding may have a policy implication regarding tradeoffs in state tax policies. The states with higher income tax rates may have more funding for public welfare but at the price of a higher unemployment rate. If a state decides to raise income taxes so as to provide more public goods, it may want to allocate more resources to the education and infrastructure systems and so forth, rather than simply to transfer payments. The better education and infrastructure systems may in turn help to attract more corporations and support local businesses. The benefits may mitigate the social cost of higher tax levied. The findings provided in this study may teach the other countries that have a similar governance structure as the US a lesson.

However, this study has certain limitations. The data used in this study refer back to as early as 2006, although it would be better if the data for several

Table 8 The Arellano and Bover dynamic panel data regression results (Dependent variable = State unemployment rate)

Independent variables	Model 5	Model 6	Model 7	Model 8
Intercept	16.426	16.183	15.827	15.94
	(1.562)	(2.091)	(1.934)	(2.518)
State unemployment rate$_{(t-1)}$	0.846***	0.844***	0.841***	0.851***
	(0.046)	(0.045)	(0.047)	(0.042)
State unemployment rate$_{(t-2)}$	-0.404	-0.418	-0.405	-0.416
	(0.327)	(0.525)	(0.426)	(0.325)
Personal income tax rate/Hike	1.227**		1.595**	1.228*
	(0.556)		(0.725)	(0.626)
Corporate income tax rate/Hike		0.876*	0.917*	1.844*
		(0.472)	(0.509)	(1.024)
Bachelor's degree completion rate	-0.491***	-0.489***	-0.497***	-0.492***
	(0.057)	(0.054)	(0.056)	(0.051)
Minimum wage	0.186**	0.166*	0.171*	0.186*
	(0.095)	(0.097)	(0.094)	(0.097)
Log(State's population)	0.149	0.185	0.191	-0.102
	(0.189)	(0.177)	(0.186)	(0.170)
SNAP benefit recipients	-0.021	-0.005	0.017	0.008
	(0.043)	(0.049)	(0.047)	(0.042)
Number of the union employees	2.363*	1.867	1.76*	2.236*
	(1.312)	(2.367)	(0.975)	(1.208)
State fixed effects	Yes	Yes	Yes	Yes
State time trends	Yes	Yes	Yes	Yes
N	750	750	750	750

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; the numbers in parentheses are robust standard errors.

Source: Authors

Table 9 The Arellano-Bond test for autocorrelation in the panel data

Order	Prob. > z			
	Model 1	Model 2	Model 3	Model 4
1	0.012	0.015	0.019	0.021
2	0.241	0.282	0.224	0.215

Source: Authors

controlled variables were available for the period(s) prior to the year 2006, which would improve the reliability of the results of this research study. In addition to this, there may be certain issues caused by multicollinearity amongst several explanatory variables in some of the models used in this study. For the purpose of future research, this research study can be expanded in several directions so as to include more data that cover more relevant variables or use an alternative dataset for robustness checks. It would also be interesting for a comparison study amongst different economies in the world.

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THE INTEREST RATE - EXCHANGE RATE NEXUS IN CHINA: A DCCA CROSS-CORRELATION COEFFICIENT WITH SLIDING WINDOW APPROACH

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This study aims to investigate the dynamics of the interest rates and exchange rates during the pandemic-induced crisis in the Chinese economy. In the study, rolling window detrended cross-correlation analysis (DCCA) was used. The DCCA coefficient was extracted based on detrended fluctuation analysis (DFA). The data used in the study are the daily data of the period from 2/1/2019 to 7/5/2021. The results obtained in the study suggest the presence of positive cross-correlation between China's interest rate and exchange rate after the COVID-19 pandemic, and they also report the existence of weak positive cross-correlation during the initial days of the pandemic. However, the weak positive cross-correlation became stronger over time. Higher interest rates are associated with higher exchange rates after the COVID-19 pandemic. The results of the research study have policy implications in that conventional higher interest rates introduced to defend the exchange rate might fail during pandemic-induced crises.

Keywords: interest rate, exchange rate, DCCA, DFA, COVID-19

JEL Classification: E44, E52, C22

INTRODUCTION

Policymakers and research scholars across the globe have a keen interest in investigating the link among macroeconomic factors due to their effects on the real economy (Hussain, Bashir & Rehman, 2023). The link between the interest rate and the exchange rate cannot be ignored among such macroeconomic factors. Policymakers use uncovered interest-rate parity-based rationale to defend the domestic currency using active interest rates. The conventional monetary policy approach to defending the exchange rate implies using a tight monetary policy (increasing interest rates) to control exchange depreciation. This approach also mitigates inflationary pressure in the economy. The basic idea is that, in the short run, high interest rates increase the cost of speculation and selling domestic currency. Higher interest rates improve the balance of payment and the exchange rate as a consequence in the long run.

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However, such a monetary approach to controlling the exchange rate failed to explain the Asian financial crisis (AFC) of 1997 and the global financial crisis (GFC) of 2008. The higher interest rates worsened the depreciation of the exchange rate instead of improving it (Basurto & Ghosh, 2000; Bautista, 2003; Saraç & Karagöz, 2016). This unexpected outcome, where an increase in interest rates leads to a further decline in the exchange rate, is commonly called the "perverse effect" (Basurto & Ghosh, 2000; Saraç & Karagöz, 2016). It is important to note that the perverse effect is not exclusive to crises, as is evidenced by the fact that it occurs in normal economic conditions as well, as is exemplified by the case of the Philippines (Bautista, 2003).

Practically, the correlation between the interest rate and the exchange rate can go either way, being either positive or negative, and is difficult to predict. Therefore, it is essential to explore the topic under discussion so as to prescribe a successful monetary policy. It would enable us to answer whether a tight monetary policy (high interest rates) successfully defends exchange rates or not.

In China, which operates under a controlled exchange rate system, the response of the exchange rate to monetary policy interventions, such as changes in interest rates, differs from that in a flexible exchange rate system (Bashir, Khan, Jones & Hussain, 2021; Hussain, Bashir & Bilal, 2021). It is important to examine whether a tight monetary policy characterized by high interest rates is sufficient to defend the exchange rate in a controlled exchange rate system as the one existent in China. Accordingly, this research is focused on exploring the dynamics between interest rates and exchange rates in the context of pandemic-induced crises. While previous studies (Bashir, Yu, Hussain & Zebende, 2016; Hussain, Zebende, Bashir & Donghong, 2017) have mainly investigated the impact of conventional economic crises, such asthe Asian financial crisis and the global financial crisis, this study aims to address the gap in the literature by analyzing the effects of pandemic-induced crises on financial markets. Studying the effects of pandemic-induced crises on interest rates and exchange rates is crucial to the comprehension of their unique dynamics and implications in financial markets. This analysis provides valuable insights to policymakers, investors, and market participants. Pandemics bring about specific challenges and disruptions to economic activities, resulting in distinct impacts on interest rates and exchange rates compared to conventional crises (Hussain *et al*, 2023).

Based on the foregoing discussion, this study aims to investigate the cross-correlation between interest rates and exchange rates in the Chinese economy using the DCCA correlation coefficient. Three hypotheses were developed for the purpose of this research study.

H1: There is a positive correlation between interest rates and exchange rates in China in the observed period.

H2: The COVID-19 pandemic crisis leads to change in the strength of the correlation between interest rates and exchange rates in China.

H3: The causality pattern between the interest and exchange rates in China will change during a pandemic-induced crisis.

To achieve the research aim and test the proposed hypotheses, a different approach and a correct proxy were applied in order to explore the relationship between the interest rate and the exchange rate for China. The detrended cross-correlation analysis (DCCA) developed by G. F. Zebende (2011) was carried out. This approach has different strengths compared to the existing literature. First, most econometric series, such as the interest rate and the exchange rate, have a unit root. In the presence of unit root, cause-and-effect analysis, regression, vector auto-regression, and cointegration analysis would provide spurious results if the unit root problem was not properly dealt with (Hussain *et al*, 2017). Second, the DCCA approach can measure detrended cross-correlation on different time scales. The DCCA coefficient is a measure used to quantify the long-term correlation between two time series. It helps identify the presence of long-term dependencies and cross-correlations in the data. By conducting detrended cross-correlation analysis, the coefficient is calculated by removing short-term trends and examining the correlation at different time scales. Positive values indicate positive long-term correlation, whereas negative values indicate negative long-term correlation, and values close to

zero suggest no significant long-term correlation at all. This coefficient is valuable in various fields for understanding persistence and interdependencies in time series data, being helpful in modeling, forecasting, and risk management (Zebende, 2011; Zebende, Da Silva & Machado Filho, 2013; Kristoufek, 2014; Saleem, Khalid & Nadeem, 2019).

The rest of the paper is structured into four sections. The second section contains a brief literature review, whereas in the third section, the methodology and the data are presented. The results and discussion are presented in Section four. The fifth section contains the conclusion of the paper.

LITERATURE REVIEW

Interest rate and exchange rate dynamics are of great importance as they have remarkable effects on the real economy and have been the point of interest of policymakers. These policy implications pertain to both the domestic economy and the rest of the world. Keeping in mind the practical implication of this relationship, monetary policy tools and the exchange rate have been under extensive investigation (Kim & Chen, 2022). However, these studies come across different econometric issues, as suggested by (Zettelmeyer, 2004). The problem with the existing literature is that they measure the relationship under discussion with regression, vector auto-regression, and the nominal proxy of the interest rate and regression analysis (Basurto & Ghosh, 2001). They argued that the nominal interest rate is not a good proxy for the monetary policy stance. Second, regression and vector auto-regression models are silent to explain the conjectured relationship due to the misidentification of exogenous shocks to the monetary policy (Christiano, Eichenbaum & Evans, 1999). In a fashion similar to the international literature, the Chinese monetary policy has also been studied either by testing (McCallum, 1988; Taylor, 1993) or through a hybrid rule. The most recent literature investigated such a context (Chang, Liu & Spiegel, 2015; Saleem, Tahir & Batool, 2021). However, these studies measure the response of the monetary policy to changes in inflation and the output growth.

The monetary policy transmission mechanism in the Chinese economy has been investigated by conducting various studies (Hussain *et al*, 2021). However, their main focus is on the monetary policy transmission through bank lending channels and risk-taking channels. Recent studies carried out by K. Rai and B. Garg (2022) and M. Hussain *et al* (2023) have investigated the exchange rate and the stock price volatility in BRICS markets. However, the analysis lacks in that it does not explore the link between the interest rate and the exchange rate in the Chinese economy. In a similar fashion, Z. Umar and M. Gubareva (2020) analyzed the exchange rate and the crypto market volatility lacking the analysis of the interest rate and the exchange rate. Moreover, H. O. Osazevbaru (2021) investigated the possible impact of the exchange and interest rate volatility on SMEs performance and found the significant evidence of long-term cointegration. In addition, the exchange rate fluctuations substantially affect exports and investment in Asian countries (Milenković, 2012).

It is worth mentioning that the existing literature on the discussed topic has been investigated using different models, such as linear regression analysis, vector autoregression (VAR), the impulse response, the vector error correction model, the Generalized Method of Movement, and instrumental regression analysis, which are all strong, but the same measure the response of variables in two dimensions, namely in the long-term and in the short-term dimensions. The goal of this study is slightly different, implying the checking of the co-movement of the interest rate and the exchange rate over different time scales. Such a model will not prove to be useful if there is a wish to check the co-movements of the interest rate and the exchange rate on different time scales. For the reason of that fact, detrended cross-correlation analysis (DCCA) was applied.

The approach used in this research study offers distinct advantages compared to the existing literature. Firstly, it addresses the issue of the unit root present in many econometric series, such as the interest rate and the exchange rate. Failure to properly deal with the unit root problem may lead to spurious results in causal and regression

analyses, vector auto-regression, and co-integration analysis (Hussain *et al*, 2017). Secondly, conventional methods, such as regression, auto-regression, and co-integration analysis, only consider the long- and short-term dimensions of the relationship studied, often overlooking the co-movements of variables across different time scales. In contrast, the approach based on DCCA applied in this study allows for the measurement of detrended cross-correlation at various time scales (Zebende, 2011; Zebende *et al*, 2013; Kristoufek, 2014).

Moreover, this research study is focused on analyzing the dynamics between interest rates and exchange rates during the pandemic-induced crises, which is quite a novel contribution. Previous studies primarily examined the effects of conventional economic crises, such as the Asian financial crisis and the global financial crisis. In a similar way, the impact of the pandemic-induced crisis on the cross-correlation between the interest rate and the exchange rate were investigated in this research study. The effect of pandemic-induced crises on these financial markets will fill the research gap in the continuously expanding literature. Being knowledgeable of how pandemic-induced crises affect financial markets is crucial in gaining comprehensive insights into their unique characteristics and implications for the global economy.

METHODOLOGY AND DATA

The detrended cross-correlation analysis (DCCA) coefficient was used so as to quantify the co-movements of the interest rate and the exchange rate. The DCCA coefficient is a powerful method to investigate the cross-correlation between nonstationary series compared to traditional correlation analysis (Kristoufek, 2014). The DCCA coefficient is a combination of DCCA (Podobnik & Stanley, 2008) and detrended fluctuation analysis (DFA) (Peng, Buldyrev, Goldberger, Havlin, Simons & Stanley, 1993; Kantelhardt, Zschiegner, Koscielny-Bunde, Havlin, Bunde & Stanley, 2002).

According to G. F. Zebende (2011), the DCCA coefficient can be defined as a ratio between the detrended covariance of two series and the detrended variance of the series of interest. Here, the DCCA coefficient can be obtained by dividing the detrended covariance of the interest rate and the exchange rate over the detrended variance of the interest rate and the exchange rate. It can be expressed as follows:

$$\rho DCCA^{(n)} = \frac{F^2 DCCA^{(n)}}{F_{DFA\{Y1\}(n)} F_{DFA\{Y2\}(n)}} \quad (1)$$

The $\rho DCCA^{(n)}$ coefficient value can range between -1 and 1 (including borderline values). The zero value implies no correlation at all. This coefficient is robust and has been applied in finance (Reboredo, Rivera-Castro & Zebende, 2014; Hussain *et al*, 2017).

It was also hypothesized that the correlation before and after the pandemic crisis (COVID-19) between the interest rate and the exchange rate may change as well. The dependence and contagion of the interest rates and the exchange rates before and after the pandemic crisis was tested (Gençay, Selçuk & Whitcher, 2002). To do so, the data had been divided into subsamples, those before and those after COVID-19, from which it follows that there are $\rho DCCA^{(n)^{Before}}$ and $\rho DCCA^{(n)^{After}}$ COVID-19. Hypothetically, it can be written as is given in Equation 2. In order to set the hypothesis and empirically test it, the method applied in the similar studies (Gençay *et al*, 2002; Gallegati, 2012; Reboredo *et al*, 2014) was used.

$$\text{Ho: } \rho DCCA^{(n)^{After}} = \rho DCCA^{(n)^{Before}} \quad (2)$$

Furthermore, research was also done in the pre- and post-COVID-19 Granger causality pattern. The hypothesis reads that the causality pattern between the interest rate and the exchange rate might change during pandemic-induced crises. The hypothesis was tested using the Granger casualty test (Granger, 1988), which implies using the following equations 3 and 4.

Two models can be defined for two variables, X and Y, namely:

$$Y = \alpha + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \varepsilon_t \quad (3)$$

$$Y = \gamma + \delta_1 Y_{t-1} + \beta_2 X_{t-1} + \varepsilon_t \quad (4)$$

In Model 3, the variable Y is regressed on its own lagged values (Y_{t-1}) and the lagged values of X (X_{t-1}). The term ε_t represents the error or the residual component. In Model 4, the variable Y is solely regressed on its lagged values (Y_{t-1}), without considering the influence of X. The term ε_t represents the error or the residual component. To assess the presence of Granger causality, the statistical significance of the coefficients β_2 in Model 3 was examined. If β_2 is found to be statistically significant, it indicates that X has a Granger causal effect on Y, suggesting a causal relationship between the variables. The significance of the coefficients is typically evaluated using the hypothesis testing methods. For instance, the F-test determines whether the coefficients significantly deviate from zero or not.

The daily data of the period from January 2, 2019 to May 7, 2021 were used. The One-week Shanghai Interbank Offer Rate (SHIBOR) is used as a proxy for the interest rate in China (Zhang & Zheng, 2020). The variable, measure, description, and data source are given in Table 1. The Chinese yuan per dollar was applied as a proxy for the exchange rate. The whole period was subjected to analysis, and the data were also divided into two halves (Figure 1). The coronavirus was first identified in December 2019 in Wuhan, China. The World Health Organization declared Public Health Emergency of International Concern on January 30, 2020 (the first vertical line). Later, it declared a pandemic on March 11, 2020 (the second vertical line). The two subsamples consist of the data of the period from 02/01/2019 to 11/03/2020 and 11/03/2020 to 07/05/2021. As shown in Figure 1, both the exchange rate and the interest responded to the COVID-19 shock and declined. However, a greater decline in SHIBOR compared to the exchange rate is obvious.

Table 1 The variable, measure, and data sources

Variable Name	Measure	Data Sources
Interest Rate	Shanghai Interbank Offered Rate (SHIBOR). One-week Shanghai Interbank Offer Rate (SHIBOR) is used as a proxy for the interest rate in China	Wind database (https://www.wind.com.cn/)
Exchange Rate	Exchange Rate Chinese Yuan Per Dollar	Investing database (www.Investing.com)

Source: Authors

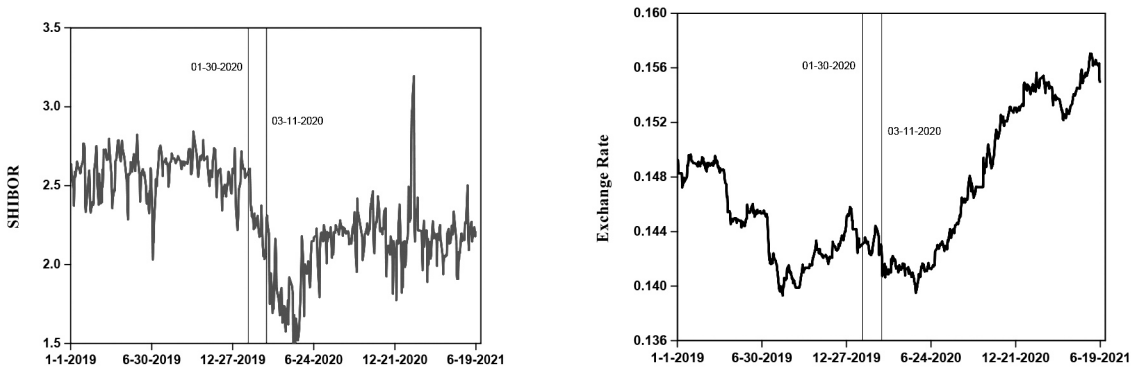

Figure 1 SHIBOR and the exchange rate

Source: Authors

RESULTS AND DISCUSSION

One of the concerns is that macroeconomic series (the exchange rate and the interest rate) contain unit root problems, and cross-correlation among such series is very difficult to estimate. The stationarity of the data was also checked through the augmented Dicky-Fuller test (ADF) (Harris, 1992; Paparoditis & Politis, 2018), the results of which are reported in Table 2. As can be seen, the null hypothesis (Ho: The exchange rate has a unit root) cannot be rejected in the case of the exchange rate. The same is also true for SHIBOR. Both hypotheses suggest that the exchange rate and SHIBOR are not stationary. Fortunately, DCCA can tackle unit root problems (Hussain *et al*, 2017).

Table 2 The augmented Dicky-Fuller test (ADF)

Hypothesis	ADF-Statistics	Probability
Ho: The exchange rate has a unit root.	-0.256653	0.9284
Ho: SHIBOR has a unit root.	-0.667346	0.1804

Source: Authors

Table 3 accounts for the descriptive statistics for the whole sample reported, before and after COVID-19, in the panels A, B, and C, respectively. Panel B of Table 3 shows that the observation that both SHIBOR and the exchange rate exhibit low values compared to their standard deviations indicates that these series do not display significant trends. In other words, these variables have limited variability or fluctuation over time, which implies that the interest rate and the exchange rate remain relatively stable without exhibiting pronounced upward or downward movements. Such stability can have implications for market participants as it suggests a relatively predictable environment regarding borrowing costs and currency valuations. However, it is important to note that the other factors apart from the trend analysis, such as market conditions, economic indicators, and policy interventions, should also be considered when assessing the overall dynamics of SHIBOR and the exchange rate. The same is true for Panel C as well. Panel A, however, suggests that the average and standard deviation mean is big compared to the standard deviation. SHIBOR volatility was observed to be less than the exchange rate after COVID-19, which suggests that the risk exchange market was bigger compared to SHIBOR (see the panels B and C). The exchange rate series is negatively skewed in both subsamples (before COVID-19 and after COVID-19). In a similar fashion, the higher values of Kurtosis observed in both subsamples suggest fatter tail returns. The Jarque-Bera test strongly rejected the null hypothesis of normal distribution in the panels A, B, and C, which suggests the data are not normally distributed.

Table 3 The descriptive statistics

Panel A: The whole sample (02/01/2019-07/05/2021)		
	SHIBOR	Exchange Rate
Mean	2.322240	0.146615
Median	2.283000	0.145281
Maximum	3.194000	0.157050
Minimum	1.481000	0.139303
Std. Dev.	0.299941	0.005006
Skewness	-0.344350	0.489325
Kurtosis	2.701979	1.900693
Jarque-Bera	14.38313	55.32916
Probability	0.000753	0.000000
Sum	1423.533	89.87486
Sum Sq. Dev.	55.05846	0.015335
Observations	613	613
Panel B: Before COVID-19 (02/01/2019 -11/03/2020)		
Mean	0.144258	2.522763
Median	0.143784	2.591000
Maximum	0.149651	2.843000
Minimum	0.139303	1.693000
Std. Dev.	0.002891	0.212569
Skewness	0.392847	-1.576334
Kurtosis	2.008869	5.671992
Jarque-Bera	20.72890	221.3135
Probability	0.000032	0.000000
Sum	44.86414	784.5792
Sum Sq. Dev.	0.002591	14.00747
Observations	311	311

Panel C: After COVID-19 (11/03/2020- 07/05/2021)		
Mean	0.145168	2.066229
Median	0.144009	2.150000
Maximum	0.153151	2.464000
Minimum	0.139507	1.481000
Std. Dev.	0.004021	0.228428
Skewness	0.535982	-0.947338
Kurtosis	1.943360	2.959023
Jarque-Bera	16.51996	26.18787
Probability	0.000259	0.000002
Sum	25.40440	361.5900
Sum Sq. Dev.	0.002813	9.079173
Observations	175	175

Notes: SHIBOR is the proxy for the interest rate in China. The exchange rate reported is the directly quoted RMB/USD rate.

Source: Authors

Table 4 contains the results of the Granger causality test. Granger causality was tested for the whole sample reported in Panel A. Panels B and C contain the Granger causality test results before COVID-19 and after COVID-19, respectively. Using the Granger causality test, the result shows that there is no evidence of causality for the whole sample (see Panel A of Table 4). In a similar fashion, the same result can be found in the subsample before COVID-19 (see Panel B of Table 4). However, it is very interesting to note that causality changed after COVID-19 (see Panel C of Table 4). SHIBOR became an important factor in explaining the Yuan/USD rate. Causality runs from SHIBOR to the exchange rate.

Table 4 The Granger causality test

Panel A: The whole sample (02/01/2019-07/05/2021)			
Null Hypothesis:	Observation	F-Statistic	Prob.
SHIBOR does not Granger-cause the exchange rate.	611	0.80528	0.4474
The exchange rate does not Granger-cause SHIBOR.		0.35580	0.7008
Panel B: Before COVID-19 (02/01/2019 -11/03/2020)			
SHIBOR does not Granger-cause the exchange rate.	309	0.02814	0.9723
The exchange rate does not Granger-cause SHIBOR.		0.44962	0.6383
Panel C: After COVID-19 (11/03/2020- 07/05/2021)			
SHIBOR does not Granger-cause the exchange rate.	173	2.94060	0.0033
The exchange rate does not Granger-cause SHIBOR.		1.65948	0.2387

Source: Authors

The DCCA detrended cross-correlation coefficient was also estimated in order to capture the cross-correlation between SHIBOR and the exchange rate. The results of the DCCA coefficient for the whole sample period are given in Figure 2. The DCCA coefficient reveals the existence of a weak negative cross-correlation between SHIBOR and the exchange rate over 10 to 15 days, beyond which period, however, cross-correlation is becoming positive and is steadily increasing, only to eventually reach its highest value of 0.333, which implies that, in the short term, changes in SHIBOR and the exchange rate tend to move in the opposite directions but, as time passes, they align and exhibit a positive relationship.

In Figure 3, the DFA coefficient was estimated for the entire study period spanning from February 2, 2019 to July 5, 2021. Both the SHIBOR and the exchange rate showed positive DFA coefficients, with the magnitudes 1.07 and 1.49, respectively, which suggests that both variables demonstrate a long-range dependence or persistence in their dynamics.

Figure 4 shows the DFA and DCCA coefficients between SHIBOR and the exchange rate for the two subsamples (before and after COVID-19). The DFA pre- and post-COVID-19 coefficient is accounted for in Table 5. The DFA coefficient before COVID-19 was 0.89, which increased to 0.96. In a similar fashion, a

significant increase in the DFA coefficient for the exchange rate can be noticed as well. The magnitude of the DFA coefficient for the exchange rate was 1.44 and reached 1.47 after COVID-19. The alpha values after COVID-19 are greater than the alpha values before COVID-19, which indicates greater persistence.

Table 5 The DFA pre- and post-COVID-19 coefficient

Variable	$\alpha_{\text{DFA Before COVID-19}}$	$\alpha_{\text{DFA After COVID-19}}$
SHIBOR	0.89	0.96
Exchange Rate	1.44	1.47

Source: Authors

The DCCA coefficient reported in Figure 4 (before COVID-19) shows that there was a weak negative cross-correlation for the initial 10 to 15 days, which faded away in the long run. However, the results reported (after COVID-19) are interesting. The cross-correlation was weak and negative in the initial 10 days. However, this correlation became positive and reached the highest magnitude of 0.666. This positive cross-correlation between SHIBOR and the exchange rate suggests that increases in the SHIBOR rate are associated with the higher exchange rate, which might oppose the conventional approach and best fit the "pervasive effect". The "pervasive effect" is the phenomenon implying that monetary authorities implement higher interest rates in order to control the exchange rate depreciation. However, such a higher interest rate further deteriorates the exchange rate instead of improving it.

From the point of view of the policy, these results have important implications. The positive DFA coefficients suggest that both SHIBOR and the exchange rate demonstrate persistent dynamics, thus indicating the presence of memory or long-term patterns in their behavior, which on its part is implicative of the fact that policymakers should consider the prior behavior and trends of these variables when formulating monetary and exchange rate policies. The findings of the DCCA coefficient highlight the existence of a time-varying relationship between SHIBOR and the exchange rate. In the short run, negative cross-correlation suggests a potential hedging effect, where fluctuations in one variable may offset the impact of the other. However, in the medium to long run, positive cross-correlation indicates synchronization between SHIBOR and the exchange rate, implying that changes in one variable tend to coincide with changes in the other. This information may guide policymakers in their understanding the interplay between the interest rate (SHIBOR) and the exchange rate, and it may help them design more effective policies to manage these variables. For instance, when

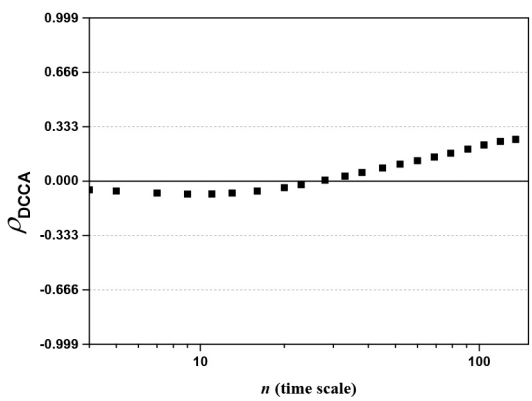

Figure 2 The DCCA coefficient for the whole sample (02/01/2019-07/05/2021)

Source: Authors

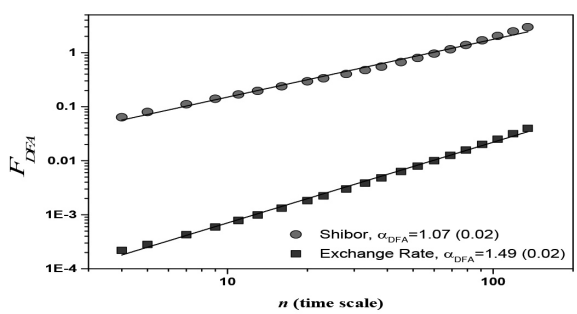

Figure 3 The DFA coefficient for the whole sample (02/01/2019-07/05/2021)

Source: Authors

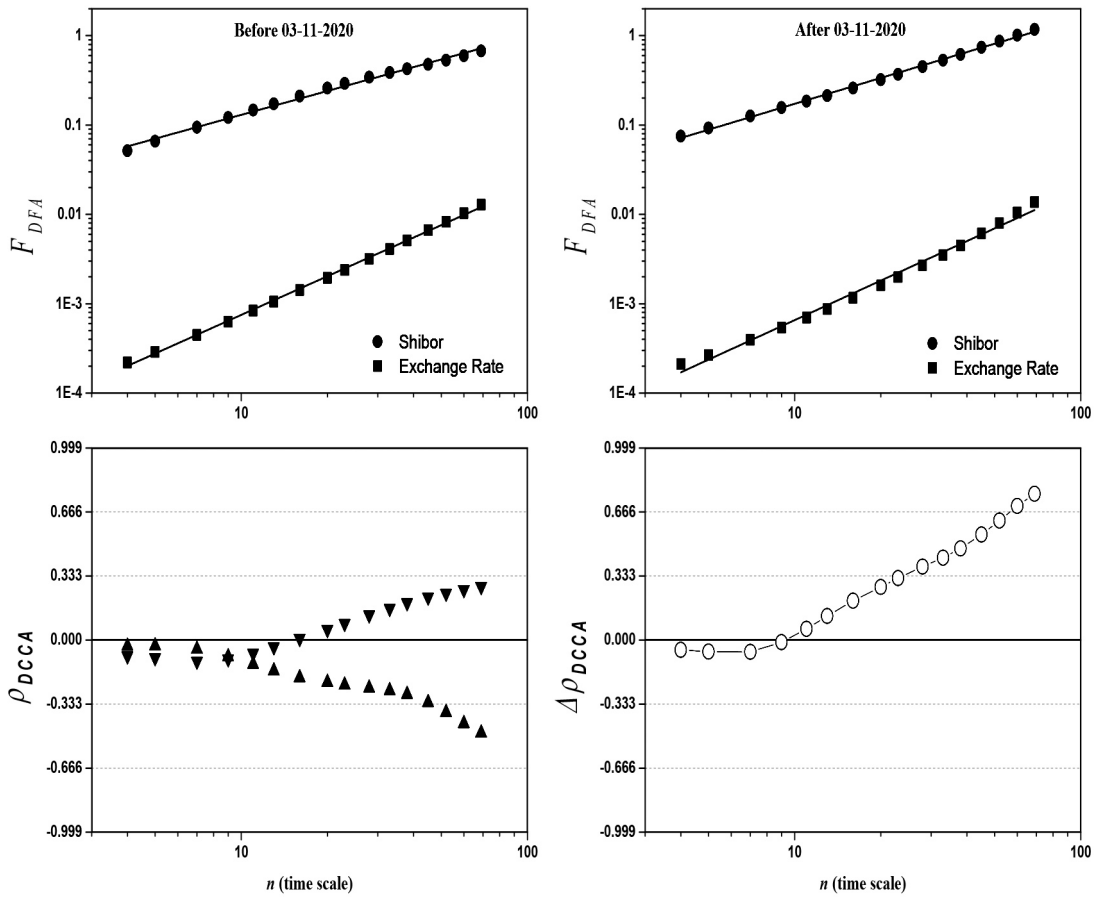

Figure 4 The DFA and DCCA pre- and post-COVID-19 coefficients

Source: Authors

considering measures to stabilize the exchange rate, policymakers should consider a potential impact of changes in the interest rate, given the fact that the two variables are becoming positively correlated over time. It is worth mentioning that the study has but one limitation, which is the fact that both the interest rate dynamics and the exchange rate dynamics can be affected by the other factors as well, for which reason this analysis is recommended as a future research question: how might the interest rate dynamics and the exchange rate dynamics change if the other factors are taken into account (e.g. the effects of the foreign trade flow, capital flows and so on).

CONCLUSION

The study findings suggest the presence of a weak correlation between SHIBOR and the exchange rate. However, a noteworthy change is observed when the data are classified into two periods, the period before and the period after the outbreak of COVID-19. Following the onset of COVID-19, the correlation between SHIBOR and the exchange rate becomes positive, indicating a stronger association between the two variables. Thus, the first hypothesis of this research study, which says that there is a positive correlation between the interest rate and the exchange rate in China, is accepted. In a similar fashion, the

second hypothesis, which says the correlation pattern between the interest rate and the exchange rate might change during COVID-19, is also accepted. Moreover, the casualty pattern also changed during COVID-19. Several reasons might justify such behavior, for example, monetary intervention to reduce higher inflation during COVID-19 by applying higher interest rates. In a similar way, the investor seeks safe haven currencies during COVID-19 that build downward pressure on domestic currencies and might cause downward pressure on the Chinese currency (depreciating the Chinese Yuan). The COVID-19 pandemic has introduced a considerable level of instability and unpredictability in financial markets, causing investors to reevaluate their risk preferences (Hussain *et al*, 2023). Consequently, the capital flows that determine exchange rates have become more uncertain and challenging to anticipate. In certain instances, investors may prioritize the stability and reliability of a currency over its interest rate, which can strengthen the correlation between interest rates and exchange rates. These circumstances highlight the intricate nature of the relationship between these factors, particularly during the times of crisis, such as the ongoing pandemic (Hussain *et al*, 2023). These findings have significant implications for policymakers, particularly during the times of crisis, such as the COVID-19 pandemic. Policymakers should closely consider the relationship between SHIBOR and the exchange rate when formulating effective strategies. Positive correlation implies that adjustments in SHIBOR are more likely to coincide with movements in the exchange rate during COVID-19 crisis periods. To optimize policy effectiveness, policymakers could coordinate the interest rate adjustments (SHIBOR) to stabilize the exchange rate during economic turmoil. By synchronizing these actions, potential adverse effects can be mitigated, which may contribute to a more stable financial environment.

Moreover, strengthening the correlation over time in the early stages of the COVID-19 period emphasizes the importance of timely and adaptable policy responses. Policymakers should closely monitor and reassess the evolving relationship between SHIBOR and the exchange rate as the crisis unfolds, which enables them to promptly adjust policy measures, thus ensuring better alignment between monetary policies and the exchange rate dynamics. Understanding the dynamic relationship between SHIBOR and the exchange rate, particularly during crises, can enhance policymakers' ability to develop effective monetary policies. By acknowledging positive correlation and its evolution, policymakers can make well-informed decisions to foster stability in both financial markets and the exchange rate movements.

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REPUBLIC OF SERBIA'S ECONOMY AFTER THE GLOBAL RECESSION OF 2020: STRUCTURAL PROBLEMS IN THE SHADOW OF GROWTH

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After the COVID-19 pandemic-induced global recession of 2020, the Republic of Serbia achieved one of its highest growth rates in 2021 in the past two decades of transition, that rate being 7.5% (only in 2004 was a higher 9% growth rate achieved). At the beginning of 2022, however, Europe was faced with a new global upheaval caused by war in Ukraine with unpredictable economic consequences. Inflationary pressures have been increasing, primarily due to the strong growth of energy and food prices. The effects of global recessions reflect in the slowdown in structural reforms in all transition economies. The paper investigates the structural performance of the growth of the Serbian economy between the global recession and the slowdown in growth. A special accent is placed on the analysis of structural problems, the solution of which was in the shadow of economic growth.

Keywords: economic growth, global recession, structural changes of the economy, structural economic problems

JEL Classification: O11, O47, E6, F6

INTRODUCTION

After the COVID-19 pandemic-induced global recession of 2020, a new global growth contraction caused by war in Ukraine followed in early 2022. Economies are being faced with an accelerated rise of energy and food prices, disrupted supply chains (Allenbach-Ammann, 2023), and company debts growing at record levels. The effects of global recessions are slowing down structural reforms in transition economies, and it is increasingly difficult to respond to the challenge of the "structural transformation", i.e. direct resources to modern highly-productive activities (McMillan, Rodrik & Sepúlveda, 2017).

The problem analyzed in this paper pertains to the slowness in the implementation of structural

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reforms, especially taking into consideration the fact that the research shows that the cumulative impact of structural reforms on growth in a period of 5 years ranges from 2.5 to 6.5 percentage points (p.p.) depending on the structural area (Ari, Pula & Sun, 2023).

The analysis of the structural performance of the growth of the economy of the Republic of Serbia (hereinafter referred to as "the RS economy") in the period after the global recession of 2020 and the analysis of the key structural problems in the economy of the RS that continuously burden its economic operations, i.e. the solution of which is constantly prolonged, are the subject matter of the research study presented in this paper.

The research presented in this paper aims to assess the degree of the interdependence of expansionary growth and the implementation of structural reforms in the economy.

The research study carried out in the paper tests the following main hypothesis:

H1: The expansion of the economic growth of the RS has not contributed to the solution of the key multiyear structural problems in the business operations of the RS economy.

In addition to the main hypothesis, the paper also tests the following auxiliary hypotheses:

H2: A debt crisis, i.e. an increase in the public debt, is a reflection of every recession.

H3: Transition countries' productivity convergence towards average productivity in the EU is faster in the years of a greater GDP growth than employment growth.

H4: Investments were the key driver of growth in the period of the economic recovery of the RS economy.

H5: Foreign companies have significantly changed the structure of the economy and crucially contributed to the growth and strengthening of the qualitative performance of the RS economy.

H6: The sectors of the future, namely information and communications technologies (ICT), and creative industry and cultural industry, demonstrate the fastest sectoral growth in the RS economy.

The methodological instrumentation used in the paper is based on the structural, sectoral, proprietary, synthetic and dynamic analysis of the activities carried out in the Serbian economy in the year of strong growth, presenting the key trends in its economic activities.

The paper is structured into three parts. In the first part (the second and third sections), a comparative analysis of global growth is carried out with an emphasis on growth in transition countries and the consequences of the global recessions of 2020 and 2022. In the second part (the fourth and fifth sections), the macroeconomic performance of growth and structural changes in the Serbian economy are analyzed, while in the third part (the sixth section), the focus is on the key multiyear structural problems in the Serbian economy.

GROWTH EXPANSION IN 2021 – THE GLOBAL AND REGIONAL LEVELS

After the global recession of 2020 caused by the consequences of the COVID-19 pandemic, the economic outlook throughout 2021 was favorable: a prolonged and strong phase of expansion, the situation with the pandemic was improving, most logistic problems and supply bottlenecks were removed, labor markets recorded improvements, and the financing conditions were favorable (European Commission, 2022a) (Table 1).

The strong 6% global growth of 2021 was mainly contributed to by developing countries (6.3% growth), with dominant growth in India (8.3%) and China (8.1%). The expansion of 2021 also affected structural shifts in global growth: the share of the advanced economy in the global GDP decreased (from 46.8% to 45.6%), the share of the US economy decreased (from 15.9% to 15.7%), the share of the economy of

Table 1 Global growth from 2019 to 2021 and the forecast for the period from 2022 to 2024

	% participation in the world GDP (PPS)		Year-on-year rates of the GDP (%)			GDP growth forecast		
	2019	2021	2019	2020	2021	2022	2023	2024
The world	100	100	2.8	-3.2	6	3.1	2.5	3.1
Advanced economy	46.8	45.6	1.8	-4.1	5.6	2.7	0.9	1.8
USA	15.9	15.7	2.3	-2.8	5.9	1.8	0.7	1.7
EU-27	15.4	14.8	1.8	-5.7	5.4	3.3	0.3	1.6
Eurozone	12.5	12	1.6	-6.1	5.3	3.2	0.3	1.5
Japan	4.1	3.8	-0.4	-4.6	1.7	1.7	1.6	1.2
United Kingdom	2.4	2.3	1.6	-11	7.5	4.2	-0.9	0.9
Emerging markets economy	53.2	54.3	3.6	-2.5	6.3	3.4	3.8	4.3
China	17.3	18.6	6	2.2	8.1	3.4	4.5	4.7
India	7.1	7	4.5	-6.6	8.3	6.9	6	6.3
Russian Federation	3.1	3.1	2.2	-2.7	4.7	-5.1	-3.2	0.9
EU candidate countries	2	2.2	1	1.5	10.5	4.8	3.4	3

Note: *GDP PPS (Purchasing Power Standard) - the GDP as per the purchasing power standard eliminates the differences in the price levels between countries and enables a comparison of their respective GDPs.

Source: European Commission (2022a)

the European Union decreased (from 15.4% to 14.8%), the share of Japan's economy decreased (from 4.1% to 3.8%) and Great Britain's economy share decreased (from 2.4% to 2.3%). On the other hand, the share of China's economy as the world's most developed economy increased (from 17.3% to 18.6%).

The European Union is facing the biggest challenges both because of its energy dependency on fossil fuel imports and because of its increasing involvement in the Ukrainian crisis. All the EU economies are faced with the sharp erosion of the household purchasing power and a decline in confidence in the business sector due to increasing production costs, supply bottlenecks and increasingly strict financing conditions. The fiscal deficit and the public debt increased significantly during the global pandemic of 2020 and 2021 due to continuous support measures (Mihajlović, 2022). In all major EU economies, the budget deficit was around -5% of the GDP in 2022, except for Germany (where it was 2.6% of the GDP).

Strong post-pandemic growth was achieved by all the transition economies in Europe in 2021: average growth was above 7%, except in Slovakia and the Czech Republic (Table 2). In 2022, growth was quite heterogeneous (ranging from 1.9% in Slovakia to over 6% in Slovenia, Croatia and Montenegro). In 2023, no growth is actually expected in the developed transition countries, whereas around 2.5% growth is expected in the candidate countries (World Bank, 2023).

THE REFLECTION OF THE CONSEQUENCES OF GLOBAL RECESSIONS AND GROWTH RISKS

The analysis of the consequences of all the wars in the last two centuries shows that the GDP *per capita* decreases by at least 9% and up to 40-70% in the most damaging wars and that the national debt increases

Table 2 The EU transition economies: Growth, purchasing power and growth forecast

	BDP (PPS)/*pc* (EU-27=100)			GDP (year-on-year rates, %)			GDP growth forecast (year-on-year rates, %)		
	2019	2020	2021	2019	2020	2021	2022	2023	2024
Czech Republic	93.2	92.8	91.0	3.0	-5.5	3.5	2.5	0.1	1.8
Slovenia	88.6	88.6	90.1	3.5	-4.3	8.2	6.2	0.8	1.7
Hungary	73.0	74.2	75.5	4.0	-4.0	7.6	3.1	1.1	2.4
Romania	69.5	72.1	72.9	4.9	-4.5	7.1	5.5	0.1	2.6
Croatia	66.4	64.3	69.8	3.4	-8.6	13.1	6.0	1.0	1.7
Slovakia	69.8	70.8	69.0	2.5	-3.4	3.0	1.9	0.5	1.9
Bulgaria	53.2	54.9	57.7	4.0	-4.0	7.6	3.1	1.1	2.4
Montenegro	50.1	44.5	47.4	4.1	-15.3	13.0	7.0	2.9	3.2
Serbia	40.9	42.5	44.2	4.3	-0.9	7.5	2.7	2.4	3.0
N. Macedonia	38.1	37.2	42.0	3.9	-6.1	4.0	2.3	2.5	2.8
Albania	30.4	30.3	32.2	2.1	-3.5	8.5	3.2	2.6	3.4

Source: European Comission (2022a)

by an average of 47 p.p. of the GDP (EBRD, 2022). Even more worrying, however, is the fact that the variations of recovery from wars are even greater: in 29% of war conflicts, the GDP *per capita* returns to the pre-war level in five years, whereas in almost 50% of all war conflicts, the GDP *per capita* remains below the pre-war level even after 25 years. The most severe lasting consequence of wars is the loss of human capital: even 25 years after the war, the population of the countries affected by the war is significantly smaller than the population of the comparative countries that did not experience war conflicts (the number of casualties, the refugee outflow and the declining birth rate). Relevant demographic estimates show that, by the end of 2022, the number of forcibly displaced people in the world will have exceeded 100 million people, with two-thirds being from Syria, Ukraine, the West Bank and Gaza, Venezuela and Afghanistan, of which almost half are children. It is interesting that one-third of refugees are located in 35 transition countries. Currently, refugees from Ukraine have increased the EU labor force by 0.5%, and 30% of the total number of the refugees are already employed in European countries, which has significantly alleviated the chronic labor shortage in EU countries.

The two biggest economic consequences of the global recession of 2020 and the global slowdown of 2022 are increasingly frequent disruptions to global supply chains and the rising debt. Given the fact that trade in intermediate goods accounts for about half of total global trade, transition economies are on average more entangled in global supply chains than typical middle-income countries. The corporate debt is at the record level in all transition economies, as a result of which there is the growth of the so-called "zombie" firms – these are the indebted companies that are in financial problems but avoid fulfilling their obligations thanks to their continuous access to cheap financing (subsidized loans, usually through state-owned banks), which directly spills over to healthy companies. The negative spillovers of "zombie" firms are particularly pronounced along the value chain, as they lead to the global supply chain disruption (EBRD, 2022).

Unlike the global recession of 2020, the economic consequences of the slowdown in growth in 2022 are difficult to predict and estimate in time. Inflationary pressures have been the highest since the inflationary shocks of the 1970s (Binici, Centorrino, Cevik & Gwon, 2022) and they are under strong pressures,

primarily energy and food prices. The EU is facing the biggest challenges both because of its energy dependency on fossil fuel imports and because of its increasing involvement in the Ukrainian crisis, which on its part will make it difficult to accomplish the EU's proclaimed goal to become a climate-neutral economy by 2050 and increase the gap in achieving a compromise between a country's individual welfare goals and the common goals of the EU (Rapsikevicius, Bruneckiene, Krušinskas & Lukauskas, 2022).

The key macroeconomic reflection of global recessions is the growth of the public debt, the consequences of which all developing countries will be faced with in the next decade (Table 3). Given the fact that a lot has changed since the Maastricht Treaty sound finance principles (increasing a debt and a deficit, new challenges of energy and digital transition), the European Commission adopted a new "fiscal adjustment reference path" (November 2022) which would cover the period of four years based on its debt sustainability analysis methodology. The goal is to strengthen the debt sustainability and promote sustainable and inclusive growth through investments and reforms in order to reduce the debt in highly- and medium-indebted countries and bring the deficit below the reference value of 3% of the GDP. The cornerstone of the "new reference path of fiscal adjustment" is the national medium-term fiscal-structural plans of the member states that are anchored in this concept and would integrate fiscal, reform and investment goals and priorities, including those for solving macroeconomic imbalances. Member states would have a greater freedom in determining their path of fiscal adjustment, on the one hand, whereas on the other, the Commission would continuously and transparently monitor the implementation of plans and use stricter monitoring instruments to indicate and financially sanction excessive deficits (a debt above 60% of the GDP) of the member states (European Commission, 2022c).

Table 3 The trend of the share of the public debt in the GDP in Europe's transition countries

	2019	2020	2021	2022 (forecast)
Hungary	65.3	79.3	76.8	76.4
Montenegro	76.5	105.3	82.5	75.5
Croatia	71.0	87.0	78.4	70.0
Slovenia	65.4	79.6	74.5	69.9
Albania	65.8	74.5	73.2	69.4
Republic of Slovakia	48.0	58.9	62.2	59.6
Serbia	52.8	58.6	57.1	55.2
N. Macedonia	40.5	51.9	51.8	51.4
Romania	35.1	46.9	48.9	47.9
Czech Republic	30.0	37.7	42.9	42.9
Bulgaria	22.5	23.6	25.6	25.1

Source: European Comission (2022a)

The key external risks to growth in 2023 are a high degree of uncertainty over the end of the war in Ukraine, the unpredictability of energy input prices and the risks of major shortages. A big risk is the formation of a wage and price spiral that would strengthen high inflation (Kammer, 2022) and a potential disorderly adjustment of financial markets to the new environment of high interest rates. Also, a significant risk originates from the negative impact of climate change. In Serbia, the five biggest risks in the next two years refer to (World Economic Forum, 2022):

- ecological damage caused by man (the deterioration of protected areas, industrial accidents, oil spills, contamination with radioactive material, trade in wild and protected animals);
- debt crises in major economies, Serbia's largest foreign trade partners;
- an employment crisis and a lack of livelihood;
- digital inequality; and
- the geo-politicization of strategic resources (the concentration, exploitation or restriction of the mobility of the goods, knowledge, services or

technologies crucial for human development, all this in order to gain a certain geopolitical advantage).

THE MACROECONOMIC GROWTH PERFORMANCE OF THE SERBIAN ECONOMY IN THE PERIOD FROM 2021 TO 2022

After the year of the highest transitional growth of 7.5%, Serbia's economy faced the consequences of the global energy crisis, primarily with the growth of inflationary pressures and the current account deficits due to the energy crisis, all of which necessarily required support for the economy and the population, as well as interventions in energy supply (Table 4). A 2.3% growth was expected in 2022, and an around 2.5% growth in 2023, which will largely depend on the consequences of the Ukrainian crisis. The dynamics of the expected slowdown in the growth of Eurozone's export markets will directly affect the production sector in Serbia, primarily big export companies, while an increase in food and energy prices on the world markets will burden the budgets of households, utility companies and the state itself.

The key macroeconomic growth performances in the period from 2021 to 2022 are as follows:

- The standard of living (the GDP *per capita*) reached EUR 9,000 in 2022 (based on the first results of the population census).
- Growth in 2021 was mainly contributed to by growth in personal consumption and investments, personal consumption having contributed the most to growth in 2022 (2.3%).
- The service sector contributed the most to growth, which is expected for transition economies at this stage of development (Bhorat, Asmal & Allen, 2020). In addition, a significant contribution was made by the tradable sectors of industry and construction in 2021, and the industry sector (a big decline simultaneously being registered in the construction sector) in 2022.
- Registered employment increased by 2.6% in 2021 and by 1.6% in 2022 (from 2.21 million to 2.31 million in 2022). In the period from 2015 to 2022, growth amounted to 320,000 workers. Compared to the year 2015, the employment rate increased by 10 p.p., amounting to 50.3% in 2022 (I-IX). After a short-term increase in 2021 (11%), the unemployment rate continued its downward trend in 2022, only to be, as in 2019, again at a record transitional minimum of 9.5% (I-IX).
- Net earnings increased by 5.4% in 2021 and 2% in 2022, having reached an average amount of EUR 630 (I-XI average). In 2021, average pensions grew

Table 4 The macroeconomic indicators of the vulnerability of RS in the period from 2015 to 2022

2015	2016	2017	2018	2019	2020	2021	2022	Indicator	Reference value
20.4	20.4	18.0	17.5	15.7	13.1	18.9	24.6	Okun's Index*	<12%
2.01	1.98	1.94	1.90	1.86	1.83	1.81	-	Dependency ratio**	>2
44.6	36.2	33.1	30.9	28.6	27.7	26.4	24.4	Youth unemployment rate	<20%
40.0	39.8	37.8	35.6	33.3	33.3	33.3	-	GINI coefficient	<30%
1.5	1.6	3.0	2.0	1.9	1.3	7.9	15.1	Inflation	<3%
17.0	17.1	17.7	20.0	22.5	21.4	22.4	22.9	Gross investments (% GDP)	>25%
-3.5	-1.2	1.1	0.6	-0.2	-8.0	-4.1	-3.1	Fiscal deficit (% GDP)	<3%
71.2	68.7	58.6	54.4	52.8	57.8	57.1	55.7	Public debt (% GDP)	<45%

Notes: * The sum of the unemployment and inflation rates; ** The ratio of the sum of the young (0-14) and the old (65+) in the working-age population (15-64).

Source: Authors

at a rate three times lower than the growth of net earnings (1.8% versus 5.4%). Due to the growth of inflationary pressures in 2022, the real growth of net earnings was 2% (in the first 11 months), while pensions fell in real terms by 4.4% in 2022.

- The higher rate of the import of goods and services (33.1%) than the rate of export (28.6%) in 2021 caused the growth of the foreign trade deficit (EUR 4.5 billion). The deficit growth trend (the export growth rate of 18.9% and the import growth rate of 20.3%) continued in 2022 (EUR 5.8 billion), so the growth of the current account deficit of the balance of payments was estimated at 4.3% of the GDP in 2021 to 6.6% in 2022.
- FDI inflows were making a constant significant contribution to macroeconomic stability. The net inflow of FDI in 2021 amounted to EUR 3.7 billion (6.9% of the GDP), which ensured the coverage of the current account deficit of the balance of payments. In 2022, the FDI growth of more than EUR 4 billion was expected. The average net FDI inflow was EUR 2.8 billion in the period from 2015 to 2021.
- The COVID-19 pandemic-induced high fiscal deficit of 2020 was halved in 2021 (falling from 8% of the GDP in 2020 to 4.1% of the GDP in 2021). The downward trend continued in 2022 (3.1% of the GDP).
- Certain indicators of Serbia's external position worsened during the period from 2021 to 2022. The external debt increased by EUR 9.2 billion (having risen from EUR 30.8 billion in 2020 to EUR 40 billion at the end of September 2022). The share of the public debt in the GDP was reduced from 57.1% in 2021 to 55.7%% of the GDP in 2022 (I-XI).
- The rise of inflation was one of the biggest economic risks in 2022 (Scott & Miles, 2020). While the year 2021 ended with the inflation growth of 7.9%, the year-on-year price growth at the end of 2022 doubled (15.1%).

In the group of the macroeconomic indicators with a high degree of risk, inflationary pressures are highlighted (The Economist, 2023), which affects all macroeconomic stabilizers, from the standard of living of the most vulnerable social groups (pensioners) to attracting investments, young people employment, social cohesion and inequality reduction. In the group of the macroeconomic indicators of the vulnerability of the Serbian economy, the dependency index deterioration trend (due to the working-age population decreasing number trend) and a high degree of inequality in income distribution (a high GINI coefficient) stand out in addition to inflation.

STRUCTURAL CHANGES IN THE ECONOMY

Productivity convergence

The competitiveness of transition countries in the medium run and long run mainly depends on the convergence of economic growth and productivity towards developed countries, as well as the factors affecting these two variables (Table 5). Extensive empirical research carried out on a significant sample of countries did not decisively confirm the fact that there was absolute convergence in place, i.e. the fact that income *per capita* in underdeveloped countries grew faster than income *per capita* in more developed countries, but it did confirm the fact that there was convergence in place if less homogeneous groups of countries were analyzed (the OECD countries, developed EU countries, transition countries, etc.) (Mathur, 2005, Barro, 2015). If the other growth factor, however, are included in the research study in addition to the GDP (absolute convergence), the results show that underdeveloped countries have more dynamic growth than the developed ones, there is the so-called conditional convergence (catch-up) and the speed of such conditional convergence is constant, being 2% per annum, the so-called iron law of convergence in theory (Barro, 2015). The research study has shown that there is a greater degree of convergence at the lower levels of observation (the sector, the area, the branch). Productivity primarily in the processing industry (the tradable sector) is the

Table 5 Productivity in the transition states 2015–2021 (the rate, %)

	2015-2019			2020-2019			2021-2020			2015-2021		
	GDP	Empl.	Producti-vity	GDP	Empl.	Producti-vity	GDP	Empl.	Producti-vity	GDP	Empl.	Producti-vity
EU 27	11.5	6.6	4.6	-5.7	-1.4	-4.3	5.4	1.4	3.9	10.8	6.5	4.0
Bulgaria	16.9	2.9	13,8	-4.0	-2.3	-1.7	7.6	0.2	7.4	20.8	0.8	20.1
Croatia	16.7	9.9	6.0	-8.6	-1.2	-7.5	13.1	1.2	11.7	20.6	9.9	9.5
Hungary	22.2	11.7	9.1	-4.5	-1.1	-3.5	7.1	1.0	6.0	25.0	11.6	11.6
Romania	26.5	0.2	26.2	-3.7	-2.1	-1.7	5.1	1.8	3.2	28.1	-0.2	28.0
Slovenia	19.5	12.2	6.5	-4.3	-0.7	-3.7	8.2	1.3	6.8	23.8	12.9	9.5
Slovakia	17.6	10.0	7.1	-3.4	-1.9	-1.5	3.0	-0.6	3.6	17.0	7.2	9.2
Serbia	17.0	13.3	3.3	-0.9	-0.2	-0.7	7.5	2.6	4.9	24.7	16.1	7.6

Source: Authors, based on the Eurostat data.

generator of sustainable growth and the standard of living due to the influence and effects of innovation and technical progress (Petrović & Gligorić Matić, 2021).

The productivity growth of the Serbian economy was 4.9% in 2021 as a result of the strong economic growth of 7.5% and the employment growth of 2.6%. In 2021, Serbia's productivity converged towards the EU average by 1.1 p.p. (from 25.9% in 2020 to 27% of the EU average in 2021), whereas it converged by 3.5 p.p. in the period from 2015 to 2021 (Figure 1).

The convergence of the productivity (the catch-up effect) of the transition states to the EU average is slow. There is constantly a big gap in the productivity of the transition states to the EU average. Due to the effects of the global pandemic in 2020, real productivity in the EU-27 (the average) increased by only 4% in the period from 2014 to 2021 but the standard of living increased by 10%. The transitional states had a high degree of the convergence of the standard of living compared to the EU-27 average in the period from 2014 to 2021. According to the EU average, Romania, Serbia and Croatia converged the most, having achieved the GDP growth per cent which was three times as fast as that of the EU-27 average (cumulative growth in Romania, Serbia and Croatia was 33%, 30%, and 32%, respectively).

Productivity convergence is lower than the standard of living convergence. The greatest productivity convergence was achieved by Romania (the cumulative growth of 28%) and Bulgaria (20%). The impact of productivity on the growth of the standard of living is different in different transition countries, primarily depending on the structure of their economies. In 2021, Romania's average annual productivity growth of 1% generated a 1.2% increase in the standard of living; in Serbia, the ratio was 1:4, in Hungary 1:2.32; in Slovakia, it was 1:1.81; in Bulgaria it was 1:1.34 and Slovenia's ratio was 1:2.21.

The dynamic comparative analysis of productivity in the transition states as per subperiods shows that the highest productivity rates of the transition states were in the subperiods in which employment growth was overshadowed by strong economic growth. In the period from 2015 to 2019, almost all the transition states achieved high growth rates with the significantly lower employment growth rates, so that the productivity rates were consequently positive and relatively high. Although Serbia's productivity of that period was positive (3.3%) because the GDP growth (17%) was higher than employment growth (13.3%), it was slightly lower than in the transition countries for the following two reasons: the implementation of fiscal consolidation until 2017 and the solving of the high unemployment rate. In the period from 2015 to 2019, the double-digit productivity growth rates of 26% and 14% in Romania and Bulgaria, respectively, were almost exclusively the result of economic growth. In the recession of 2020, Serbia managed to preserve employment (-0.2%) and slightly reduce productivity

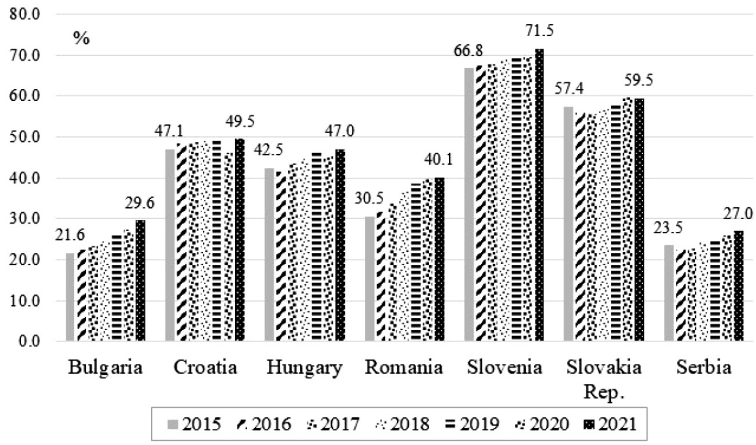

Figure 1 The trend of the productivity convergence of the transition countries (EU-27=100)

Source: Authors

(-0.7%) in the conditions of a slight contraction of growth (-0.9%) unlike the other transition countries, in which the strong recession had affected the decline in employment and productivity. Because of the structure of their economies, the biggest drop in productivity was recorded, in addition to the EU developed countries, namely -7.5%, -3.7%, -3.5% in Croatia, Slovenia, and Hungary, respectively. Strong post-recession growth in 2021 in all the transition states, especially in those that had experienced major declines in 2020, contributed to the high productivity growth rates.

The volume and efficiency of investments

The investments made in the period from 2015 to 2021 were the key driver of economic growth in Serbia (Table 6). The record growth of 7.5% of the gross investments in 2021 contributed as much as 3.4 p.p. The share of total investments in the GDP was 25% in 2021. Although the amount of the investments in the GDP affects economic growth, dynamic economic growth mostly depends on the efficiency of investments: in the period from 2001 to 2021, the incremental capital coefficient (ICC) was 6.1, i.e. the average efficiency of the investments in Serbia was 16.3% (in the period from 2001 to 2021, the GDP growth by 1 p.p. required a 6.1% share of investments in the GDP). In the growth period between 2016 and 2021, despite the recession of 2020, the efficiency of investments increased three times and amounted to 15.3% compared to the growth period between 2011 and 2015 (Jakopin & Čokorilo, 2023).

Changes in the key performance of the economy

In 2021, the year of strong growth, the economy improved most of its business performance (Table 7). Out of the EUR 27.4 billion VAT, 52.4% was generated by the sector of micro-, small and medium-sized enterprises (MSMEs), and 47.6% was generated by the sector of big enterprises. The economy was a net gainer for seven consecutive years (i.e. from 2015 to 2021), which is a curiosity in the transition period. The profit made by the economy increased in real terms by 34% in the period from 2016 to 2021, and the current loss decreased by 11% in the same period.

The analysis of the structural changes in the effects of the operations of the economy shows that significant changes took place in the business balance sheet and the employment structure: the participation of big companies in the structure of the GVA (from 47.3% to 47.6%) and in the employment structure (from 42.8% to 43.7% of the total employment in the economy).

Table 6 The efficiency of investments in RS from 2001 to 2021 as per subperiods

Period	GDP (the growth rate %)	Total investments* (a share in the GDP, %)	Incremental Capital Coefficient – ICC	Investment Efficiency Coefficient (%) – IEC
2001-2005	6.4	21.0	3.26	30.61
2006-2010	3.0	21.9	7.34	13.62
2011-2015	0.9	18.0	20.85	4.80
2016-2021	3.4	22.4	6.50	15.30
2001-2021	3.4	20.9	6.13	16.30

Note: * The sum of gross investment in fixed assets and changes in inventories.

Source: Authors

Table 7 The economic balance of the RS in 2021 (in million EUR)

	No. of the companies	No. of the employees	Income	Net profit	Net loss	Net result	GVA	Capital	Cumulative loss	Liabilities
Total	106,219	1,261,765	125,635	8,188	2,348	5,840	27,361	75,142	31,583	100,929
SMEs	105,603	710,202	76,970	4,948	1,685	3,263	14,329	37,965	22,682	66,620
Big	616	551,563	48,665	3,240	663	2,577	13,032	37,177	8,900	34,309
2021/2020 (the rates, %)										
Total	-1.9	2.8	11.6	34.1	-10.6	67.8	14.3	1.9	-9.1	2.1
SMEs	-1.9	1.2	10.4	23.0	-8.5	49.5	13.5	2.5	-9.6	-0.9
Big	3.9	4.9	13.4	55.4	-15.7	98.5	15.2	1.3	-7.9	8.7

Source: Authors

In 2021, the SME sector significantly increased productivity and profitability, and big companies increased liquidity as well (Table 8). The concentration of the GVA (the 10 largest companies) shows the growth (from 13.7% in 2020 to 14.1% in 2021 in the GVA of all the companies).

Changes in the ownership structure of the economy

The structural analysis of the economy as per the ownership structure showed that a total of 2,848 companies with majority foreign capital had changed the structure of the economy and crucially contributed to growth, having strengthened the qualitative performance of the economy and export competitiveness (Table 9). The business they had been doing resulted in high growth rates in all business segments in 2021. The GDP growth rate of the foreign companies was 2.4 times higher than the average in the economy, the number of the employees had increased by as much as 8.2% in 2021 compared to 2020, income had risen by 24%, the profit was bigger by 58%, the positive result had doubled, the capital growth rate was as much as 30.5%, and the liabilities also increased in real terms by 19%. The GVA of the domestic private companies participated 25% in the GDP in 2021, whereas the GVA of the foreign private companies had an almost 20% share in the GDP, while the GVA of the state enterprises participated 6.7% in the GDP. The increasingly accelerated concentration of the profits and GVA of the foreign-owned companies is noticeable. The foreign-owned companies operated more productively, more cost-effectively and more profitably than the domestic privately-owned companies. They were more liquid and had a smaller debt. The state-owned enterprises constantly operated unprofitably, they were illiquid and unprofitable.

Table 8 Qualitative indicators of the economy of the RS in the period 2020-2021.

	2020					2021				
	Economy	Micro-	Small	Medium-sized	Big	Economy	Micro-	Small	Medium-sized	Big
Productivity (in RSD 000)	2,124.6	1,627	1,944	2,175	2,344	2,550	1,976	2,355	2,618	2,778
Economy	1.04	1.02	1.05	1.05	1.04	1.06	1.04	1.06	1.07	1.06
Profitability	4.72	0.16	8.74	8.28	3.54	7.77	3.81	10.83	10.68	6.93
Solvency	1.60	1.01	1.81	1.66	2.11	1.61	1.05	1.78	1.69	2.05
GLR	0.96	0.74	1.35	1.13	0.92	1.02	0.75	1.37	1.20	1.05
RLR	0.64	0.51	0.88	0.78	0.61	0.67	0.50	0.87	0.81	0.69
Net profit rate	3.35	0.12	4.44	4.46	3.27	5.02	2.61	4.95	5.39	5.74
Business profit rate	5.49	4.62	6.06	5.97	5.19	6.63	4.90	6.56	6.24	7.57
Net loss rate	2.33	6.01	1.31	1.67	1.83	1.87	4.76	1.07	1.57	1.36
ROA	2.72	0.49	4.65	4.40	2.39	4.25	1.84	5.82	5.48	4.32
ROE	6.00	1.88	9.75	9.72	3.73	10.07	54.99	12.00	12.43	7.54

Notes: Productivity - the ratio of the GVA and the employees; Economy - the ratio of income and expenses; Profitability - the ratio of the net result and capital; Solvency - the ratio of the business assets and the liabilities; General liquidity ratio (GLR) - the ratio of the current assets and the short-term liabilities; Reduced liquidity ratio (RLR) - the ratio of the current assets minus the inventories and the short-term liabilities; Net profit rate - the ratio of the net profit to the sales revenue; Net loss rate - the ratio of the net loss to the total income; Business profit rate - the ratio of the business profit to the sales revenue; ROA (Return on Assets) - the rate of return on business assets; ROE (Return on Equity) - the rate of return on equity.

Source: Authors

Table 9 The property structure of the GVA in RS - the growth rates of the period from 2016 to 2021

	2016	2017	2018	2019	2020	2021	2016 to 2021 rates	
							Cumulative	Average
Economy	13.5	4.4	8.3	5.4	6.3	14.3	64.3	8.6
Privately-owned domestic	13.9	2.5	9.5	10.4	11.9	10.1	73.9	9.7
Privately-owned foreign	5.7	13.7	9.5	14.0	-1.7	32.6	95.4	11.8
State-owned	2.8	-3.3	4.2	-18.7	7.0	-9.4	-1.6	-0.3

Source: Authors

The growth of the sectors of the future

As the sectors of the future, the ICT, creative industry and cultural industry sectors have continuously been recording dynamic growth (Jakopin & Čokorilo, 2023). The ICT sector is the strongest, but the creative industry sector is growing the fastest (Table 10). The cultural industry sector is gradually recovering from the effects of the recession. In 2021, the companies doing business in the ICT, creative industry and cultural industry sectors had the GDP growth of 16%, 32% and 19%, respectively, and the employment growth of 13%, 16% and 3.5%, respectively. The ICT sector is constantly increasing its share in the GDP (from 4.1% in 2019, 4.8% in 2020, and 5.2% in 2021). Within the ICT sector, computer programming, consulting and related activities and telecommunications generated more than EUR 2.5

Table 10 The performance of the ICT, creative industry and cultural industry sectors in RS in the period from 2019 to 2021

	2019			2020			2021		
	No. of BC	No. of the employees	GVA (mill. EUR)	No. of BC	No. of the employees	GVA (mill. EUR)	No. of BC	No. of the employees	GVA (mill. EUR)
ICT	4,601	46,443	1,885	5,363	57,717	2,228	5,803	65,074	2,789
% of the economy	4.4	4.0	9.1	5.1	4.7	10.0	5.5	5.2	10.2
CREATIVE INDUSTRY	6,629	39,908	955	7,510	50,728	1,247	7,944	58,647	1,775
% of the economy	6.3	3.4	4.6	7.1	4.2	5.6	7.5	4.6	6.5
CULTURAL INDUSTRY	3,750	22,313	345	3,796	23,271	359	3,719	24,079	460
% of the economy	3.6	1.9	1.7	3.6	1.9	1.6	3.5	1.9	1.7

Note: BC - business companies (enterprises).

Source: Authors

billion GVA in 2021. In 2021, the creative industry sector participated 3.3% in the GDP, and the cultural industry sector had a 0.9% share in the same. Unlike the previous two sectors dominated by a few strong activities, the activities carried out in the cultural industry sector are diverse.

STRUCTURAL PROBLEMS OF THE ECONOMY

The negative effects of the operations carried out by active companies with no employees at all

Bankruptcy procedures are still time consuming, the number of active companies with no employees at all are decreasing very slowly (constantly being around 20% of the total number of companies in the economy), current losses are slightly reduced, but they still have a big share in the economy, while their accumulated losses of 2021 accounted for 37.6% of the cumulative losses of the economy.

The number of active companies without employees at all (21,051) accounts for 20% of all the companies in 2021. This group of companies generate a loss ranging from 400 to 500 million euros every year (Table 11). In 2021, they made a loss of EUR 413 million, i.e. 17.6% of all the losses in the economy. Their cumulative loss of close to EUR 12 billion accounts for 38% of all the accumulated losses of the economy. It is also important to note that there is an increasing concentration of accumulated losses in once big systems currently undergoing bankruptcy.

Illiquid operations of micro-enterprises

The qualitative business performance of more than 80,000 micro-enterprises (counting up to nine employees) speaks of the depth of the problems faced by this extremely important segment of the entrepreneurial sector (Table 12). Year after year, their business is constantly illiquid, they are faced with low profitability and burdened with losses and indebtedness. The primary reasons lie in the slow implementation of structural reforms (the application of new digital technologies, the digitization of business processes, and so on, in order to increase efficiency and reduce costs), the need for a greater availability of the favorable sources of financing (Culkin & Simmons, 2018) and the introduction of the infrastructure for microfinancing, a lack of appropriate personnel, and the need to improve tax regulations.

Table 11 The operations of active companies with no employees at all in RS in the period from 2019 to 2021

	2019		2020		2021	
	mill. EUR	% of the economy	mill. EUR	% of the economy	mill. EUR	% of the economy
No. of the companies	21,787	20.5	22,290	20.6	21,051	19.8
Net profit	218	4.0	208	3.7	329	4.0
Net loss	477	19.7	511	21.0	413	17.6
Cumulative loss	9,971	33.3	12,671	39.4	11,886	37.6
Net result	-259	-	-303	-	-84	-

Source: Authors

Table 12 The business effects of active micro-enterprises in RS in the period from 2019 to 2021

	2019		2020		2021	
	Economy	Micro-	Economy	Micro-	Economy	Micro-
No. of active companies	106,033	80,461	108,285	82,327	106,219	80,033
General liquidity ratio	0.96	0.75	0.96	0.74	1.02	0.75
Reduced liquidity ratio	0.64	0.52	0.64	0.51	0.67	0.50
Net profit rate	3.2	-0.8	3.3	0.1	5.0	2.6
Business profit rate	5.1	3.8	5.5	4.6	6.6	4.9
ROA	2.9	0.1	2.7	0.5	4.2	1.8
ROE	6.1	-8.4	6.0	8.2	10.1	55.0

Source: Authors

The growth of liabilities and the high indebtedness of the economy

The total liabilities of the economy in 2021 increased by 2% and exceeded EUR 100 billion (Table 13). The one-third of the liabilities were attributed to micro-, and one-third were made by big enterprises. Both indebtedness indicators were at the same level as they had been in 2015, the ratio of the liabilities to the financing sources being 57.3% and the ratio of the liabilities to capital being 134.3%.

The total liabilities of the economy in 2021 increased by 2.1%, the biggest increase in liabilities being experienced by big companies (8.7%). In the liabilities structure, big companies (34%) and micro-companies (33%) have the biggest and almost the same share, whereas medium-sized enterprises participate 19% and small enterprises 14%.

The analysis of the indebtedness of the economy conducted through the ratio of the total liabilities and total sources of financing (Indebtedness 1, Table 14) shows a slight downward trend from 2015 to 2019 (by 1.8 p.p.) thanks to the favorable external situation, primarily due to the falling interest rates and the favorable lending terms and conditions. In 2020, as a result of the recessionary effects, the indebtedness of the economy further worsened, so that it remained at the same level in 2021. The analysis of the debt carried out through the ratio of the total liabilities and capital (Indebtedness 2) had a slight downward trend in the period from 2015 to 2018, and a slight increase in the period from 2019 to 2020. This leverage indicator did not change in 2021.

Table 13 The growth trend of the total liabilities of the RS economy in the period from 2015 to 2021

	2015	2016	2017	2018	2019	2020	2021
Billion EUR	68.3	70.3	74.9	77.8	82.4	91.6	100.9

Source: Authors

Table 14 The trend of the indebtedness of the RS economy in the period from 2015 to 2021

	2015	2016	2017	2018	2019	2020	2021
Indebtedness 1	57.8	56.8	56.5	55.8	56.0	57.3	57.3
Indebtedness 2	136.9	131.7	129.6	126.0	127.0	134.0	134.3

Notes: Indebtedness 1 - the ratio of the total liabilities to the total sources of financing; Indebtedness 2 - the ratio of the total liabilities to capital.

Source: Authors

High cumulative losses of the economy

Although the trend of the growth of accumulated losses was stopped in 2021, they are still high and burden the economy (Table 15). The cumulative losses of the economy in 2021 amounted to EUR 31.6 billion, and their growth trend was interrupted in 2021. In the structure of cumulative losses, more than half (51.1%) were located in micro-enterprises, 9.3% were attributed to small enterprises, 11.5% were found in medium-sized enterprises, and 28.2% were those pertaining to big enterprises. The total rate of the decline in the accumulated losses of the economy in the period from 2016 to 2021 was -11%. The analysis per economic segments, however, shows that the cumulative losses fell for medium-sized enterprises (-41%), small enterprises (-16.4%) and big enterprises (-34%), but increased for micro-enterprises by even 30%.

The long-term financial balance

The analysis of the net working capital (NWC) shows that the indicator of the long-term financial balance of the economy (the coverage of the current assets from long-term financing sources) was in the positive zone for the first time in the transition in 2021, which implies that the fixed assets were being financed from long-term financing sources (Table 16). The degree of the coverage of the fixed assets by the long-term funding sources is positive for all the groups of companies by the size, except for the group of the micro-enterprises which lack funds from long-term sources for financing fixed assets.

External debt

Serbia's external debt was increased by EUR 10.2 billion in the period from 2015 to 2021 (Table 17). In that period, the debt of the economy increased by EUR 4.6 billion. At the end of September 2022, Serbia's external debt amounted to around EUR 40 billion, which was estimated to be at the two-thirds of the GDP. Structurally, the public sector's debt was 51%, the corporate debt was 38%, and the banks' debt was 11%.

Table 15 The cumulative loss growth/decline rate in RS in the period from 2016 to 2021

	2016	2017	2018	2019	2020	2021	Cumulative rate from 2016 to 2021
Economy	1.4	0.1	-4.5	-5.0	6.1	-9.1	-11.1
Micro-	19.1	4.0	-3.5	6.5	13.5	-10.1	29.9
Small	6.0	13.3	-7.0	-15.5	-6.0	-5.8	-16.4
Medium-sized	-31.9	-12.3	3.7	2.0	3.8	-10.0	-41.1
Big	-1.0	-4.0	-7.2	-18.1	-0.8	-7.9	-33.9

Source: Authors

Table 16 The trend of the NWC in the economy (million EUR)

	2015	2016	2017	2018	2019	2020	2021
Economy	-6,216	-4,424	-3,549	-2,734	-2,363	-2,764	1,136
Micro-	-2,661	-3,726	-4,122	-3,658	-5,042	-5,926	-5,961
Small	726	1,012	1,233	1,541	1,827	3,154	3,699
Medium-sized	-1,477	891	1,161	1,277	1,981	1,528	2,477
Big	-2,804	-2,601	-1,821	-1,894	-1,128	-1,520	921

Note: The NWC represents the difference between the long-term sources of financing and the fixed assets. It shows the coverage of the current assets from long-term sources of financing.

Source: Authors

Table 17 The structure of the external debt in the period from 2015 to 2022 (mill. EUR)

	Public Sector	Enter-prises	Banks	Total external debt	GDP	%GDP
2015	15.3	8.7	2.2	26.2	35.7	73.4
2016	15.7	8.8	2	26.5	36.8	72.0
2017	13.9	9.3	2.3	25.5	39.2	65.1
2018	13.4	10.2	3.1	26.7	42.9	62.2
2019	13.9	11	3.4	28.3	46.0	61.5
2020	15	12	3.8	30.8	46.8	65.8
2021	19.1	13.3	4	36.5	53.3	68.4
2022*	20.5	15	4.5	40	60.2**	66.7**

Notes: * On September 30, 2022; ** Assessment.

Source: Authors

CONCLUSION

The year 2021 was one of the most successful transition years in the Serbian economy. After the GDP growth rate in 2004 (9%), the growth rate of 7.5% was the highest in the transition period from 2001 to 2022. As an extremely important factor, however, (Gligoric Matic & Jovanovic Gavrilovic, 2022) growth stability was not retained. The strong expansion of growth in 2021 was short-lived. At the beginning of 2022, all the economies were faced with the new challenges and risks caused by the unpredictable consequences of war in Ukraine (UNCTAD, 2022; UNDP, 2022; UN DESA, 2022). Given the fact that numerous countries are involved in the Ukrainian conflict, the consequences of that will be global and long-lasting, with a number of well-known "old" risks thought to have become a relic of the past, namely inflation, the cost-of-living crisis, trade wars, capital outflows from emerging markets, the widespread social unrest, the escalation of geopolitical confrontations.

This research study has confirmed the main hypothesis and all the auxiliary hypotheses set in the paper, namely:

- Although macroeconomic and structural business performance improved in the year of strong growth, the solution to the key structural problems in the economy remained in the shadows, their solution being prolonged for the next period (the main hypothesis H1). This particularly applies to the bankruptcy procedures that continue to be time-consuming, to a large number of the active companies with no employees at all (20% of the total number of the companies operating in the economy) that generate a big loss every year. In addition, the business done by micro-enterprises is a systemic problem burdening the business activities the entire economy. The fact that the total liabilities of the economy exceeded EUR 100 billion and that the debt of the economy in the structure of the total external debt of EUR 40 billion is 38% should be added to that.

- Based on the analysis of the business operations carried out in the recession of 2020 and in the year of the slowdown in growth in 2022, the hypothesis that the growth of the public debt is a consequence of every recession (the auxiliary hypothesis H2) has also been confirmed.

- The comparative structural analysis of productivity convergence towards average productivity in the EU in the transition economies has confirmed the hypothesis that convergence is faster in those years when the GDP growth is faster than employment growth (the auxiliary hypothesis H3).
- The analysis of the trend of the efficiency coefficient of investments as per transition subperiods has confirmed that investments in RS played the key role and contributed to growth in the most investment-efficient subperiods, namely from 2001 to 2005 and from 2015 to 2021 (the auxiliary hypothesis H4).
- The structural analysis of the companies' ownership structures in RS has shown that 2,848 foreign-owned companies made the key contribution to the growth and improvement of the qualitative performance of the economy in the economic growth period from 2015 to 2021 (the auxiliary hypothesis H5).
- The sectoral analysis of the RS economy has shown that the companies doing business in the sectors of the future (i.e. in the ICT, creative industry and cultural industry sectors) achieved the double-digit GDP growth rates in 2021 (the auxiliary hypothesis H6).

Sustainable economic growth is not possible without an accelerated implementation of structural reforms. The strong growth of the RS economy in 2021 was short-lived. The period between the global recession in 2020 and the slowdown in growth in 2022 was not used to solve the accumulated structural problems in the economy. Despite the increase in the external growth risks (the high degree of uncertainty about the end of war in Ukraine, the unpredictability of energy input prices), the focus of the economic policymakers should be directed towards the faster resolution of structural problems in the economy, primarily towards the restructuring and consolidation of state-owned enterprises and encouraging entrepreneurship development.

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THE IMPACT OF THE COVID-19 PANDEMIC ON THE HOUSEHOLD DEPOSITS VOLUME: THE CASE OF SLOVENIA

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In this paper, the impact of the COVID-19 pandemic on the savings of Slovenian households in banks is explored. For this purpose, an econometric model is developed and the macroeconomic variables exerting a statistically significant impact on household deposits in banks are identified. Among all the macroeconomic variables considered in the paper, the research study has shown that there are only two macroeconomic variables with a statistically significant impact. These two macroeconomic variables are the Euro Overnight Index Average (EONIA) reference interest rate used as a proxy variable for the rate of return, and the price of one Bitcoin as a yield on an alternative investment opportunity. The results of this research study are important for both the Central Government in Slovenia and for Slovenia's banks as household deposits are a source of funding for banks in the time of a crisis as well, and because of the fact that the volume of the loans granted accelerates the GDP growth, which shows the successful implementation of the economic policy.

Keywords: banking, household deposits, EONIA, Bitcoin, Slovenian Stock Exchange Index, COVID-19

JEL Classification: E21, G21, G52, D14

INTRODUCTION

In March 2020, there was the outbreak of the COVID-19 pandemic in Slovenia and the Government restricted public life in the country accordingly. N. Donthu and A. Gustafsson (2020) explain that the business environment changed overnight after the appearance of the COVID-19 pandemic. Significant changes happened in the business operations of companies and in customer behavior. The restrictions introduced in public life reduced demand and people's consumption, the economic activity at the country level consequently also declining. The decline in the economic activity in Slovenia in the first quarter of 2020 was strong according to the Statistical Office of the Republic of Slovenia (SORS) (2023), having amounted to 11%. In the third quarter of 2020, the epidemiological picture in the country improved, which had a positive impact on the

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economic activity in the country. The epidemiological situation deteriorated again in the third quarter of 2020, so the Government reintroduced restrictions on movement and public life, which however were not as severe as those in the first quarter but were more protracted as the restrictions on public life lasted for a longer time. The restrictions on movement and public life affected the consumption habits of individuals. The way of shopping changed, as people were less likely to visit physical stores, hence being forced to buy goods online. As a result, the consumption structure changed as well, at least in the short run, as it increased in favor of the products available for purchase online.

Because the appearance of the COVID-19 pandemic in Slovenia has changed the way individuals purchase goods, an answer is sought in this paper to the question whether the appearance of COVID-19 has also changed the volume of people's savings and the ways people save in Slovenia. Saving is an important activity, since bigger savings at a given disposable income reduce current consumption. According to C. Denizer and H. C. Wolf (2000), the household sector is the main sector of any national economy that saves. Bigger household savings increase the volume of savings in the national economy, which are then available to investors to finance their investments. Companies in Slovenia obtain the majority of all needed financial resources to finance investments from banks. If banks want to grant loans to companies for investments, it is essential how much savings households in Slovenia have in banks in the form of deposits. The more deposits households hold with banks, the more loans banks can grant to companies to finance their respective investments. Consequently, a greater volume of household deposits in banks accelerates the GDP growth in the country.

This paper aims to analyze how the volume of household deposits in banks in Slovenia has changed due to the appearance and presence of the COVID-19 pandemic and which macroeconomic variables affect the volume of household deposits in banks in Slovenia. This research question allows us to derive the following two hypotheses:

H1: The volume of household savings in banks in Slovenia increased during the COVID-19 pandemic.

H2: The volume of household savings in banks in Slovenia is influenced by the economic activity in the country, return on bank deposits and return on the alternative forms of investment.

The hypothesis H1 is based on the experience of the time with the COVID-19 pandemic, when the population was forced to reduce current consumption due to restrictions on movement. On the other hand, the hypothesis H2 takes into account the fact that the economic activity in the country determines the volume of household income, and that return on bank deposits and return on the alternative forms of investment determine the attractiveness of bank deposits. It is important for banks and the Central Government in Slovenia to understand the exact key determinants of household deposits in banks in Slovenia in the time of the COVID-19 pandemic and what it is that drives these key determinants. It is in Slovenia's banks' interest to grant more loans to companies, because a greater volume of loans at a given risk level increases the profitability of banks in Slovenia. More loans granted to companies accelerate the GDP growth, which is in the Slovenian Central Government's interest, because it shows the successful implementation of the economic policy.

This paper is organized into a few sections. The section that follows is a review of the existing literature dealing with household savings during the COVID-19 pandemic. The literature dealing with household savings in Slovenia during the COVID-19 pandemic is prioritized in this paper. In the section discussing the research model, the model to be used to measure the impact of the COVID-19 pandemic on household savings in bank deposits in Slovenia is explained. The section dedicated to the research data accounts for the possible macroeconomic variables that determine the size of household savings in Slovenia in bank deposits during the COVID-19 pandemic. The discussion of the research model results presents the statistically significant macroeconomic variables affecting the volume of household savings in Slovenia in bank deposits during the COVID-19 pandemic.

The conclusion summarizes the key findings of the research study and explains the guidelines for further research in this area.

LITERATURE REVIEW

The personal savings function has been the subject matter of studies carried out by numerous authors. J. M. Keynes (1936/2007) explains that household savings are a linear function of disposable income, where household savings are positively correlated with disposable income. Classical economic theory, described in the works of A. Smith (1789/1994) and D. Ricardo (1817/2015), neoclassical economic theory, described in the works of R. Solow (1956) and T. Swan (1956), as well as financial repression theory, described in the works of R. McKinnon (1973) and E. Shaw (1973), agree that the motivation of households to save is positively correlated with the interest rate.

J. J. Heim (2017) explained the personal savings functions in the US economy. He found personal savings to be the functions of disposable income, tax cut-induced crowding out, the prime interest rate, stock market levels, consumer confidence levels, and inflation. T. Callen and C. Thimann (1997) did research in the empirical determinants of household savings in the OECD countries. The empirical results of their research study show that public and corporate savings, growth, and demographic trends are the important determinants of household savings, the other variables with a statistically significant impact on household savings being inflation, unemployment, the real interest rate, and financial deregulation. S. Rocher and M. H. Stierle (2015) reviewed previous studies on household savings and compiled a list of the variables that determine the volume of household savings. They showed that, among the other variables that determine household savings, there were also the rates of return on alternative investment opportunities. In addition, they found out that proxies, the unemployment rate and inflation positively affected household savings.

The impact of savings and the efficiency of financial intermediation on economic growth was studied by M. Grbic (2016). The results of her research show that the improvement of the efficiency of financial intermediaries accelerates economic growth at the country level. A greater economic activity simultaneously increases financial intermediaries' business volume. Since the economies of scale reduce transaction and information costs, the efficiency of financial intermediations grows. Savings in the economy were also studied by N. Jankovic (2015). He carried out a study of the twin deficit, which relates to the budget deficit and the current account deficit in the Republic of Serbia. If there is a twin deficit, then the country spends more than it produces, and investments are greater than savings. The results obtained in his research study show that the financial position of countries whit a chronic budget deficit and without a sufficient amount of domestic savings to finance excessive government spending will further deteriorate in crisis situations. Austerity during the COVID-19 pandemic has already been researched by many authors. G. Torkar (2022) finds that there was an almost 20% growth of household deposits in banks in Slovenia in 2020, which he attributes to the unpredictable emergencies caused by the emergence of COVID-19. He also notes that banks underestimated the growth of household deposits during the COVID-19 pandemic, since the growth of household deposits was projected at only 4.4% in 2020. His research study also sums up the fact that, in years to come, banks will insist on attachments to households and nonfinancial corporations, amounting to a total of 72%. P. Dolenc, M. Ahtik, M. Lavrič, B. Poljšak, M. Požlep, F. Remšak, I. Sokolovska and R. Volčjak (2021) find that, in the second half of 2021, the deposits of households and nonfinancial corporations accounted for about 60% of all the liabilities of the Slovenian banking system, which is equivalent to about 64% of the GDP in Slovenia. They also note that the share of household deposits in the structure of the liabilities of the banking system is amongst the highest in the euro area.

The Bank of Slovenia (2020) also finds that 78% of household deposits are sight deposits, which allows their holders to use them immediately so as to overcome potential liquidity problems. The future development of the volume of household deposits is

therefore uncertain itself. The Bank of Slovenia does not expect households to reduce their holdings in the form of deposits with banks, which would be due to a decrease in savers' confidence in the stability of banks' operations and the entire banking system. At the same time, the Bank of Slovenia estimates that households will remain cautious and not convert their savings into time deposits, which on its part will increase the share of sight deposits in the future.

D. Di Virgilio (2022) studied the stability of sight deposits in banks in Slovenia under the assumption of different interest rate regimes. The study showed that sight deposits from households and nonfinancial corporations were highly stable even in the conditions of low interest rates. In the same study, the Bank of Slovenia simulated the impact of a gradual increase in the reference interest rate on the volume of bank deposits and found that the volume of deposits would decrease due to the increase in the reference interest rate, but the expected rate of decline was low.

M. Dossche, G. Krustev and S. Zlatanos (2021) analyzed household savings in the euro area having been deposited since the beginning of the COVID-19 pandemic only to find that the propensity of the euro area households to save had sharply risen in early 2020. The higher propensity of households to save was due to lower consumption, which was involuntary. Households had invested much of their savings in the aftermath of the COVID-19 pandemic in the most liquid assets. The authors also found that older households and households with higher income had saved more during the COVID-19 pandemic.

In their study, M. Dossche and S. Zlatanos (2020) explain that the greater savings of the euro area households in early 2020 were such due to the two reasons. The first reason was the restriction of movement that led to an involuntary reduction in household consumption. The second reason was the uncertainty of households with respect to their employment and the level of their future income, this uncertainty having been caused by the sudden outbreak of the COVID-19 pandemic. Due to said uncertainty, households in the euro area started to accumulate precautionary savings.

RESEARCH MODEL

In this research study, a linear econometric model is used because J. M. Keynes (1936/2007) explains that household savings are the linear function of disposable income. The dependent variable in this model will be the volume of household deposits in Slovenia at all banks, which will contain deposits of all maturities, both sight deposits and time deposits, and deposits in all currencies, both in the domestic currency EUR and in other currencies. In this way, the dependent variable will include total household savings at all banks in Slovenia, but not savings in vaults.

This research initially considers a broad range of the independent variables in the study. The attractiveness of deposits as an investment form is determined by interest rates. Deposit interest rates are different for different maturities and currencies, but all interest rates are of the same origin, which is the short-term reference interest rate, i.e. the Euro Overnight Index Average (EONIA). The attractiveness of deposits is also determined by the yields of alternative investments. Gold as the basic precious metal, the Bitcoin as the basic cryptocurrency, the Slovenian Stock Exchange Index (SBITOP), and savings in mutual funds are considered to be the alternative investments. Only gold is considered of all precious metals, because the prices of the other precious metals, namely of silver, platinum and palladium, are strongly positively correlated with each other and the multi-collinearity between the independent variables in the final linear econometric model is unwanted.

The multivariate linear econometric model is defined by the multivariate linear regression model. If y is the dependent variable, if x_i are the independent variables, where $i = 1, 2, \ldots, n$, if β_i are the regression coefficients of the multiple regression, if α is the regression constant, and if ε are the residuals, then the multivariate linear regression model is defined by the following equation (Košmelj, 1983):

$$y = \alpha + \sum_{i=1}^{n} \beta_i \cdot x_i + \varepsilon \quad (1)$$

The Pearson correlation coefficients between the prices for each pair of precious metals and the corresponding exact significance levels are shown in Table 1.

Employment has a significant impact on the volume of savings, since it is only the employed income-generating population who can save. Among the macroeconomic variables that measure employment in the economy, this research study considers the number of employed individuals and the unemployment rate. Among the independent variables, this research study also considers the economic activity, which measures the amount of created added value and the ability of companies to pay income to employees. The economic activity is measured using different macroeconomic variables. In this research study, the GDP and the industrial production index are taken into consideration. The added value created at the economy level is a necessary condition for companies to pay income to their employees. The amount of the income paid to employees depends on capital owners' preferences, i.e. on how much added value they want to keep for themselves and how much added value they want to pay to their employees in the form of their personal income, which affects both consumption and savings. The income earned by employees in the Slovenian economy is measured by means of the two macroeconomic variables, namely the average gross salary and the average net salary in euros.

DATA

The observation period was from June 2018 to December 2021, which is 21 months before the start of the COVID-19 pandemic and 21 months after the start of the COVID-19 pandemic. In this way, the length of the period of time prior to the outbreak of the COVID-19 pandemic is equal to the length of the time period after the outbreak of the COVID-19 pandemic. Since the values of the macroeconomic variables: the GDP, employment and the unemployment rate are only available at the quarterly level, this research study first considers the values of all the listed independent variables at the quarterly level when

Table 1 The Pearson correlation coefficients between the precious metal prices

		Gold	Silver	Platinum	Palladium
Gold	Pearson Correlation	1	0.800**	0.467	0.744**
	Sig. (2-tailed)		<0.001	0.080	0.001
	N	15	15	15	15
Silver	Pearson Correlation	0.800**	1	0.722**	0.726**
	Sig. (2-tailed)	<0.001		0.002	0.002
	N	15	15	15	15
Platinum	Pearson Correlation	0.467	0.722**	1	0.738**
	Sig. (2-tailed)	0.080	0.002		0.002
	N	15	15	15	15
Palladium	Pearson Correlation	0.744**	0.726**	0.738**	1
	Sig. (2-tailed)	0.001	0.002	0.002	
	N	15	15	15	15

Note: ** - The correlation is significant at the 0.01 level (2-tailed).

Source: Authors

developing the linear econometric model. Given the fact that the data on a quarterly basis were included in the study, the length of the time series of the data in the study was 15 quarters.

The time series of the nominal data were drawn from various data sources. The data on household bank deposits, the EONIA interest rate, the savings paid into mutual funds, average gross salaries and average net salaries for the observed period were obtained from the Monthly Bulletins of the Bank of Slovenia. The EONIA interest rate is the reference interest rate for overnight loans in the EUR currency. It is calculated as a weighted average of all interest rates on unsecured overnight loans carried out by participating banks on the interbank market in the euro area (Bank of Slovenia, 2022a). The data on the GDP, employment, unemployment rates and the industrial production index were obtained on the SiStat online data platform, which is managed by the Statistical Office of the Republic of Slovenia (hereinafter referred to as SORS). In this research study, the value at the end of the quarter for each variable in the time interval, which was defined as the observation period at the beginning of the research, is considered.

The data about the stock exchange index of the Ljubljana Stock Exchange, SBITOP, were retrieved from the annual trading reports of the Ljubljana Stock Exchange. This research study takes into account the value of the SBITOP index on the last day of each respective quarter. The prices of precious metals, namely gold, silver, palladium, and platinum were extracted from the online data platform operated by the Elementum company in Slovenia. There were two prices of precious metals available, the one in EUR per kilogram or the other in EUR per ounce. Between both options, the data in EUR per kilogram were opted for. The price of the Bitcoin cryptocurrency in EUR was also considered as a macroeconomic variable in the research. Its values were retrieved from the Yahoo Finance online data platform. Since quarterly data are used in this research, the last market price of each precious metal and Bitcoin reached on the last trading day of the quarter were used.

In the next step, the time series of the nominal data were deflated and so converted into the time series of the real data, in which way the effect of inflation was removed from the time series of the nominal data. The consumer price index was used as the deflator. The values of this index were taken from the SiStat online data platform, which is managed by SORS. SORS publishes the values of the consumer price index on a monthly basis. This research study used the consumer price index calculated as the base index, where the base was the average price level in 2015, which means that deflation delivered real data for each observed macroeconomic variable in the average prices since 2015. This research study considered the monthly consumer price indices at the end of each quarter in the time interval defined at the beginning of this research as the observation period.

The nominal data deflation was achieved by dividing the nominal data at the end of each quarter by the value of the consumer price index at the end of the same quarter, which was followed by multiplying the obtained result by one hundred. In order to calculate the EONIA real reference interest rate, the Fischer formula was used in the study (Fisher, 1907). Out of all the observed macroeconomic variables, the macroeconomic variables: employment and the unemployment rate were not deflated.

RESULTS AND DISCUSSION

Figure 1 shows the development of the nominal value of household deposits in banks in Slovenia in the selected time interval. The nominal value of household deposits in banks in Slovenia increased in the entire time interval, which was defined at the beginning of this research as the observation period. This means that the nominal value of household deposits increased even after the outbreak of the COVID-19 pandemic. Since the COVID-19 pandemic in Slovenia started in March 2020 and if the observed time series of the data is split into two parts, the first part ending with February 2020 and the second part starting with March 2020, then the hypothesis H1 can be tested using the independent simple *t*-test. The alternative

hypothesis in this case is that the average nominal value of household deposits in banks in Slovenia after the outbreak of the COVID-19 pandemic was greater than the average nominal value of household deposits in banks in Slovenia before the outbreak of the COVID-19 pandemic. The results of this test are and the corresponding one-sided significance level . The independent sample *t*-test hence shows that the nominal value of household deposits increased after the outbreak of the COVID-19 pandemic. Both the graphical method and the independent sample *t*-test consequently confirm the hypothesis H1 that the volume of household savings in banks in Slovenia increased during the COVID-19 pandemic.

The linear econometric model is developed using the IBM SPSS Statistics software, version 27. The stepwise method is used to include the independent variables in the model. The method first includes in the model the independent variable that explains the largest share of the variability of the dependent variable in the model. At each step, the stepwise method also excludes insignificant independent variables from the model and finally ends with those independent variables in the model, which all together explains the largest share of the variability of the dependent variable in the model, whereby all the independent variables in the model are statistically significant. In this way, this research study has developed an econometric model, in which only two statistically significant independent variables appear, namely the EONIA and the price of one Bitcoin. The coefficients of the linear econometric model are shown in Table 2.

Whether the considered macroeconomic variables as lagged variables are statistically significant in the econometric model or not is not tested in this research study. Asset prices are market variables, which typically change intraday and very quickly. Therefore, asset prices quickly lose relevance as time passes and have increasingly smaller impact on the investor's investment decision. Within the framework of this research study, the time series of the quarterly data were used. Hence, there are also the quarterly time series of market prices. As a result, there is one quarter of time between the two consecutive data points in the time series, which makes the earlier data point out of the two consecutive data points too old to have a significant impact on the investor's investment decision. Consequently, it makes no sense to test quarterly asset prices as lagged variables for statistical significance in the econometric model.

According to the Bank of Slovenia (2020), 78% of household deposits are sight deposits. Therefore, both independent variables in the econometric

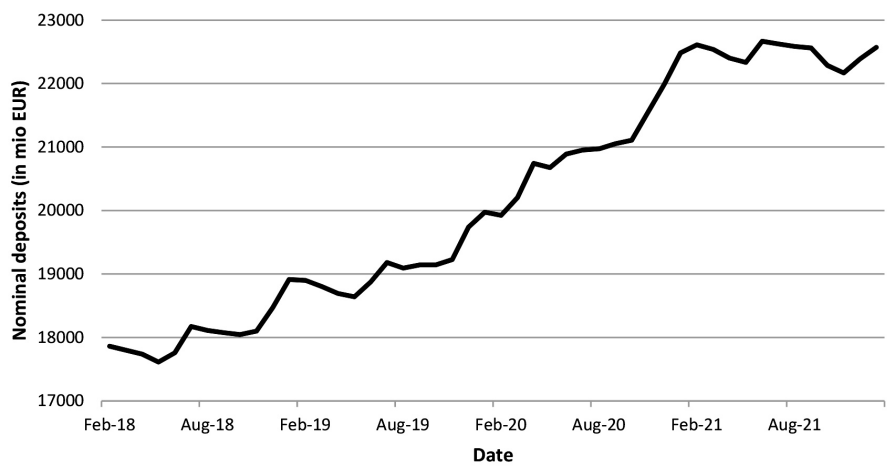

Figure 1 The development of the nominal value of household deposits in banks in Slovenia

Source: Authors

Table 2 The coefficients of the linear econometric model

Model B		Non-standardized coefficients		Standardized coefficients	T	Sig.
		Std. error	Beta			
1	(Constant)	12022.053	1140.419		10.542	<0.001
	EONIA	-18251.323	2458.926	-0.899	-7.422	<0.001
2	(Constant)	13787.513	763.987		18.047	<0.001
	EONIA	-12489.238	1861.592	-0.616	-6.709	<0.001
	Bitcoin	0.056	0.11	0.458	4.988	<0.001

Source: Authors

model only explain the variability of household sight deposits in banks in Slovenia. If this research wanted to find out the macroeconomic variables that determine the amount of household time deposits in banks in Slovenia, then it would have to develop another econometric model. Consequently, it is also understandable that EONIA is a statistically significant independent variable in the model, since it is the reference interest rate for the shortest maturity and thus determines the return on investment with the shortest maturity, which is overnight. EONIA is not an interest rate in use for retail deposits in banks in Slovenia and hence is included in this model only as a proxy variable. However, EONIA drives deposit rates for retail deposits. According to J. Eisenschmidt and F. Smets (2019), money market rates have tracked the key central bank's interest rate closely as the later decreased below zero. They also explain that retail deposit rates, especially those of households, appear to have a zero-lower bound. Deutsche Bundesbank (2019) also explains that, due to the exceptional interest rate environment in 2018, some institutions charged negative interest rates on large corporate deposits, as well as the large deposits made by wealthy retail depositors.

W. Boungou (2022) studied the effects of a negative interest rate policy on retail deposit rates in banks. His research showed that banks had reduced their retail deposit rate in response to the introduction of the negative interest rate policy. This effect varies from country to country, especially among the countries with the euro as the domestic currency. Moreover, this research study also shows that reduction in the retail deposit rate is not prompt. However, it becomes stronger if the negative interest rate policy persists over time. Overall, the findings of this research study confirm the fact that banks are reluctant to reduce retail deposit interest rates, this reluctance decreasing when negative interest rates have been in place for a longer period of time. This finding additionally supports the research result of J. Eisenschmidt and F. Smets (2019), where they concluded that retail deposit rates appeared to have a zero-lower bound.

Since household deposits in banks are a function of the interest rate, this research study leaves EONIA in the model despite its negative pre-sign. Economically speaking, of course, it makes little sense to invest in an asset with a negative rate of return. However, the negative regression coefficient for this independent variable in the model shows that households increase their deposits in banks in the times of uncertainty due to the corona crisis because they see in bank deposits the safety provided by the deposit insurance scheme. In this light, the interest rate is the variable that brings the portfolio of both positive and negative benefits to the investor. On the one hand, a positive interest rate brings to the investor a reward for the invested capital in the form of a profit with a positive pre-sign. A negative interest rate, on the other hand, discourages the investor from investing in an asset with a negative interest rate. However, a bank deposit also provides safety to the investor through a deposit insurance scheme. Consequently, the interest rate on a bank deposit reflects all the benefits together, and

no investor can only take the positive benefits of the investment in a bank deposit, namely the deposit insurance scheme. An investor must also accept the negative benefits if investing in a bank deposit with a negative interest rate. In this light, the deposit insurance scheme reduces the actual credit risk of banks in the eyes of households who own deposits in banks and expect banks to pay the deposits back to them at maturity. The deposit insurance scheme reduces the actual credit risk of banks with the deposit insurance fund, which is behind the deposit insurance scheme and is available to cover deposit payments in the event of a bank failure. This is an attractive characteristic of a bank deposit in comparison to other investment alternatives since no other investment provides the investor with similar capital protection. The deposit insurance scheme is a part of bank regulation, and the importance of bank regulation has been studied by many authors. V. Todorović, M. Jakšić and N. Tomić (2017) studied the role of bank regulation in the modern financial environment and concluded that bank regulation significantly contributed to safer banking operations and financial stability in the country.

The main contribution of the Central Government to the volume of household deposits in banks in Slovenia is therefore the definition of the deposit insurance scheme. Reduction in the deposit insurance level or even the abolition of the deposit insurance scheme may have a significant impact on the volume of household deposits in banks. The safety of a deposit insurance scheme composes the level of deposit insurance and the hedge fund behind the deposit insurance scheme. In Slovenia, this hedge fund behind the deposit insurance scheme is managed by the Bank of Slovenia, which is the central bank in Slovenia. As can be seen from the data, the current deposit insurance scheme in Slovenia has been accepted well by households as household deposits in Slovenian banks have been growing since the outbreak of the COVID-19 pandemic. An open question is whether a further increase in the deposit insurance level can increase the attractiveness of bank deposits for investors or not. A higher deposit insurance level would also include deposits with greater values, but the number of such deposits is smaller. According to the Bank of Slovenia (2021), 88% of individuals have deposits in one bank in Slovenia, those deposits being below EUR 20,000 and an average deposit in this interval amounting to only EUR 2,800.

The Bank of Slovenia (2021) also explains that there are but a few banks in Slovenia that introduced negative interest rates on household deposits during the COVID-19 pandemic, but these rates only apply to the deposits exceeding the predetermined threshold. This threshold varied from bank to bank, the same not being below EUR 100,000 in any bank in September 2021. This threshold corresponds to the deposit insurance level. At the end of 2020, 1.1% of individuals had deposits amounting to more than EUR 100,000 in one bank and the total value of these deposits was EUR 4.9 billion. Further reduction in this threshold for the application of negative interest rates on household deposits might lead to a partial withdrawal of deposits from banks or the transfer of deposits to the other forms of investment (mutual funds, pension savings, investments in real estate) in the future, which some banks have already become aware of and have already introduced negative interest rates. The same banks also notice that individuals are already redirecting their savings within the same bank to other investments, mainly mutual funds.

Negative interest rates have been further explored and discussed by L. Brandao-Marques, M. Casiraghi, G. Gelos, G. Kamber and R. Meeks (2021), who explain that retail depositors value the safety and convenience of bank deposits, and that they consider switching accounts so as to take advantage of better rates as troublesome. The deposit insurance scheme provides this safety to retail depositors. The negative interest rate policy does not seem to have reduced retail deposits in banks. After the negative interest rate had been adopted, the share of household or nonfinancial corporate deposits in the balance sheet did not decline in any relevant economy. J. Eisenschmidt and F. Smets (2019) and Deutsche Bundesbank (2019) explain that, in the euro area, banks' reliance on retail deposits has even risen since the policy rate stepped onto the negative territory, which itself means that retail deposits have even increased after the policy interest rate became negative.

Since the regression coefficient for the price of Bitcoin is positive in the econometric model developed within the framework of this research study, it shows that average household income in Slovenia is so big that it allows households to save in two different asset classes, namely in bank deposits (as a safer form of savings) and in Bitcoin (as a riskier property form). The positive regression coefficient for the price of Bitcoin additionally shows that households are steadily increasing their savings in both asset classes, which is why this regression coefficient is also statistically significant.

The developed linear econometric model is statistically significant, and the results of the analysis of the variance are shown in Table 3.

As the statistically significant independent variables in the model, EONIA and the price of Bitcoin account for 93.8% of the total variability of household deposits in all banks in Slovenia. The correlation metrics for the linear econometric model are shown in Table 4.

The graphic analysis of the residuals shows that the standardized residuals of the linear econometric model are approximately normally distributed, which confirms the fact that the correlation between the independent variables in the model, i.e. between EONIA and the price of one Bitcoin, is sufficiently low (Figure 2). Consequently, the key assumption behind the linear econometric model is fulfilled.

The Bank of Slovenia (2022) explains that even if the epidemiological situation deteriorates, the intensity of the household deposit accumulation in banks will most likely be smaller compared to the period after the outbreak of the COVID-19 pandemic, when consumption opportunities were limited and uncertainty about the development of the COVID-19 pandemic, as well as the control of the COVID-19 pandemic, was very high. Increased inflation could be an additional reason for the lower growth of household deposits in banks or even for a partial outflow of household deposits from banks in the future. Combined with low or even negative interest rates on household deposits, inflation reduces the real profitability of deposits and may motivate households

Table 3 The results of the variance analysis

Model		Sum of squares	Df	Mean square	F	Sig.
1	Regression	36014739.25	1	36014739.25	55.093	<0.001[b]
	Residual	8498180.645	13	653706.203		
	Total	44512919.89	14			
2	Regression	41747947.77	2	20873973.88	90.593	<0.001[c]
	Residual	2764972.123	12	230414.344		
	Total	44512919.89	14			

Notes: "b" includes predictors: (Constant), EONIA; "c" includes predictors: (Constant), EONIA, Bitcoin

Source: Authors

Table 4 The correlation metrics

Model	R	R square	Adjusted R square	Std. error of the Estimate
1	0.899[a]	0.809	0.794	808.5209975
2	0.968[b]	0.938	0.928	480.0149410

Notes: "a" includes predictors: (Constant), EONIA; "b" includes predictors: (Constant), EONIA, Bitcoin

Source: Authors

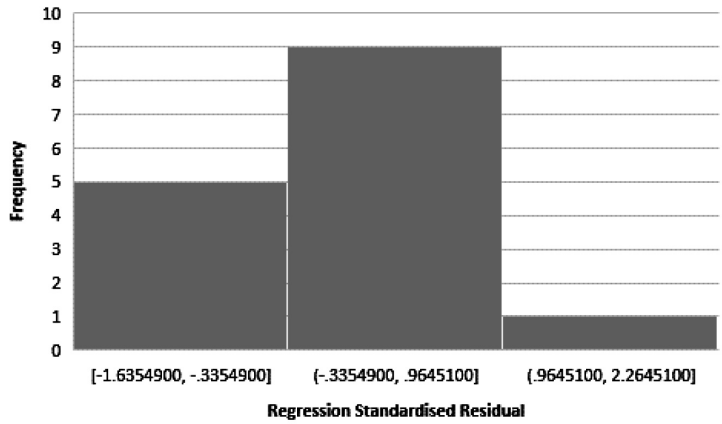

Figure 2 The histogram of the standardized residuals with the adjusted normal distribution

Source: Authors

with bigger savings to redirect the savings to more profitable alternative investments. Nevertheless, the Bank of Slovenia believes that, given the traditionally prudent behavior of Slovenian savers, the likelihood of a sudden major withdrawal of household deposits due to inflationary pressures is currently low.

CONCLUSION

This paper investigates how the occurrence/outbreak and presence of COVID-19 has changed the volume of household savings in banks in Slovenia and which macroeconomic variables affect the volume of household deposits in banks in Slovenia. Two hypotheses are derived from the research question. The research results confirm the hypothesis H1, i.e. that the volume of household savings in banks in Slovenia increased during the COVID-19 pandemic. On the other hand, the econometric model developed within the framework of this research study shows that the volume of the deposits held by households in banks in Slovenia is statistically significantly influenced by only two macroeconomic variables, namely by EONIA and the price of one Bitcoin. Consequently, the research results only partly confirm the hypothesis H2. The volume of the deposits held by households in banks in Slovenia is thus not affected by the economic activity, but it is rather affected by return on bank deposits, which determines the attractiveness of bank deposits as a form of investment, and the price of one Bitcoin as an alternative form of investment.

The econometric model developed in this paper has some limitations as well. The first limitation arises from the fact that 78% of all household deposits in Slovenian banks are sight deposits. Therefore, this econometric model only shows those macroeconomic variables that affect the volume of household sight deposits, but not time deposits. If this research wanted to find out which macroeconomic variables determine the volume of household time deposits in banks in Slovenia, then this research study would have to develop yet another econometric model. The importance of this econometric model, which explains the movement of household time deposits in banks in Slovenia, will increase when interest rates on time deposits begin to rise, at which point time deposits will become a more attractive investment opportunity for households in Slovenia. This is also an opportunity to further explore how the COVID-19 pandemic has affected households saving in time deposits.

Of course, the length of the time interval defined at the beginning of the research study as the

observation period is another limitation of the econometric model. This observation period spans up to December 2021, the last month with the available data before this research started. Of course, the economic consequences of the COVID-19 pandemic by December 2021 have not yet been fully revealed. For a comprehensive analysis of the impact of the COVID-19 pandemic on household deposits in banks in Slovenia, this research should take into consideration the entire period since the outbreak of the COVID-19 pandemic, i.e. the period from March 2020 up to the time when the economic consequences of the COVID-19 pandemic fully emerge, which is also an opportunity for further research in the future.

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