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EXPLORING THE LINKAGE BETWEEN DOMESTIC SAVINGS, INVESTMENT AND ECONOMIC GROWTH: EVIDENCE FROM THE EASTERN EUROPEAN ECONOMIES

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Abstract

Beyond the theoretical aspects, the interplay between savings, investment and economic growth has vital importance in designing the proper economic policies for the long-run developmental objectives particularly for developing countries. Accordingly, this present paper aims to investigate the dynamic linkage between domestic savings, investment and economic growth for the Eastern European economies by incorporating the annual panel data spanning over 1995-2021. By revealing the existence of long-run relationship, the paper derives that savings and investment are the key factors of economic growth, which is vindicated by the recently pioneered model so called cross-sectional autoregressive distributed lag (CS-ARDL) method. Furthermore, the results of panel causality tests confirm the validity of causal nexus running from savings and investment to economic growth. In addition, the paper concludes with some policy recommendations that are drawn upon the findings.

Key words*: Savings, Investment, GDP per capita, Eastern European Economies*

JEL Classification: E21, E22, E52, E62, F21, P20

1. Introduction

The linkage between saving and economic growth is one of the key challenges within the field of macroeconomics, which has charmed significant attention from scholars in this area. The systematic theoretical discussions can be traced back to the growth models proposed by Harrod (1939) and Domar (1946). In a simple closed economy, private investment expenditures via domestic savings play a pivotal role in increasing national output, as they stimulate both productive capacity and aggregate demand. Accordingly, in the context of a fixed rate of capital per unit of output in a setting of constant marginal returns to capital, the growth of output is contingent upon the capital accumulation process (Agrawal 2001). In other words, the engine of economic growth would be private sector investment expenditures or saving rate.

Given the existence of diminishing marginal returns to capital input and limited substitution possibilities among the factors of production, the Neoclassical Growth Model (NGM), as developed by Solow (1956) posits that savings precede economic growth. However, growth-enhancing effect of higher saving rate is binding with the short-run due to the existence of decreasing marginal returns to capital.

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Thus, higher savings solely yield higher steady state output per worker via investments. Therefore, proponents of the NGM not only advocate so-called saving-led growth hypothesis but also claim that continuous growth rate of output per worker depends on exogenous factors, i.e. exogenous growth rate of population and technology (Agrawal 2001; Bolarinwa and Obembe 2017; Đidelija 2021).

Unlike the Classical view, inspired by the epochal work by Keynes (1936), proponents of Keynesian view advocates the validity of "growth-led saving hypothesis" or "income-led savings growth hypothesis" that is income or economic growth precedes savings (Karahan, 2018). According to this view, likewise private sector consumption expenditures, saving is predetermined by disposable personal income. With the acceleration of effective demand by means of expansionary economic policies would lead higher income growth and thus, savings would eventually grow. The validity of Keynesian view is subject to have been some pioneering empirical investigations. Carroll and Weill (1994) are the proponents of the Keynesian view and vindicate the validity of Keynesian view by using the cross-country and household level data. Moreover, the findings of the analysis by household level data suggested that households with higher income save more of their disposable income than households with lower income do. Thus, Carroll and Weill (1994) hypothesis suggests that the role of savings on growth is exaggerated.

Even though the association between savings and economic growth has solid theoretical and empirical background with different arguments, the linkage between savings and investment also needs special attention. In some prominent models of economic growth by Harrod (1939), Domar (1946) and Solow (1956), investment and thus capital accumulation process is regarded as a catalyst of economic growth. In a closed economy framework, household savings and undistributed profits are the basic financing sources of investment expenditures. Therefore, the linkage between savings and investment expenditures is constructed via capital accumulation process. Nonetheless, in a pioneering work Feldstein and Horioka (1980) link the savings and investment expenditures by considering the role of international capital flows and integration with the international financial markets. In this respect, Feldstein and Horioka (1980) argue that under the perfect capital mobility, the linkage between domestic savings and domestic investments weakens or domestic savings could not be channelized into the financing the domestic investments. However, the relationship between domestic savings and domestic investments could be significant when imperfect capital mobility exists (Atanasio et al. 2000).

It should also be noted that identifying the direction and magnitude of the causal nexus between savings, investment and economic growth is of crucial importance not only for theoretical purposes but also for the policy-making processes. In order to design proper policies for the developmental objectives of the individual economies, policy-makers should account for the direction and magnitude of those variables. Hence, the presence of theoretical and economic policy aspects, investigating the nexus between saving and economic growth deserves special attention especially for the cases of developing economies. Together with the unprecedented pace of globalization, breakup of the Eastern Bloc by the end of the Cold War, a new political and economic order interceded for the centrally planned economies. Desire for adoption of free-market economy embracing upon price mechanism and institutional reforms such as liberalization of trade and capital accounts regimes have induced radical and structural changes in those economies. However, the income disparities with the industrialized and developed free-market economies remain as a major issue to be solved by those economies. To this end, some Central and Eastern European (CEE) countries have had a striking progress in catching-up with those industrialized and developed free-market economies by joining to the EU in the earlier periods of 2000s. However, majority of the post-Soviet countries (except for Estonia, Latvia, and Lithuania) have been gruelling in alleviating the income disparities with the developed countries.

On the other hand, the transition phase into free-market economy has varied by country due to economic conditions, geopolitical concerns and institutional capabilities. In this context, most of the Post-Soviet Union countries (except for Baltic countries, i.e. Estonia, Latvia, and Lithuania) have experienced severe economic, political and security issues. Therefore, income disparities with the developed countries and alleviation of the poverty are still one of the substantial challenging issues for those economies. In this respect, institutional quality, efficiency of institutions are some key factors in achieving these goals for transition economies[1]. The impact of institutional quality on economic well-being has a long tradition in the terrain of the development economics and can be traced back to the seminal studies by Veblen (1919), North (1990), and more recently by Acemoglu et al. (2001) and Acemoglu and Robinson (2008) (Gwartney et al. 2004). In accordance with the rationale of these pioneering works, institutions tend to influence economic performance by improving

the capital accumulation and within the presence of efficiently working market-institutions savings might be channelized into the feasible and profitable investment projects (Gwartney et al. 2004; Efendic and Pugh 2007).

In line with the foregoing arguments, layout of the remainder is as follows. Section 2 presents the figures related with the trends among the variables of interest for the sample countries in recent two decades. Throughout the theoretical arguments, section 3 reviews the theoretical and empirical literature in which the special attention is addressed for the Eastern European economies. Section 4 discusses the issues on data and model to be estimated whereas section 5 presents the empirical strategy rigorously. Section 6 documents the results of empirical analyses through the implementation of the methodologies discussed in the previous section. Finally, section 7 concludes the paper with some policy recommendations through the findings that are documented in section 6. Based on the findings, policy recommendations are more prone to promotion of savings and thus investment expenditures that are projected to stimulate economic growth for the Eastern European economies.

2. Savings, Investment and GDP in Eastern Europe

The present paper specifically focuses on the transition economies of Eastern Europe in unveiling the dynamic interaction between savings, investment and economic growth rather than identifying the role of the determinants that are supposed to influence those variables respectively. Such a view does not mean that these factors do not have an impact on savings, investment and growth. Instead, the objective is charming attention the way in which the interaction between these three variables is realised. Furthermore, this approach aims to determine whether Classical or Keynesian view may be valid in the context of the Eastern European economies. In this regard, trends in three variables for the recent two decades are displayed in Table 1.

Table 1. Trends in GDP per capita, saving and investment

	2002-2011			2012-2021		
	Y	S	I	Y	S	I
Albania	2970.81	9.647	34.657	4191.65	8.995	24.326
Armenia	2537.85	6.511	36.505	3911.74	6.832	20.544
Azerbaijan	3629.58	44.894	31.462	5316.79	35.535	23.464
Belarus	4437.79	27.823	32.291	6125.85	32.205	30.134
Bulgaria	5636.60	15.787	26.878	7495.15	22.236	20.777
Croatia	11685.42	18.652	25.937	12920.87	19.935	21.125
Czechia	15459.98	31.349	29.534	18439.77	32.845	26.893
Estonia	14639.92	28.475	31.579	18592.44	30.256	27.625
Georgia	2600.00	4.925	26.950	4239.99	10.568	25.225
Hungary	11164.09	24.228	24.272	13421.03	29.704	24.706
Latvia	10799.25	19.630	31.091	14530.72	21.748	23.588
Lithuania	10330.89	16.287	23.005	15369.54	21.718	19.032
Moldova	2004.35	-9.962	28.314	3003.89	-2.748	24.332
North Macedonia	3859.80	4.069	22.982	4952.96	15.542	31.205
Poland	9369.66	18.536	21.284	13424.59	22.824	20.467
Romania	6927.53	17.581	26.628	9810.04	21.955	24.776
Russia	7840.61	31.547	21.850	9643.27	29.791	23.030
Serbia	4660.95	4.363	21.542	6018.07	12.328	20.644
Slovakia	12579.74	25.298	26.788	16835.14	25.122	22.362
Slovenia	19885.16	27.177	27.299	22081.09	27.216	19.919
Ukraine	2213.26	21.000	22.133	2339.51	10.743	16.393

Note: Y: Real GDP per capita (constant 2015 US $), S: Gross domestic savings (% of GDP), I: Gross fixed capital formation (% of GDP).

Source: Research findings.

Despite the rising tendency in GDP per capita, except for a few cases, savings rate tends to decline whereas EU member states have managed to increase their savings rate during the recent two decades. Notwithstanding factors such as the global financial crisis that emerged in 2008 and the emergence of the COVID-19 pandemic, Table 1 shows that the GDP per capita in the countries in the sample tends to grow in recent two decades. Nevertheless, it is hard to reiterate that gross domestic savings and gross fixed capital formation follow a uniform tendency across countries despite the growth in gross domestic product per capita. It is also striking that with a few exception (Albania, Azerbaijan, Russia, Slovakia, and Ukraine) most of the countries in the sample managed to increase savings between two decades.

Meanwhile, it is doubtful to claim that similar propensity prevails for gross fixed capital formation. Because, barring very few countries (Hungary, North Macedonia, and Russia), gross fixed capital formation has shrunk in the recent decade. Nevertheless, with the exception of few countries, gross fixed capital formation has a share at least 20% of national income in overall. Despite the declining tendency in gross fixed capital formation in majority of the countries in the sample, the requirement for additional capital could have been satisfied by the inflows of foreign capital during the transition process. The revisions in the supervisory and regulatory institutions, improvement of the governance structures and solid implementation of the institutional reforms have been charmed the foreign investors to invest in these countries besides the economic factors (i.e. status of the factors of production, implementation of monetary policy, fiscal incentives etc.). (Redek and Susjan 2005; Chousa et al. 2005; Efendic and Pugh 2015)[2].

3. Literature Review

In accordance with the theoretical arguments concerning the nexus between savings and economic growth, the literature comprises a substantial corpus of empirical studies that lend support to either the Classical approach or the Keynesian approach. The findings of these studies have not revealed any clear-cut relationship or uniform tendency, depending on the selection of sample, methodology and the variables that proxy for savings and economic growth. Empirical studies that support the Classical approach have manifested that savings have a positive influence on economic growth, or that savings precede economic growth. In earlier stunning papers by Cullison (1993), Husain (1996), Alguacil et al. (2004), Irandoust and Ericson (2005), Sepehri and Akram-Lodhi (2005) are those that suggest the validity of savings-led growth hypothesis. In addition, some recent empirical studies have also disclosed the validity of the Classical view. In this respect, Oladipo (2010), Amusa and Busani (2013), Tang and Tan (2014), Jagadeesh (2015), Nwanne (2014), Nguyen and Nguyen (2017), Patra et al. (2017), Soylu (2019), Ribaj and Mexhuani (2021), and Chakraborty (2023) are those that validate the savings-led growth hypothesis. It should also be noted that the empirical literature also harbours the studies that confirm the Keynesian view in which economic growth precedes savings. In this regard, the earlier attempts by Sinha and Sinha (1998), Saltz (1999), Anoruo and Ahmad (2001), Agrawal (2001) and Baharumshah et al. (2003) are those that validated income-led savings hypothesis.

Apart from the studies that aim to examine the direct linkage between saving and economic growth, this study considers the role of investment in terms of causal nexus between saving and economic growth as well. Accordingly, the literature contains a plethora of empirical studies that have investigated the nexus between saving, investment and economic growth by employing a variety of econometric techniques on different countries and country groups in the recent period. Nevertheless, the empirical studies have not revealed any uniform tendency among those variables. It should also be noted that the majority of these studies have focused on the case studies of developing countries. To this end, Verma (2007) reports the validity of Keynesian view, with which considering the presence of structural breaks for Indian economy over the period 1950-2004. Moreover, the findings also highlight that savings clearly determine the investments; however, the view of "investments are the engine of growth" finds no ground in overall. These findings are also verified in a more recent paper by Yadav et al. (2018) who incorporate a relatively larger data set in examining the dynamics of saving, investment and growth for Indian economy over the period 1951-2015.

Even though bulk of empirical literature is devoted on the case of developing countries, the studies on Eastern European economies and transition economies are relatively scanty regarding the nexus between saving and economic growth. In this vein, Soylu (2019) incorporates the annual time series data spanning over 1992 and 2016 for Poland by considering the impact of saving and foreign direct investment on economic growth. It is documented that both saving and foreign direct investment positively influence economic growth in the long-run. In a more recent attempt, Ribaj and Mexhuani (2021) investigate

the nexus between saving and economic growth by utilizing time series data over the period 2010-2017 for Kosovo, which is one of the new and small open economy in Eastern Europe. The findings reveal that saving precedes economic growth for Kosovo. For Bosnia and Herzegovina, Đidelija (2021) investigates the causal interplay between saving and economic growth by utilizing the quarterly data between 2000 and 2016 by performing causality tests. However, the findings do not assert any significant causal relationship between saving and economic growth for Bosnia and Herzegovina.

It is worth mentioning that some recent pioneering works link the interaction between savings, investment and economic growth by considering the role of institutions for the case of transition economies. In this context, Redek and Susjan (2005) suggest that better institutions tend to accumulate both physical and human capital to the extent that rising productivity induces more output growth in transition economies of Europe. In a more recent paper, Efendic and Pugh (2015), who derive that well-performing institutions together with investment expenditure tend to upswing GDP for transition economies in Europe, suggest an analogous receipt as long as derived by Redek and Susjan (2005). Contrary to these studies, it is notable to underline that Havrylyshyn and van Rooden (2003) demonstrated that investment and human capital do not have any significant effect on growth despite the positive influence of institutional framework on economic growth for these economies.

As evidenced by the aforementioned empirical studies, research on the Eastern European countries and transition economies remains scarce. It is for this reason that this study has been designed to address the existing gap in the empirical literature on the Eastern European countries and transition economies. Accordingly, the existence of a dynamic relationship between saving, investment and growth will be examined using cointegration tests developed by Westerlund and Edgerton (2007). Furthermore, the direction and magnitude of the long-run relationship between the variables will be examined using the CS-ARDL technique developed by Chudik et al. (2016). Moreover, the causality relationship between the variables will be tested using the recently developed panel Granger non-causality test by Juodis et al. (2021). As these techniques have yet to be employed within the empirical literature, this study constitutes a valuable contribution to that field.

In line with the foregoing arguments stated by both theoretical and empirical literature, this present study aims to test the following two main competing hypotheses:

H_1: Domestic savings and investments tend to influence economic growth.
H_2: Economic growth tends to influence domestic savings and investments.

In order to test the validity of these hypotheses, the present study develops the empirical strategy, which is based on cointegration relationship and causal nexus among the variables and will be discussed in the next sections.

4. Model Specification and Data

Given that the main objective of the present study is to investigate the long-run dynamic relationship between saving, investment and economic growth, focusing on the Eastern European countries, the following baseline functions in implicit form will be estimated:

$$LY_{it} = f(LS_{it}, LI_{it}) \quad (1)$$
$$LS_{it} = f(LY_{it}, LI_{it}) \quad (2)$$
$$LI_{it} = f(LY_{it}, LS_{it}) \quad (3)$$

Where LY_{it}, LS_{it}, and LI_{it} denote the natural logarithms of GDP per capita, gross domestic saving as percentage of GDP and gross fixed capital formation as percentage of GDP per capita, whereas subscripts *i* and *t* denote the cross-sectional unit and time dimensions respectively.

Throughout the baseline specifications, validity of the foregoing hypotheses will be examined for the twenty-one Eastern European countries[3]. Due to limitations on the availability of appropriate data, the empirical analysis were conducted over the period 1995-2021 on annual basis. All data regarding the variables specified above were compiled from the World Development Indicators (WDI) of the World Bank on annual basis[4]. In order to avoid skewness, all variables were converted into their natural logarithmic form. Table 2 presents the descriptive statistics and correlation matrix for the variables included in the empirical analysis. As the difference between the maximum and minimum values is greater for GDP per capita (LY) and gross domestic savings (LS), which are the focus of the variables, the standard deviation values are relatively higher, indicating strong volatility across countries and time periods. Nevertheless, the standard deviation of gross fixed capital formation (LI) is lower, which results in a greater difference between the maximum and minimum values.

Table 2. Descriptive statistics and correlation matrix

Panel A. Descriptive Statistics			
Variables	LY	LS	LI
Observations	567	567	567
Mean	8.7216	2.7260	3.1195
Standard Deviation	0.7789	0.8838	0.2543
Minimum	6.8331	-4.1195	1.3944
Maximum	10.1163	4.0616	4.0554
Panel B. Correlation Matrix			
Variables	LY	LS	LI
LY	1.0000		
LS	0.5214	1.0000	
LI	0.1330	0.1547	1.0000

Note: Descriptive statistics of all the variables are computed in their natural logarithms.
Source: Research findings.

5. Estimation Strategy

The dynamic linkage between savings, investment and economic growth is examined by employing various methods and this section provides a detailed discussion on the estimation strategy.

5.1. Panel Cointegration

In order to reveal the existence of dynamic long-run interaction between the variables of interest, the present paper utilizes the panel lagrange-multiplier (LM) cointegration test, which is known as one of the second-generation panel cointegration tests. In this regard, Westerlund and Edgerton (2007) consider the following data generating process:

$$y_{it} = \alpha_i + x'_{it} + \varepsilon_{it} \quad (4)$$

Where i=1,2,...,N and t=1,2,...,T denote the cross-sectional unit and time periods, whereas x_{it} is a vector of explanatory variables by k x 1, which follows a full random walk process. Yet, ε_{it} represents the error-component by which consists of the following elements:

$$z_{it} = u_{it} + v_{it} \text{ and } v_{it} = \sum_{j=1}^{t} \vartheta_{ij} \quad (5)$$

Where ϑ_{ij} has an independent and identically distributed (i. i. d) process with zero mean and constant variance. In the light of this information, Westerlund and Edgerton (2007) obtained the LM test statistic through the following equation:

$$LM_N^+ = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{\omega_i^{-2}} s_{it}^2 \quad (6)$$

Where s_{it} is the partial sum process of the fully modified estimate of z_{it} and $\widehat{\omega_i^{-2}}$ is equal to the conditional long-run variance of u_{it} in equation 5. Considering the presence of cross-sectional dependence, the LM test statistic was developed to test the null hypothesis of 'there is cointegration' against the alternative, probability values, which are suitable for the bootstrap distribution were developed in order to account for cross-sectional dependence. To the extent that the calculated LM test statistic is lower than the bootstrap critical values, the null hypothesis of cointegration is accepted (Westerlund and Edgerton 2007, 186-187).

5.2. Long-Run Elasticity Estimation

By accounting for the likelihood of the cointegration relationship between the variables of interest, the present paper employs a novel approach in unveiling the long-run elasticities of the variables. To this end, Chudik et al. (2016) pioneered a method so called CS-ARDL model that has some certain advantages. Firstly, it is feasible within the presence of cross-sectional dependency (CD) and slope heterogeneity with different integration order of the series. Secondly, with the inclusion of error correction term it shows dynamic character since the lagged dependent variable is considered as weakly exogenous regressor. Thirdly, this approach enables the control of CD in both the short-run and the long-run. In the presence of CD, long-run effects can be captured by controlling for

unobservable factors (Sohag et al. 2021). In accordance with the approach proposed by Chudik et al. (2016), the CS-ARDL estimator is based on the following regression equation:

$$y_{it} = \mu^{*}_{yi} + \sum_{l=0}^{Py} \varphi_{il} y_{i,t-l} + \sum_{l=0}^{Px} \beta'_{il} x_{i,t-l} + \sum_{l=0}^{P\bar{z}} \omega'_{il} \overline{z_{t-l}} + \varepsilon^{*}_{it} \quad (7)$$

Where $\bar{z}_t = (\bar{y}_t, \bar{x}'_t)'$ and $P\bar{z} = [T^{1/3}]$. Throughout the equation 7, individual mean level coefficient of the CS-ARDL model is given by the following representation:

$$\hat{\theta}cs - ardl, i = \frac{\sum_{l=0}^{Px} \hat{\beta}_{il}}{1-\sum_{l=0}^{Py} \widehat{\varphi_{il}}} \quad (8)$$

Where $\hat{\varphi}_{il}$ and $\hat{\beta}_{il}$ denotes the estimated short-run coefficients through the equation 7. Estimation of the mean long-run effects are based on $N^{-1}\sum_{i=1}^{N} \hat{\theta}_{cs-ardl,i}$ (Chudik et al. 2016).

In order to estimate the long-run effects across the variables, this paper employs the cross-section augmented distributed lag (CS-DL) model for the purpose of establishing a benchmark and ensuring the robustness of the results obtained through the implementation of the CS-ARDL model. Developed by Chudik et al. (2016), this approach directly estimates the long-run effects of independent variable(s) on dependent variable without incorporating error correction mechanism. To this end, Chudik et al. (2016) assume the following dynamic auxiliary regression model:

$$y_{it} = c_{yi} + \theta'_i x_{it} + \sum_{j=0}^{p-1} \delta_{ij} \Delta x_{i,t-j} + \sum_{j=0}^{p\bar{y}} \omega_{y,ij} \overline{y_{t-j}} + \sum_{j=0}^{p\bar{x}} \omega'_{x,ij} \overline{x_{t-j}} + e_{it} \quad (9)$$

Where $\bar{x}_t = N^{-1}\sum_{i=1}^{N} x_{it}$ and $\bar{y}_t = N^{-1}\sum_{i=1}^{N} y_{it}$. Pooled and mean group estimator for the treatment of long-run effects throughout the equation 9 is represented by the following equations (Chudik et al. 2016):

$$\widehat{\theta_{MG}} = N^{-1}\sum_{i=1}^{N} \hat{\theta}_i \text{ and } \widehat{\theta_P} = \left(\sum_{i=1}^{N} \omega_i X'_i M_{qi} X_i\right)^{-1} \sum_{i=1}^{N} \omega_i X'_i M_{qi} y_i \quad (10)$$

Where $\widehat{\theta_{MG}}$ and $\widehat{\theta_P}$ represents mean group and pooled CS-DL estimators. In addition, these CS-DL estimators are quite delicate to the multi-collinearity problem between the cross-sectional averaged variables and can wipe out them from estimation process (Namahoro et al. 2021).

5.3. Panel Causality Analysis

Causality interplay between the variables of interest will be examined in a bifurcated approach. In the presence of both CD and slope heterogeneity, the panel Fisher causality test, which was pioneered by Emirmahmutoglu and Kose (2011)[5], remains a viable option even in the absence of a cointegration relationship among the variables. To that end, Emirmahmutoglu and Kose (2011) suggest standard Wald test statistics and Fisher statistics respectively. However, the former is more effective when the variables are integrated in the same order, whereas the latter is more effective when the variables are integrated in different orders. In the presence of non-stationary variables, the nuance parameter issue would render the Wald statistics ineffective. Therefore, Emirmahmutoglu and Kose (2011) propose an approach by which augmenting the standard VAR model with maximum lag orders in the presence of CD and slope heterogeneity. In this respect, the following Fisher test statistics is employed for testing the null hypothesis non-causality between the variables of interest:

$$\lambda = -2\sum_{i=1}^{N} \ln(p_i) \quad (11)$$

Where pi denotes the p-values of the Wald test statistics, which are computed for each cross-sectional unit.

In a more recently developed approach, Juodis et al. (2021) tailored a novel method in testing for Granger non-causality within the presence of CD and homogeneity/heterogeneity conditions. Moreover, this test cannot suffer size distortions even if time dimension (T) is smaller than cross-sectional dimensions (N). In other words, it has power advantage within the presence of large N and small T; it can produce results that are more efficient compared to the counterparts, i.e. Dumitrescu and Hurlin (2012) (Xiao et al. 2022). By setting the linear restriction on Granger causation parameters, Juodis et al. (2021) assume the following linear dynamic panel data model:

$$y_{i,t} = z'_{i,t}\theta_i + x'_{i,t}\beta_i + \varepsilon_{i,t} \quad (12)$$

Where $z_{i,t} = \left(1, y_{i,t-1}, \ldots, y_{i,t-p}\right)'$, $x_{i,t} = \left(x_{i,t-1}, \ldots, x_{i,t-p}\right)'$, $\theta_{i,t} = \left(\theta_{i,t-1}, \ldots, \theta_{i,t-p}\right)'$ and $\beta_i = \left(\beta_{1,i}, \ldots, \beta_{p,i}\right)'$. In addition, i=1,…,N denotes the cross-sectional unit, t=1,…,T denotes the time dimension whereas p = 1,…,P denotes the lag length for heterogeneous autoregressive coefficient. The null hypothesis of $x_{i,t}$ does not Granger cause of $y_{i,t}$ by the pooled least-

squares estimator of β, which Juodis et al. (2021) develop as in the following form:

$$\hat{\beta}=\left(\sum_{i=1}^{N} X_i^{'} M_{Zi} X_i\right)^{-1}\left(\sum_{i=1}^{N} X_i^{'} M_{Zi} y_i\right) \quad (13)$$

Where $M_{Zi}=I_T-Z_i\left(Z_i^{'}Z_i\right)^{-1}Z_i^{'}$. As the pooled least squares estimator of "β" is subject to Nickell bias, Juodis et al. (2021) propose the application of the half-panel jackknife (HPJ) method developed by Dhaene and Jochmans (2015) as a means of eliminating this inherent bias. Thus, Juodis et al. (2021) derive the following bias-corrected version of Wald test for Granger non-causality in the following form:

$$\widehat{W}_{HPJ}=NT\tilde{\beta}^{'}\left(\hat{J}^{-1}\hat{V}\hat{J}^{-1}\right)^{-1}\tilde{\beta} \quad (14)$$

Where $\hat{J}=\frac{1}{NT}\sum_{i=1}^{N} X_i^{'} M_{Zi} X_i$ and $\tilde{\beta}$ is the HPJ estimator that removes the bias associated with pooled estimator under homogeneity restriction. In accordance with the aforementioned methodological arguments, the empirical results will be discussed in the following section.

6. Empirical Results and Discussion

The initial phase of the present empirical endeavour is devoted to the examination of whether the panel data set exhibits cross-country dependency and slope homogeneity. The phenomenon of cross-country dependency is likely to emerge when an economic, financial or commercial shock occurs in one country, with the potential to influence the remaining countries in the sample. It is possible that the issue of CD will arise, given that some countries in the sample have integrated in terms of economic, commercial and financial aspects, or have strong trade partnerships with each other. It is therefore essential to examine the presence of potential cross-country dependence across the sample in order to ensure the reliability of subsequent analyses. Developed by Pesaran (2004), various types of cross-sectional dependency (CD) tests have been conducted. The results of the CD tests with respect to each baseline specification are displayed in the above segment of Table 3. The results indicate that cross-country dependency is present with respect to each specification. In this context, the results of both types of CD tests clearly indicate that the null hypothesis of no cross-sectional dependency is rejected, with the computed test statistics exceeding the critical values at the 1% significance level for each specification. As the dynamic linkage between domestic saving and economic growth will be examined in a linear panel data context, the homogeneity of the slope parameters is also examined by the $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests, which are pioneered by Pesaran and Yamagata (2008). The results of the tests demonstrate that the slope parameters are heterogeneous, thereby rejecting the null hypothesis of slope homogeneity at the 1% significance level for each test.

Once the existence of CD and heterogeneity in the panel data set has been established, the next step is to ascertain whether the variables are stationary. The presence of unit root may lead fictious results in further steps of the empirical analyses if it is not adequately addressed in subsequent empirical analyses. For this purpose, two types of unit root tests that are developed by Im et al. (2003) and Pesaran (2007) were employed and the relevant results were reported in Table 4. In this respect, both tests yielded consistent results. Based on the W-statistics, the results of the IPS (2003) test indicate that the series of LS and LI are stationary at the level, i.e. I (0), whereas the series of LY becomes stationary after first differencing. Analogously,

Table 3. CD tests and slope homogeneity

	A. Cross-Sectional Dependency Tests		
Dependent Variable	LY_{it}	LS_{it}	LI_{it}
CD Test	37.863*	31.695*	22.771*
CD_{LM} Test	81.771*	63.001*	37.297*
LMadj Test	77.400*	77.890*	72.181*
	B. Homogeneity Tests		
Dependent Variable	LY_{it}	LS_{it}	LI_{it}
$\tilde{\Delta}$ Test	59.848*	40.875*	15.630*
$\tilde{\Delta}_{adj}$ Test	64.844*	44.287*	16.934*

Notes: * denotes the significance level at 1%.

Source: Research findings.

Table 4. Panel unit root tests

	IPS		CIPS		
Variables	Level	1st Difference	Level	1st Difference	Outcome
LY	1.9090	-10.4729*	-2.547	-3.932*	I(1)
LS	-6.3634*	-22.6639*	-3.115*	-5.353*	I(0)
LI	-3.6044*	-11.0491*	-2.828*	-4.427*	I(0)

Note: IPS denotes the unit root test that is developed by Im et al. (2003) whereas CIPS denotes the cross sectional augmented version of the IPS test that is developed by Pesaran (2007). *,**,*** denote the significance levels at 1 %, 5 % and 10 %. Critical values for the CIPS test at 1%, 5% and 10% significance levels are -2.81, -2.66, and -2.58 respectively.

Source: Research findings.

Table 5. Panel LM cointegration test

Dependent Variable	LY_{it}	LS_{it}	LI_{it}
LM-Statistics	2.264(0.697)	1.728(0.920)	1.117(0.995)

Note: *, **, *** denotes the significance levels at 1%, 5%, and 10% respectively. Bootstrap p-values are shown in parenthesis for panel LM cointegration test.

Source: Research findings.

the results of CIPS test are consistent with the results of IPS (2003) test. Hence, it can be deduced that the series of LS and LI are stationary at a constant level, whereas the LY series becomes stationary after undergoing a first difference, resulting in a stationary series at a first difference level, or I(1).

In the presence of CD and heterogeneity, the presence of the long-run relationship amongst the variables was estimated by performing panel LM cointegration test. By considering the presence of CD and heterogeneity with mixed order of integration amidst the variables, and the relevant results are reported in Table 5. The main difference associated with this cointegration test lays on the setup of the null hypothesis, which indicates that cointegration relationship among the selected variables exists. Moreover, in the presence of CD, this test enables the generation of inference based on bootstrap p-values. Given that the LM statistics are accompanied by bootstrap p-values, it can be concluded that the null hypothesis of cointegration exists among the selected variables to the extent that the computed bootstrap p-values are not statistically significant with respect to each specific model.

In what follows, the direction and magnitude of the long-run dynamic interplay among the variables is estimated by conducting two methods pioneered by Chudik et al. (2016) and relevant results are documented in Table 6.

Accordingly, panel A is devoted to the results of CS-ARDL model in which CD bias is wipe out for different time horizons under error-correction mechanism. The findings of CS-ARDL model firmly accentuate the validity of Classical approach, which indicates that savings precede economic growth. To this end, 1% rise in LS leads to increase in LY by 4.69% in the short-run. Similar tendency exists in the long-run to the extent that 1% rise in LS upswings LY by 4.75%. On the other hand, the effect of investments are more dominant on growth both in the short-run and in the long-run. In this respect, 1% increase in LI accelerates LY by 11.2% and 13.7% respectively. In line with the expectations, the of error correction term is negative and statistically significant indicating that speed of adjustment to the long-run equilibrium path is almost 98% per year. It should also be highlighted that the findings of CS-ARDL model does not support the Keynesian view that suggests economic growth precede savings to the extent that the coefficient of LY is not significant neither in the short-run nor in the long-run. While investment has positive effect on saving in the short-run, in the long-run its effect on saving redeems. To that end, 1% rise in LI upswings LS by 33.8% in the short-run whereas the long-run coefficient of LI is statistically insignificant. It is worth mentioning that despite the coefficient of EC is negative and significant; it exceeds one in absolute manner. Thus, it indicates that system has an oscillatory adjustment process.

Table 6. Results of CS-ARDL and CS-DL models

		A. CS-ARDL	
Dependent Variable	ΔLY_{it}	ΔLS_{it}	ΔLI_{it}
EC_{t-1}	-0.9826(0.0487)*	-1.1212(0.0628)*	-0.9524(0.1068)*
Long-run Coefficients			
LS_{t-1}	0.0475(0.0210)**		-0.0232(0.1359)
LI_{t-1}	0.1375(0.0310)*	0.0088(0.3468)	
LY_{t-1}		0.2608(0.6579)	-2.1461(2.1281)
Short-run Coefficients			
ΔLS	0.0469(0.0184)**		0.0322(0.0757)
ΔLI	0.1128(0.0248)*	0.3385(0.1963)***	
ΔLY		-0.1114(0.9408)	1.0602(0.4745)**
		B. CS-DL	
Dependent Variable	ΔLY_{it}	ΔLS_{it}	ΔLI_{it}
LS	0.0979(0.0604)***		0.0112(0.0878)
LI	0.1322(0.0421)*	0.3121(0.3541)	
LY		0.4130(0.7438)	0.6080(0.5775)

Note: *, **, *** denotes the significance levels at 1%, 5%, and 10% respectively.

Source: Research findings.

Finally, the results also manifest that savings and economic growth have no significant effect on investment expenditures in the long-run even though error correction term is negative and statistically significant for the estimated model in which LI is chosen as dependent variable. Nonetheless, the short-run estimation results reveal that economic growth positively influences investment expenditures to the extent that 1% rise in LY soars LI by 1.06% whereas the estimation results demonstrate that LS does not have any significant effect on LI.

Panel B in Table 6 documents the results of CS-DL model. In order to identify the long-run interconnectedness among the selected variables, this approach does not require estimating the error correction terms for each specification. Thus, the long-run coefficients are directly estimated and relevant results are reported in Table 5. Analogous to the findings revealed by the estimation of CS-ARDL model, the findings of CS-DL model firmly vindicates the validity of Classical approach, which suggests that saving precedes economic growth. In this respect, 1% rise in LS tends to increase LY by 9.79% whereas 1% rise in LY does not have any significant effect on LS. Moreover, capital accumulation process works in the model where economic growth is dependent variable to the extent that 1% rise in LI accelerates LY by 13.2%. However, in the model where saving is dependent variable, investment does not have any effect on saving in the long-run. The results also documents that economic growth and saving do not have any significant effect on investment expenditures. The coefficients of LS and LY are not statistically significant.

Once the long-run relationship between the variables has been established, the empirical analysis will be terminated with an examination of the causal relationship between the variables of interest. In this context, two types of causality tests were performed and the relevant results are reported in Table 7. Panel A in Table 7 presents the findings of the Fisher-type causality test proposed by Emirmahmutoglu and Kose (2011). The results of the Fisher-type causality test support the Classical view, which posits that saving precedes economic growth. In conclusion, the evidence supports the hypothesis that there is a unidirectional causal relationship between saving and economic growth. The null hypothesis of LS does not cause LY is rejected at the 5% significance level. Furthermore, unidirectional causality is observed from investment to economic growth. With regard to this matter, the null hypothesis of LI does not cause LY is rejected at the 10% significance level. Similarly, the causal relationship between savings and investments is unidirectional. Accordingly, the causal relationship between saving and investment is unidirectional, with the null hypothesis regarding the LS not causing LI being rejected at the 5% significance level.

Table 7. Panel causality tests

A. Panel-Fisher Causality Test		
Direction of Causality	Fisher Statistics	Outcome
LS → LY	88.236[0.022]**	H_0 is rejected
LY → LS	22.001[0.214]	H_0 is accepted
LI → LY	43.073[0.080]***	H_0 is rejected
LY → LI	31.065[0.147]	H_0 is accepted
LS → LI	71.252[0.038]**	H_0 is rejected
LI → LS	36.513[0.125]	H_0 is accepted
B. JKS Panel Granger Non-Causality Test		
Direction of Causality	HPJ Wald Test	Outcome
LS → LY	8.5283(0.009)*	H_0 is rejected
LY → LS	2.1141(0.146)	H_0 is accepted
LI → LY	30.9941(0.000)*	H_0 is rejected
LY → LI	4.0431(0.670)	H_0 is accepted
LS → LI	11.3720(0.003)*	H_0 is rejected
LI → LS	2.2227(0329)	H_0 is accepted

Note: ** and *** denote the significance levels at 5% and 10%. For Panel-Fisher Causality Test p-values are shown in brackets whereas for JKS Panel Granger Non-Causality Test p-values are shown in parentheses.

Source: Research findings.

Panel B represents the results of panel Granger non-causality tests developed by Juodis et al. (2021). As with the results of Fisher-type causality tests, the results of JKS Granger-non causality tests suggest the presence of a unidirectional causal relationship between saving and economic growth, with causality flowing from saving to economic growth. With regard to this matter, the null hypothesis of the LS does not Granger-cause that of the LY, which is rejected at the 1% significance level. Therefore, this finding lends support to the veracity of the classical perspective in opposition to the Keynesian view. Conversely, unidirectional causality is also present between saving and investment, as evidenced by the rejection of the null hypothesis of LS not Granger-causing LI at the 1% significance level. Furthermore, unidirectional causality also exists between investment and economic growth, such that the null hypothesis of LI does not Granger-cause of LY is rejected at the 1% significance level.

Within the presence of cross-country dependence and mixed order integration of the variables of interest, this paper unveils the long-run cointegration relationship between domestic saving and economic growth with the inclusion of gross fixed capital formation as a proxy for the investment. The direction of the dynamic linkage between domestic saving and economic growth tends to support the validity of the Classical view that suggests saving precedes economic growth. In addition, these findings are also in accordance with the EGM, which postulate that saving is the leading factor that determines economic growth in a more modern way. In this context, these findings vindicate the findings documented by earlier attempts such as Cullison (1993), Husain (1996), Agrawal (2001), Alguacil et al. (2004), Sepehri and Akram-Lodhi (2005), Oladipo (2010) and Jangili (2011). In addition, the findings documented by the empirical analysis in this endeavour also in favour of the findings reported by some recent empirical studies that specifically focus on some countries and group of countries (Jagadeesh 2015; Nwanne 2014; Nguyen and Nguyen 2017 and Patra et al. 2017). Within the context of the Eastern European economies, this paper also support the findings that specifically focus on some transition economies that are involved in the sample. To this end, the findings asserted by Soylu (2019) and in a more recent paper by Ribaj and Mexhuani (2021) tend to support the findings documented in this present study. Accordingly, since savings precede the economic growth, policy-makers in those countries design the appropriate policies in favour of promoting savings and investment expenditures.

7. Conclusions

The nexus between savings and economic growth represents one of the most contentious areas in macroeconomics. The prevailing consensus among scholars has yet to emerge, with differing opinions as to whether savings precede economic growth or the latter precedes the former. For those with a developmental perspective, the capital accumulation process is a key factor that stimulates economic growth. This perspective represents a pivotal consideration for developing countries, particularly for transition economies seeking to narrow the gaps with industrialised free-market economies. Accordingly, the objective of the present study is to provide novel empirical evidence for a broader group of countries in Eastern Europe, including those that emerged from the Soviet Union. The findings of the CS-ARDL and CS DL models, in conjunction with the panel causality tests, provide compelling evidence that savings precede economic growth in the Eastern European countries. Furthermore, alongside savings, investment represents another pivotal indicator that elucidates the growth process.

Motivated by the foregoing findings, some policy recommendations could be suggested as well. Given that savings precede economic growth, it is recommended that economic policies should be designed in a manner that promotes savings. The implementation of conventional economic policy tools in an appropriate manner can facilitate the mobilisation of savings across the economy. As with the monetary policy, one of the principal instruments capable of mobilising savings is the interest rate. Central banks should utilise this tool in a way that does not impede the primary objectives of monetary policy, namely price stability and financial stability. Consequently, the independence of central banks and the credibility of their monetary policy are crucial elements in satisfying the confidence of economic agents. Such satisfaction may in turn facilitate savings being channelled into the financial system.

With regard to the fiscal policy, governments should endeavour to reduce the tax burden on borrowers and, conversely, impose fewer taxes on the profits generated from financial investment. Accordingly, declining tax burden on households and investors may positively contribute to the tax revenues of governments, which in turn reduces the pressure on fiscal balances. Thus, overall saving rate of the economies may rise due to the rises in public savings.

For the efficient implementation of monetary and fiscal policies, some institutional and regulatory actions are required, with the coordination of central banks and governments. In this context, the integration of financial markets with a diverse range of financial instruments would facilitate financial deepening, thereby enabling investors to access the liquidity required for their investment projects. Nonetheless, performance of institutions and absorptive capabilities of the reforms by institutions may vary since the sample covers EU and non-EU countries even though there is a common view that well-performing institutions tend to trigger economic performance. Therefore, future researches should be conducted by accounting for the role of institutions on savings, investment, and economic growth together with the other potential determinants. Since the quality and performance of institutions and speed of adjustments to the reforms vary by country, it would be quite beneficial to decouple transition economies into the sub-samples as of which EU member states and non-EU states.

Endnotes

1. The author is grateful to the views suggested by the anonymous reviewers whom address the role of institutions on economic performance for transition economies.
2. Efendic and Pugh (2015) finds out the adverse effect of foreign direct investment (FDI) inflows on GDP at level, however, the second lag of FDI inflows tend to have positive and significant influence on the latter.
3. Based on the definition by United Nations (2022), selection of the sample countries in Eastern Europe is inspired by Djokoto et al. (2023). See Appendix on Table A1 for the list of the countries.
4. See Appendix on Table A2 for the detailed definition of the variables.
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References

Acemoglu, D., Johnson, S. and Robinson, J. A. 2001. The colonial origins of comparative development: an empirical investigation. *The American Economic Review*, 91 (5): 1369–1401. https://doi.org/ 10.1257/aer.91.5.1369

Acemoglu, D. and Robinson, J. A. 2008. The Role of Institutions in Growth and Development. *Commission on Growth and Development Working Paper*; No. 10. http://hdl.handle.net/10986/28045 (accessed December 12, 2024).

Agrawal, P. 2001. The relation between saving and growth: cointegration and causality evidence from Asia. *Applied Economics* 33 (4): 499-513. https://doi.org/10.1080/00036840122210

Alguacil, M., Cuadros, A. and Orts, V. 2004. Does saving really matter for growth? Mexico (1970–2000). *Journal of International Development* 16 (2): 281-290. https://doi.org/10.1002/jid.1075

Amusa, K. and Busani, M. 2013. Saving and economic growth in Botswana: an analysis using bounds testing approach to cointegration. *Journal of Economics and Behavioral Studies* 5 (4): 200-209. https://doi.org/10.22610/jebs.v5i4

Anoruo, E. and Ahmad, Y. 2001. Causal relationship between domestic savings and economic growth: evidence from seven African countries. *African Development Review* 13 (2): 238-249. https://doi.org/10.1111/1467-8268.00038

Baharumshah, A. Z., Thanoon, M. A. and Rashid, S. 2003. Saving dynamics in the Asian countries. *Journal of Asian Economics* 13 (6): 827-845. https://doi.org/10.1016/S1049-0078(02)00187-2

Bolarinwa, S. T. and Obembe, O. B. 2017. Empirical analysis of the nexus between saving and economic growth in selected African countries (1981–2014). *Journal of Development Policy and Practice* 2 (1): 110-129. https://doi.org/10.1177/2455133316676420

Carroll, C. D. and Weil, D. N. 1994. Saving and growth: a reinterpretation. *Carnegie-Rochester Conference Series on Public Policy* 40, 133-192. https://www.sciencedirect.com/science/article/pii/016722319490006X (accessed June 20, 2023).

Chakraborty, D. 2023. Exploring causality between domestic savings and economic growth: fresh panel evidence from BRICS Countries. *Economic Alternatives* 29 (1): 48-69. https://doi.org/10.37075/EA.2023.1.03

Chousa, J. P., Khan, H. A., Melikyan, D. and Tamazian, A. 2005. Assessing institutional efficiency, growth and integration. *Emerging Markets Review* 6 (1): 69-84. https://doi.org/10.1016/j.ememar.2004.09.004

Chudik, A., Mohaddes, K., Pesaran, M. H. and Raissi, M. 2016. Long-run effects in large heterogeneous panel data models with cross-sectionally correlated errors. In Essays in honour of Aman Ullah, edited by G. Gonzalez-Rivera, C. R. Hill, and T. H. Lee, 85-135. Leeds: Emerald Group Publishing Limited.

Cullison, W. E. 1993. Saving measures as economic growth indicators. *Contemporary Economic Policy* 11 (1): 1-8. https://doi.org/10.1111/j.1465-7287.1993.tb00366.x

Đidelija, I. 2021. The causal link between savings and economic growth in Bosnia and Herzegovina. *South East European Journal of Economics and Business* 16 (2): 114-131. https://doi.org/10.2478/jeb-2021-0018

Djokoto, J. G., Hysa, E. and Mansi, E. 2023. Foreign divestment and domestic investment in Eastern European countries. *Post-Communist Economies* 36 (1): 90-104. https://doi.org/10.1080/14631377.2023.2237211

Dhaene, G. and Jochmans, K. 2015. Split-panel jackknife estimation of fixed-effect models. *The Review of Economic Studies* 82 (3): 991–1030. https://doi.org/10.1093/restud/rdv007

Domar, E. D. 1946. Capital expansion, rate of growth, and employment. *Econometrica* 14 (2): 137-147. https://doi.org/10.2307/1905364

Dumitrescu, E. and Hurlin, C. 2012. Testing for Granger noncausality in heterogeneous panels. *Economic Modelling* 29 (4): 1450-1460. https://doi.org/10.1016/j.econmod.2012.02.014

Efendic, A. and Pugh, G. 2007. Institutions and economic performance: an overview of empirical research with the main focus on transition economies. *South East European Journal of Economics and Business* 2 (1): 25-30. https://doi.org/10.2478/v10033-007-0012-2

Efendic, A. and Pugh, G. 2015. Institutional effects on economic performance in Post-Socialist Transition: a dynamic panel analysis. *Acta Oeconomica* 65 (4): 503-523. https://doi.org/10.1556/032.65.2015.4.1

Emirmahmutoglu, F. and Kose, N. 2011. Testing for Granger causality in heterogeneous mixed panels. *Economic Modelling* 28 (3): 870-876. https://doi.org/10.1016/j.econmod.2010.10.018

Feldstein, M. and Horioka, C. 1980. Domestic saving and international capital flows. *The Economic Journal* 90 (358): 314-329. https://doi.org/10.2307/2231790

Gwartney, J. D., Holcombe, R. G. and Lawson, R. A. 2004. Economic freedom, institutional quality, and cross-country differences in income and growth. *Cato Journal* 24 (3): 205-233. https://www.cato.org/sites/cato.org/files/serials/files/cato-journal/2004/11/cj24n3-2.pdf (accessed 14 December 2024).

Harrod, R. 1939. An essay in dynamic theory. *The Economic Journal* 49 (193): 14-33. https://doi.org/10.2307/2225181

Havrylyshyn, O. and van Rooden, R. 2003. Institutions matter in transition, but so do policies. *Comparative Economic Studies* 45: 2-24. https://doi.org/10.1057/palgrave.ces.8100005

Husain, A. M. 1996. Private saving and its determinants in Pakistan: the case of Pakistan. *The Pakistan Development Review* 35 (1): 49–70. https://doi.org/10.30541/pdr.v35i1

Im, K. S., Pesaran, M. H. and Shin, Y. 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115 (1): 53-74. https://doi.org/10.1016/S0304-4076(03)00092-7

Irandoust, M. and Ericsson, J. 2005. Foreign aid, domestic savings, and growth in LDCs: an application of likelihood-based panel cointegration. *Economic Modelling* 22 (4): 616-627. https://doi.org/10.1016/j.econmod.2004.03.004

Jagadeesh, D. 2015. The impact of savings in economic growth: an empirical study based on Botswana. *International Journal of Research in Business Studies and Management* 2 (9): 10-21. https://www.ijrbsm.org/pdf/v2-i9/2.pdf (accessed May 15, 2023).

Jangili, R. 2011. Causal Relationship between Saving, Investment and Economic Growth for India: what does the Relation Imply? *RBI Occasional Papers* No. 32, https://mpra.ub.uni-muenchen.de/40002/ (accessed July 25, 2023).

Juodis, A., Karavias, Y. and Sarafidis, V. 2021. A homogeneous approach to testing for Granger non-causality in heterogeneous panels. *Empirical Economics* 60: 93–112. https://doi.org/10.1007/s00181-020-01970-9

Karahan, Ö. 2018. The causal relation between savings and economic growth in Turkey. In Contributions to Economics, the Political Economy of Development in Southeastern Europe, edited by S. Roukanas, P. Polychronidou and A. Karasavvoglou, 127-139. Cham, Springer.

Keynes, J. M. 1936. The general theory of employment, interest and money. Cambridge, Macmillan Cambridge University Press.

Namahoro, J. P., Nzabanita, J. and Wu, Q. 2021. The impact of total and renewable energy consumption on economic growth in lower and middle- and upper-middle-income groups: evidence from CS-DL and CCEMG analysis. *Energy* 237: 1-13. https://doi.org/10.1016/j.energy.2021.121536

Nguyen, N. T. K. and Nguyen, H. H. 2017. Impacts of domestic savings on economic growth of Vietnam. *Asian Journal of Economic Modelling* 5 (3): 245-252. https://doi.org/10.18488/journal.8.2017.53.245.252

North, D. C. 1990. Institutions, institutional change and economic performance. Cambridge, Cambridge University Press.

Nwanne, T. F. I. 2014. Implication of savings and investment on economic growth in Nigeria. *International Journal of Small Business and Entrepreneurship Research* 2 (4): 74-86. https://www.eajournals.org/wp-content/uploads/Implication-of-Savings-and-Investment-on-Economic-Growth-in-Nigeria.pdf (accessed August 20, 2023).

Oladipo, O. S. 2010. Does saving really matter for growth in developing countries? The case of a small open economy. *International Business & Economics Research Journal* 9 (4): 87-94. https://doi.org/10.19030/iber.v9i4.556

Patra, S. K., Murthy, D. S., Kuruva, M. B. and Mohanty, A. 2017. Revisiting the causal nexus between savings and economic growth in India: an empirical analysis. *EconomiA* 18 (3): 380-391. https://doi.org/10.1016/j.econ.2017.05.001

Pesaran, M. H. 2004. General Diagnostic Tests for Cross-Section Dependence in Panels. *IZA Discussion Paper* No. 1240, https://docs.iza.org/dp1240.pdf. (accessed July 23, 2023).

Pesaran, M. H. 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics* 22 (2): 265-312. https://doi.org/10.1002/jae.951

Pesaran, M. H., Ullah, A. and Yamagata, T. 2008. A bias-adjusted LM test of error cross-section independence. *The Econometrics Journal* 11 (1): 105–127. https://doi.org/10.1111/j.1368-423X.2007.00227.x

Pesaran, M. H. and Yamagata, T. 2008. Testing slope homogeneity in large panels. *Journal of Econometrics* 142 (1): 50–93. https://doi.org/10.1016/j.jeconom.2007.05.010

Redek, T. and Susjan, A. 2005. The impact of institutions on economic growth: The case of Transition Economies. *Journal of Economic Issues* 39 (4): 995-1027. https://doi.org/10.1080/00213624.2005.11506864

Ribaj, A. and Mexhuani, F. 2021. The impact of savings on economic growth in a developing country (the Case of Kosovo). *Journal of Innovation and Entrepreneurship* 10: https://doi.org/10.1186/s13731-020-00140-6

Saltz, I. S. 1999. An examination of the causal relationship between savings and growth in the third world. *Journal of Economics and Finance* 23: 90–98. https://doi.org/10.1007/BF02752690

Sepehri, A. and Akram-Lodhi, H. 2005. Transition, savings and growth in Vietnam: a three-gap analysis. *Journal of International Development* 17 (4): 553-574. https://doi.org/10.1002/jid.1174

Sinha, D. and Sinha, T. 1998. Cart before the horse? The saving–growth nexus in Mexico. *Economics Letters* 61 (1): 43-47. https://doi.org/10.1016/S0165-1765(98)00144-X

Sohag, K., Chukavina, K. and Samargandi, N. 2021. Renewable energy and total factor productivity in OECD member countries. *Journal of Cleaner Production* 296: 1-8. https://doi.org/10.1016/j.jclepro.2021.126499

Solow, R. 1956. A contribution to the theory of economic growth. *The Quarterly Journal of Economics* 70 (1): 65-94. https://doi.org/10.2307/1884513

Soylu, Ö. B. 2019. Do foreign direct investment and savings promote economic growth in Poland? *Economics and Business Review* 5 (4): 3-22. https://doi.org/10.18559/ebr.2019.4.1

United Nations. 2022. Department for General Assembly and Conference Management. https://www.un.org/

dgacm/en/content/regional-groups (accessed August 25, 2023).

Veblen, T. 1919 (first published in 1961). The place of science in modern civilization, and other essays. New York, Russell & Russell NY.

Verma, R. 2007. Savings, investment and growth in India: an application of the ARDL bounds testing approach. *South Asia Economic Journal* 8 (1): 87-98. https://doi.org/10.1177/139156140600800105

Westerlund, J. and Edgerton, D. L. 2007. A panel bootstrap cointegration test. *Economics Letters* 97 (3): 185-190. https://doi.org/10.1016/j.econlet.2007.03.003

World Bank. 2023. World Development Indicators Database. https://databank.worldbank.org/source/world-development-indicators (accessed September 25, 2023).

Xiao, J., Karavias, Y., Juodis, A., Sarafidis, V. and Ditzen, J. 2023. Improved tests for Granger non-causality in panel data. *The Stata Journal* 23: 230-242.https://doi.org/10.1177/1536867X231162034

Yadav, I. S., Goyari, P. and Mishra, R. K. 2018. Saving, investment and growth in India: evidence from cointegration and causality tests. *Economic Alternatives* 24, 55-68. https://www.unwe.bg/eajournal/en/journalissues/article/13359 (accessed October 14, 2023).

APPENDIX

Table A1. List of sample countries

Albania	Czechia	Moldova	Slovakia
Armenia	Estonia	North Macedonia	Slovenia
Azerbaijan	Georgia	Poland	Ukraine
Belarus	Hungary	Romania	
Bulgaria	Latvia	Russian Federation	
Croatia	Lithuania	Serbia	

Table A2. List of variables and data sources

Variables	Long Definition	Data Source
Real GDP per capita (LY)	Value in constant 2015 US $	WDI, World Bank
Gross Domestic Saving (LS)	% of GDP	WDI, World Bank
Gross Fixed Capital Formation (LI)	% of GDP	WDI, World Bank