

Financial inclusion and inflation in Southeast European countries

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Abstract

Background: As a complex socio-economic concept, financial inclusion is related to the improvement of access and use of formal financial products and services (such as bank deposits, loans, insurance, etc.) by all participants in the financial system. More inclusive financial systems contribute to poverty reduction, decrease in inequalities among different income groups leading to economic growth, and economies more resilient towards macroeconomic shocks.

Purpose: This paper aims to assess the relationship between financial inclusion and inflation in Southeast European countries, focusing on Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey in the period from 2011 to 2021.

Study design/methodology/approach: The financial inclusion index was constructed using Principal Component Analysis (PCA). The connection between the financial inclusion index and inflation was investigated using panel regression modeling (OLS, fixed-effect, and random-effect models).

Findings/Conclusions: The research showed that countries with higher levels of financial inclusion are more resilient to inflation. This finding is consistent with other research implying that policymakers and other stakeholders within a financial system should contribute to promoting financial inclusion and building more inclusive financial systems.

Limitations/future research: The main limitation of the research is related to data availability for multidimensional index construction. Future research should be directed to providing a better understanding of whether the relationship between financial inclusion and inflation is under the influence of other monetary policy instruments, such as interest rates.

Keywords

financial inclusion, inflation, Southeast European (SEE) countries, Principal Component Analysis (PCA), panel regression

Introduction

As one of the main focuses of policy makers of developed and developing economies, financial inclusion ensures that there are no obstacles to access and use of basic financial products/services that are most needed by poor individuals within the financial system (Allen, Demirguc-Kunt, Klapper, Soledad & Peria 2016; Ozili, 2018). Financial inclusion contributes to the achievement of

sustainable goals (Sahay et al., 2015; Demirguc-Kunt, Klapper & Singer, 2017). There is evidence that it contributes to the social inclusion of the poor (Bold, Porteous & Rotman, 2012) and poverty alleviation (Neaime & Gaysset, 2018).

Most importantly, financial inclusion contributes to economic growth, and therefore it improves health and education and reduces income inequalities. A functional financial system creates equal opportunities by enabling excluded

individuals to integrate into the economy, contribute to economic growth, and protect themselves from macro-economic shocks. Many studies prove that financial inclusion and an inclusive financial system play a major role in promoting growth and alleviating poverty. For this reason, financial inclusion has great potential to integrate poor individuals into formal financial flows and break the downward spiral of poverty and income inequality. Of course, financial systems in the real world are far from inclusive; the financial infrastructure in developing countries is underdeveloped, inefficient and does not provide much choice.

Although the financial systems in the South-East European countries (SEE) have changed significantly in the recent past, the share of individuals who are financially excluded is still high. Financially excluded individuals have a limited access to financial products and services (such as loans and savings) and are unable to adequately participate in the growth and development of their economies, and are thereby deprived of the opportunity to effectively contribute to economic growth and poverty alleviation.

In contrast to most of the research that focuses on understanding the relationship and contributions of financial inclusion towards economic growth and poverty alleviation, this paper turns the attention to understanding the relationship of financial inclusion and inflation (inflation rates). In the new “normal” after the COVID-19 pandemic, governments are put to the new challenge of battling inflation resulting from expansionary monetary policies in the aftermath of the pandemic and the war between Russia and Ukraine.

The main goal of this paper is to provide more insight into the relationship between the level of financial inclusion and inflation. The research hypothesis is that countries with a higher level of financial inclusion (higher level of inclusiveness of financial systems) have a lower level of inflation. The research covers the period from 2011 to 2021 and is focused on the countries of SEE including Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey.

The rest of the paper is organized as follows. The second section provides previous research on the relationship between financial inclusion, economic growth, and inflation. The third section provides an overview of the methodology used

while in the fourth part the research results are presented and discussed. Concluding remarks, policy implications and recommendation for future research are given in the final section of the paper.

1. Theoretical background and previous research on nexus between financial inclusion and inflation

Academic research papers on financial inclusion mostly focus on promoting growth, development, and financial stability (Sarma & Pais, 2011; Cull, Demirgüç-Kunt & Lyman, 2012; Ghosh, 2013, Kim, Yu & Hassan, 2018). Also, it is worth mentioning that some studies (Kpodar & Andrianaivo, 2011; Ghosh, 2013; Fungáčová & Weill, 2015; Gabor & Brooks, 2017; Ozili, 2019; Vasile, Panait & Apostu, 2021; Apostu, Panait, Vasile, Sharma & Vasile, 2023) focus on government practices, financial system innovations in terms of introducing new financial institutions (i.e., microfinance institutions and credit unions), technological approaches (i.e., mobile accounts, FinTech) to promote financial inclusion, and the impact of the COVID-19 pandemic on financial inclusion.

Claessens & Perotti (2007) identify financial inclusion as a key driver of economic growth, while Sethi (2018) finds that financial inclusion can contribute to economic growth. Access to financial products and services at low prices improves the living standards of the poor. Individuals with low incomes are granted low-budget loans that are used to start their small businesses, especially in rural areas. Business activities stimulated in this way contribute to production growth at the state level resulting in higher macroeconomic growth, increasing the living standards of individuals with low incomes.

Improving access to bank deposits and insurance by the population that is financially excluded leads to the accumulation of financial sources in the financial market. Financial markets are then able to fulfil one of their main functions of efficient funds allocation into profitable long-term investments. A sound financial infrastructure can directly affect economic growth. Mehrotra & Yetman (2014) prove that the access of individuals to banking products and services brings benefits that create inclusive growth. The absence of adequate access to loans, both for individuals and for small and medium-sized enterprises, leads to negative consequences for the overall growth of employment. Also, Bruhn and Love (2014) reveal that financial access has a positive impact on

poverty and the income level of the poor. Park and Mercado (2015) find that financial inclusion contributes towards poverty alleviation and reduction of income inequalities. Harley, Adegoke and Adegbola, (2017) investigate the role of financial inclusion towards achieving economic growth and poverty alleviation in developing countries using the panel data analysis. They prove that the number of ATMs and bank branches are the most important indicators of increasing the level of financial inclusion. Gretta (2017) also proves the impact of financial inclusion on economic growth. Okoye, Adetiloye, Erin and Modebe (2017) investigate the impact of financial inclusion on economic growth and development in Nigeria showing that financial inclusion has impacted poverty reduction in Nigeria through the delivery of rural credits.

While financial inclusion is complementary to economic growth, there is mixed evidence on the connection between financial inclusion and inflation. As the theory suggests, one of preconditions of economic growth is an expansionary monetary policy which stimulates an economy by boosting demand through monetary and fiscal stimulus, but directly drives inflation. A scarcity of literature on the nexus between financial inclusion and monetary policy shows that higher financial inclusion contributes to better usability of central banks interest rate for stabilization of consumer price levels (Mehrotra & Yetman, 2014; Mehrotra & Nadhanael, 2016). In contrast to previous conclusions, Evans (2016) finds that in 16 African countries, the level of financial inclusion contributes to the effectiveness of monetary policy only in the short run, while the long-run effectiveness is achieved through interest rates management. Analyzing the correlation between financial inclusion and monetary policy on the sample of the South Asian Association for Regional Cooperation (SAARC) countries in the period from 2004 to 2013, Lenka and Bairwa (2016) find a significant correlation between financial inclusion and inflation, namely it is found that an increase in financial inclusion (accessibility) is associated with a decrease in inflation and price stability.

Several empirical studies (Arshad et al. 2021; Saraswati, Maski, Kaluge & Sakti, 2020; El Bourainy, Salah & El Sherif, 2021) find that increased financial inclusion contributes to reduction of inflation, which improves the effectiveness of monetary policy. Using the Structural Vector Autoregressive (SVAR)

technique, Arshad et al. (2021) confirm the existence of the inverse correlation in which a monetary policy contributes to the increase in financial inclusion. Using the generalized Method of Moments (GMM) on the sample of 37 developing countries over the period 2009–2018, El Bourainy et al. (2021) conclude that in developing countries a financial inclusion increase contributes to lower inflation rates. Similar conclusion is drawn by Jungo, Madaleno and Botelho, (2022), who test the effectiveness and efficiency of monetary policy in controlling inflation in respect to an increase in financial inclusion. A comparative analysis shows that financial inclusion increases the effectiveness of monetary policy in Sub-Saharan Africa countries, while in Latin America and the Caribbean countries financial inclusion improves the efficiency of monetary policy.

2. Methodology of empirical research

2.1. Data sources and variables

The research data for the study were obtained from several different databases, namely the World Bank Global Findex Survey database (WB-FAS), the International Monetary Fund Financial Access Survey database (IMF-FAS) and the World Bank - World Development Indicators database (WB-WDI). The research was focused on the countries of SEE, including Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey and covers the ten-year period from 2011 to 2021.

The description of the variables is presented in Table 1. Inflation was measured by the annual change in consumer prices, while financial inclusion was measured by eight individual variables, through financial inclusion dimensions and the financial inclusion index (FII). The initial set of individual variables was also used for FII construction based on the literature review (Sarma 2008; Sarma 2012; Amidzic, Massara & Mialou, 2014; Sarma 2016; Cámara & Tuesta (2018); Goel & Sharma (2017); Park & Mercado (2018); Nguyen, (2021); Borhan, Muda & Mohamad, 2021; Gupte, Venkataramani and Gupta (2012), and data availability for SEE countries.

Table 1 Data and variables description

Variable label	Variable	Description	Data source
z_inf	Inflation	Inflation rate, consumer prices (annual %)	WB-WDI
FII	Financial inclusion index - FII		
racun	Account at financial institution	Percentage of respondents having a bank account at financial institutions (% +15 age)	WB-GFS
n_racun	Deposit accounts	Number of deposit accounts at commercial banks per 1,000 adults	IMF-FAS
posudba	Borrowing from financial institution	Percentage of respondents who borrowed money from financial institutions (% +15 age)	WB-GFS
kor_deb	Use of debit or credit card	Percentage of respondents who used debit or credit cards (% +15 age)	WB-GFS
stednja	Savings at financial institution	Percentage of respondents who saved money at financial institution (% +15 age)	WB-GFS
ne_depo	Outstanding loans	Outstanding loans from commercial banks % GDP	IMF-FAS
filijala	Number of branches	Number of commercial bank branches per 100,000 adults	IMF-FAS
bankomat	Number of ATMs	Number of ATMs per 100,000 adults	IMF-FAS

Source: the authors

2.2. Methods used

2.2.1. Construction of financial inclusion index

For constructing a multidimensional FII for SEE countries, the exploratory two-stage PCA was used as suggested by Amidzic et al. (2014), Cámara and Tuesta (2018), Park and Mercado, (2018), Nguyen (2021), and Borhan et al. (2021). As proposed by Sarma (2008) and used by Amidzic et al. (2014), Nguyen (2021) and others, the variables used for the index construction were normalized using the min-max normalization method. Normalization was used to scale data to fall in the range between 0 and 1.

The first-stage PCA was used for identifying and grouping the variables in relevant dimensions. Then, the weights of the indicators representing dimensions were extracted and estimated. The estimation of factors loading was obtained using the rotation of the axes using the varimax technique. Based on the results of the first-stage PCA, two dimensions (factors) were extracted.

In the second-stage PCA, the weights for each dimension were calculated using unrotated matrix and by using the aforementioned dimensions as explanatory variables, the FII was created.

To further verify adequate correlations among the selected indicators of financial inclusion, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used before conducting Factor Analysis.

2.2.2. Model specification

For the purpose of evaluating the relationship between financial inclusion and inflation, three panel models were used. We tested three regression

models using pooled OLS, fixed and random effects estimators to assess which regression model fits the data. The estimators were tested using the Hausman test and the Breusch–Pagan test of model adequacy.

(1) Regression model at the level of individual variables of financial inclusion: For the purposes of determining the connection between inflation rate and financial inclusion, the following panel regression model was formulated at the level of individual variables of financial inclusion:

$$Z_inf = \alpha_{it} + \beta_1 racun_{it} + \beta_2 n_racun_{it} + \beta_3 posudba_{it} + \beta_4 kor_deb_{it} + \beta_5 stednja_{it} + \beta_6 ne_depo_{it} + \beta_7 filijala_{it} + \beta_8 bankomat_{it} + u_{it} \sum_{k=0}^n \binom{n}{k} x^k a^{n-k} \quad (1)$$

where:

z_inf	Inflation	Inflation rate, consumer prices (annual %)
racun	Having an account	Percentage of respondents who have an account at a financial institution (% aged 15+)
n_racun	Holding deposit accounts	Number of deposit accounts with commercial banks per 1,000 adults
posudba	Lending	Percentage of respondents who borrowed money from a financial institution (% age 15+)
kor_deb	Using a debit or credit card	Percentage of respondents using a debit or credit card (% age 15+)
stednja	Savings	Percentage of respondents who save at a financial institution (% age 15+)
ne_depo	Outstanding deposits	Percentage of respondents who have unpaid deposits at a financial institution (% of GDP)
filijala	Branches of commercial banks	Number of commercial bank branches per 100,000 adults

bankomat	ATMs	Number of ATMs per 100,000 adults
i	Country	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey
t	Time/ years	2011, 2014, 2017, and 2021

(2) Regression model at the level of factors obtained through the construction of the FII: For the purposes of determining the connection between economic growth and financial inclusion, the following panel regression model was formulated at the level of factors obtained through the construction of the FII:

$$y = \alpha_{it} + \beta_{1s_FII_f1} fl_{it} + \beta_{2s_FII_f2} f2_{it} + u_{it} \quad (2)$$

where:

s_FII_f1	Availability and Use	Factor 1 Financial inclusion
s_FII_f2	Access	Factor 2 Financial inclusion
i	Country	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey

t	Time/ years	2011, 2014, 2017, and 2021
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(3) Regression model at the level of the FII: For the purposes of determining the connection between economic growth and financial inclusion, the following panel regression model was formulated at the level of the FII:

$$y = \alpha_{it} + \beta_{1s_FII} s_FII_{it} + u_{it} \quad (3)$$

where:

s_FII	Index of financial inclusion	Index of financial inclusion
i	Country	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Montenegro, North Macedonia, Romania, Slovenia, Serbia, and Turkey
t	Time/ years	2011, 2014, 2017, and 2021

3. Results and discussion

3.1. Descriptive statistics

Table 2 shows the overall descriptive statistics on inflation rate and individual indicators of financial inclusion for all the observed SEE countries.

Table 2 Descriptive statistics of indicators of financial inclusion and for observed SEE countries aggregated

Variables	Obs	Mean	Std. Dev.	Min	Max
Inflation	48	3.050666	3.666394	-1.418184	19.59649
Account at financial institution	47	64.11277	22.5944	10.57	99.05
Deposit accounts	33	1845.737	965.4469	596.33	3926.25
Borrowing from financial institution	47	20.5666	10.39704	4.55	42.84
Use of debit or credit card	35	39.454	20.42749	5.81	89.83
Savings at financial institution	47	14.86617	9.257208	3.17	39.85
Outstanding loans	48	56.57188	14.68935	31.02	97.6
Number of branches	44	28.87545	11.17838	11.63	60.4
Number of ATMs	44	66.50477	28.67434	25.68	140.7

Source: WB-WDI, IMF-FAS and WB-GFS databases, the authors' calculation

Data show that the average inflation rate for all SEE countries in the analyzed period was 3% with standard deviation of 3.6%. On average, 64% of adults in the SEE countries observed had an open account at financial institutions, over 39% of them used debit cards. Just above 20% of the adults borrowed and 14% saved money. The average number of deposit accounts for the SEE countries analyzed per 1,000 adults was 1,845 accounts, meaning that on average one person had more than one account opened at financial institutions. There were approximately 29 bank branches and 66 ATMs per 100,000 inhabitants in these SEE countries.

Given that the descriptive statistics on inflation rate presented in the previous table represent

consolidated data for observed years for SEE countries, Table 3 shows more in-depth data on the level of interest rate within the SEE region, disaggregated by year, while Table 4 presents descriptive statistics on inflation rates, disaggregated by the SEE countries observed.

Table 3 Descriptive statistics of inflation in observed SEE countries, disaggregated per year

Indicators per year	Obs	Mean	Std. Dev	Min	Max
2011	12	4.73463	2.593056	1.802852	11.1374
2014	12	.7853703	2.771865	-1.418184	8.854573
2017	12	2.453879	2.811806	.8101333	11.14431
2021	12	4.228785	4.952595	1.223825	19.59649

Source: WB-GFS databases, the authors' calculation

As the table shows, there was a decrease in the average inflation rate for these SEE countries, which was 4.73% in 2011, to 0.79% in 2014, and 2.45% in 2017. As the inflation rates increased

worldwide due to the COVID-19 and Russia - Ukraine war, in 2021 the inflation rate was increased in the SEE region and it was at the level of 4.23%.

Table 4 Descriptive statistics of inflation disaggregated by SEE country

Indicator per country	Obs	Mean	Std. Dev.	Min	Max
Albania	4	2.289265	.7859318	1.625865	3.429123
Bosnia and Herzegovina	4	1.391457	1.925412	-.8971941	3.67125
Bulgaria	4	2.040265	2.469372	-1.418184	4.219903
Croatia	4	1.435353	1.261169	-.2151962	2.554507
Greece	4	1.090668	1.897954	-1.312261	3.329853
Montenegro	4	1.882667	1.798895	-.7105141	3.450143
North Macedonia	4	2.051354	1.893749	-.281705	3.904754
Romania	4	3.312228	2.455763	1.06831	5.789253
Serbia	4	5.109003	4.101309	2.082448	11.1374
Slovenia	4	1.337092	.7866042	.1993438	1.917065
Turkey	4	11.51681	5.714276	6.47188	19.59649

Source: WB-WDI, IMF-FAS and WB-GFS databases, the authors' calculation

The access dimension was represented by three indicators: percentage of individuals with an opened account at financial institutions, number of deposit accounts per 1,000 inhabitants, and outstanding loans, while the other dimension was represented by the set of two indicators related to availability (the number of branches and the number of ATMs per 100,000 inhabitants) and usage (usage of debit account, borrowing, and saving).

Table 5 First-stage factor analysis – factor correlation (varimax rotation)

Variable	Factor 1 loadings (availability and usage)	Factor 2 loadings (access)	Uniqueness
Account at financial institution	0.5228	0.4349	0.5376
Deposit accounts		0.5375	0.6998
Borrowing from financial institution	0.7807		0.3485
Use of debit or credit card	0.7516	0.4130	0.2645
Savings at financial institution	0.7991	0.3448	0.2426
Outstanding loans		0.8340	0.2792
Number of branches	0.3741		0.8210
Number of ATMs	0.9621		0.0734

Source: the authors' calculation

The “Access” dimension was represented by three indicators: percentage of individuals with an opened account at financial institutions, number of deposit accounts per 1,000 inhabitants, and outstanding loans, while the “Usage and availability” dimension was represented by the set of two indicators related to availability (the number of branches and the number of ATMs per 100,000 inhabitants) and usage (usage of debit account, borrowing, and saving).

3.2. Financial inclusion index for SEE

The results of the first-stage PCA used for FII construction are presented in Table 5. Dimensions extracted for the researched SEE countries, “access” and “usage and availability”, are consistent with the dimensions extracted by Borhan et al., (2021).

The second-stage PCA results and obtained loading factors are showed in Table 6.

Table 6 Second-stage factor analysis – factor correlation

Variable label	Factor label	Factor loadings	Uniqueness
s_FII_f1	Usage and availability	0.5249	0.7245
s_FII_f2	Access	0.5249	0.7245

Source: the authors' calculation

The KMO statistics for the first-stage PCA was 0.573, which was more than the minimum required threshold (0.50). This confirms that the indicators were correlated and suitable for structure detection using factor analysis.

Table 7 presents the computed FII values for SEE developing economies for the years 2011-2021. As it can be observed from Table 7, Slovenia had the highest level of financial inclusion with the average value of 0.903 and Romania's level was the lowest, with the value of 0.235.

Table 7 Descriptive statistics of FII disaggregated by SEE countries, 2011-2021

SEE country	2011	2014	2017	2021	Avg.	Std. dev.	Rank
Slovenia	0.800	0.883	0.928	1.000	0.903	0.084	1
Greece	0.855	0.734	0.682	0.991	0.815	0.138	2
Croatia	0.620	0.841	0.889	0.859	0.802	0.123	3
Bulgaria	0.592	0.704	0.761	0.785	0.711	0.086	4
Turkey	0.214	0.471	0.689	0.607	0.495	0.208	5
Montenegro	0.374	0.445	0.515	0.598	0.483	0.096	6
Serbia	0.255	0.361	0.356	0.566	0.385	0.131	7
North Macedonia	0.179	0.366	0.366	0.409	0.330	0.103	8
Bosnia and Herzegovina	0.192	0.233	0.264	0.457	0.287	0.117	9
Albania	0.288	0.319	0.221	0.258	0.272	0.042	10
Romania	0.019	0.251	0.239	0.431	0.235	0.169	11

Source: the authors' calculation

As it can be observed from the previous table, there is an evident increase in the level of financial inclusion among all the SEE countries observed. While Slovenia, Greece and Croatia had the highest level of financial inclusion with the FII of 0.903, 0.815, and 0.802 respectively, Bosnia and

Herzegovina, Albania and Romania had the lowest level of financial inclusion.

3.3. Results of panel regressions

Table 8 shows the results of panel regression model 1.

Table 8 Results of panel regression - association of financial inclusion variables with inflation

Variables	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)	Hausman's test Sigmamore Differences (b) – (c)
racun	.0063009 (0.850)	.1081472 (0.106)	.0063009 (0.848)	.1018463
n_racun	.0013549 (0.067)+	.0020174 (0.399)	.0013549 (0.047)**	.0006625
posudba	.0787971 (0.535)	-.470063 (0.012)**	.0787971 (0.525)	-.5488602
kor_deb	-.0655963 (0.293)	.0009003 (0.975)	-.0655963 (0.275)	.0664966
stednja	.1200331 (0.388)	.1736287 (0.054)*	.1200331 (0.373)	.0535956
ne_depo	-.1061255 (0.156)	.0730674 (0.159)	-.1061255 (0.134)	.1791929
filijala	-.1362461 (0.061)*	-.0639219 (0.567)	-.1362461 (0.041)**	.0723242
bankomat	.0296787 (0.563)	-.0903165 (0.222)	.0296787 (0.554)	-.1199953
F statistic/ Wald chi2(s)	F(8, 14) = 2.21 (0.0928)	F(8,6) = 6.58 (0.0169)	Wald chi2(8) = 17.69 (0.0237)	
R-squared	0.5582	0.0548	0.5582	
Adj. R-squared	0.3057			
sigma-e		.78553205	.78553205	
Prob>chi2				0.0994

Note: confidence level: *** p<0.001 ** p<0.05, * p<0.01

Source: the authors' calculation

The Hausman test showed that the random effects model was more appropriate for testing the model's contribution to explaining the variance of the dependent variable. The F statistic showed that the random effects model was statistically significant ($p < 0.05$) and that 0.5582% of the variance of the change in the dependent variable was explained in the model.

The model showed that there was a positive correlation between holding deposit accounts and the inflation rate, meaning that the higher level of

financial inclusion measured by the percentage of adults holding accounts was related to the increase in inflation rates. In contrast, the research showed a negative correlation between the number of branches and inflation, meaning that the higher number of bank branches was related to a decrease in inflation rates.

Table 9 shows the results of regression model 2 - the relation between financial inclusion factors and inflation.

Table 9 Results of panel regression - association of financial inclusion factors with inflation

Variables	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)	Hausman's test Sigammore Differences (b) – (c)
s_FII_f1	-1.461839 (0.513)	2.240042 (0.645)	-1.1755683 (0.953)	2.415611
s_FII_f2	-7.166514 (0.798)	-9832857 (0.878)	-6444125 (0.867)	-3388731
F statistic/ Wald chi2(s)	F(2, 45) = 0.38 (0.6891)	F(2,34) = 0.11 (0.8920)	Wald chi2(2) = 0.05 (0.9753)	
R-squared	0.0164	0.0103	0.0113	
Adj. R-squared	-0.0273			
sigma-e		2.7740969	2.7740969	
Prob>chi2				0.7413

Note: confidence level: *** $p < 0.001$ ** $p < 0.05$, * $p < 0.01$
Source: the authors' calculation

The Hausman test showed that the random effects model was more appropriate ($\text{Prob} > \chi^2 = 0.7413 < 0.05$) for testing the contribution of the model to explaining the variance of the dependent variable. However, the random effects model did not explain a statistically significant part of the variance of the dependent variable, so it can be concluded that the factors of financial inclusion did not explain changes in inflation. Furthermore, it

must be noted that the practical significance of the obtained results proves that a higher level of financial inclusion factors (Usage and availability and Access) contributed to a lower level of interest rates.

Table 10 shows the results of the regression model 3 - the association of the financial inclusion index with inflation.

Table 10 Results of panel regression - association of financial inclusion index with inflation

Variables	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)	Hausman's test Sigammore Differences (b) – (c)
s_FII	-1.649774 (0.419)	.2679605 (0.930)	-7254393 (0.757)	.9933998
F statistic/ Wald chi2(s)	F(1, 46) = 0.66 (0.4193)	F(1,35) = 0.01 (0.9298)	Wald chi2(1) = 0.10 (0.7568)	
R-squared	0.0142	0.0142	0.0142	
Adj. R-squared	-0.0072			
sigma-e		2.7430785	2.7430785	
Prob>chi2				0.5947

Note: confidence level: *** $p < 0.001$ ** $p < 0.05$, * $p < 0.01$
Source: the authors' calculation

The Hausman test showed that the random effects model was more appropriate ($\text{Prob} > \chi^2 = 0.5947 < 0.05$) for testing the contribution of the model to explaining the variance of the dependent variable. However, the random effects model did not explain a statistically significant part of the variance of the dependent variable, so it can be

concluded that the FII did not explain changes in inflation. The practical significance of the obtained results shows negative association between the FII and inflation, meaning that a higher level of financial inclusion contributed to a lower level of inflation.

Conclusions

This paper contributes to the body of knowledge on the nexus between financial inclusion and inflation rate in SEE countries. Using panel regression models, the research aimed to establish the connection between the level of financial inclusion and inflation rate measured by the consumer prices index.

Using PCA, the FII was constructed for all the observed SEE countries. Based on the previous research and taking into account the availability of data, eight indicators were identified to be included in FII construction. The FII was created according to the methodology used by Sarma (2008, 2010, 2012), Amidzic et al. (2014), and Borhan et al. (2021).

Descriptive statistical analysis showed that in the observed period from 2011 to 2021, there was an increase in the inflation rates in all the observed SEE countries. The measures of financial inclusion included: (1) measures at the level of individual variables of financial inclusion, (2) measures at the level of factors obtained through the FII, and (3) measure at the level of the FII. For the evaluation of the nexus between financial inclusion and inflation, three panel regression models were constructed for each level of financial inclusion measurement.

Overall, all three models proved that increased financial inclusion, measured by individual indicators, factors or index, was contributing to lower inflation rates. The first regression model showed that there was a positive correlation between having deposit accounts and the inflation rate, and a negative correlation between the number of branches and inflation. The analysis of the correlation between financial inclusion factors and inflation led to the conclusion that higher availability and usage of financial services/products as well as access are associated with lower level of inflation. These findings are consistent with El Bourainy et al. (2021) research.

While the main limitation of the research is related to data availability for multidimensional index construction, it can be concluded that financial inclusion in SEE countries is positively related to a lower level of inflation. Further research should be direct to provide better understanding of whether this relationship is under the influence of other monetary policy instruments, such as interest rates. Based on the obtained results, it can be recommended that governments in SEE countries should consider incorporating financial

inclusion as a tool for interest rate reduction in their policy agendas.

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