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TESTING THE VALIDITY OF THE PURCHASING POWER PARITY THEORY FOR THE WESTERN BALKAN COUNTRIES

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Paper presented at the 14th International Scientific Conference EKONBIZ 2026 - The Economy under Conditions of Uncertainty and Innovation, June 12th 2026, Bijeljina.

Abstract: The aim of this research is to empirically examine the long-term validity of the Purchasing Power Parity (PPP) theory in the Western Balkan countries—Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and Albania—in relation to the U.S. dollar. The study applies modern methodological techniques for testing the stationarity of time series, including univariate ADF, PP, and KPSS tests, as well as panel SURADF tests, both in their classical form and with the inclusion of a Fourier component. The univariate tests indicate that real exchange rates are non-stationary in levels but become stationary after first differencing, implying that standard tests do not confirm the validity of the PPP theory. The classical SURADF test also does not provide strong evidence of stationarity, except in the case of North Macedonia. However, the extended SURADF test with a Fourier function consistently rejects the null hypothesis of a unit root for all analyzed countries, indicating the existence of a long-term equilibrium in real exchange rates. To the best of our knowledge, this study represents the first systematic application of the Fourier-augmented panel SURADF unit root test to the empirical testing of the Purchasing Power Parity hypothesis for Western Balkan economies. By explicitly allowing for smooth nonlinear structural changes, the applied methodology significantly enhances the detection of mean-reverting behavior in real exchange rates that conventional linear and panel unit root tests fail to identify. The findings therefore provide robust empirical support for the long-run validity of the PPP hypothesis in the

region and offer relevant implications for exchange rate policy formulation and assessments of international competitiveness.

Key words: purchasing power parity, real exchange rate, stationarity, SURADF test, Fourier function, Fourier-augmented panel unit root test, Western Balkans.

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1. INTRODUCTION

The Purchasing Power Parity (PPP) theory represents one of the central theoretical foundations of international macroeconomics and exchange rate determination. Its validity has direct implications for the assessment of external competitiveness, exchange rate misalignment, and the formulation of monetary and exchange rate policies. In particular, the long-run validity of PPP is crucial for small open economies, where exchange rate dynamics play a key role in shaping inflationary pressures and external balance.

Despite an extensive empirical literature on PPP, existing studies predominantly focus on advanced and emerging economies, while empirical evidence for the Western Balkan countries remains relatively limited and methodologically fragmented. Moreover, many earlier studies rely on conventional linear unit root and panel tests, which are known to suffer from low statistical power and sensitivity to structural breaks—features that are especially pronounced in

transition economies exposed to frequent economic and institutional shocks.

However, although numerous studies find evidence of a unit root in the real exchange rate, some authors warn that such findings are often the result of the low statistical power of conventional tests. Recent research indicates that these tests not only ignore cross-sectional (inter-regional) information—which reduces estimation efficiency—but also have limited ability to distinguish between nearly non-stationary but actually stationary processes. According to Krugman, P., Obstfeld, M., & Melitz, M. (2017), there are several reasons why PPP may not hold in practice: (1) the presence of barriers to international trade (e.g., tariffs, transportation costs), which hinder arbitrage and violate the law of one price; (2) deviations from perfect competition, where monopolies and oligopolies influence price formation; and (3) difficulties in defining a representative consumer basket, since its composition varies among countries, making it difficult to align inflation differentials through exchange rate adjustments.

To increase the statistical power of stationarity testing, many authors have turned to the use of panel data. Levin, A., C. F. Lin, and C. S. Chu (2002), as well as Im, K. S., M. H. Pesaran, and Y. Shin (2003), developed extended ADF tests adapted for panel analyses, which demonstrated significant improvements in power even in small samples. However, these tests share a common shortcoming—dependence among time series within the panel (so-called cross-sectional dependence). To overcome this issue, Zellner, A. (1962) proposed the Seemingly Unrelated Regressions (SUR) method, and O'Connell, P. G. J. (1998) showed that SUR estimates can eliminate bias in testing without a significant loss of power.

Despite methodological advancements, Taylor, M. P. and Sarno, L. (1998) and Breuer, J. B., McNown, M. S., and Wallace, M. (2001) emphasize that the problem of “all-or-nothing” tests still remains—tests that do not allow the identification of which specific series within the panel are stationary, as the null hypothesis of a unit root is tested jointly for all panel members. In this context, Breuer and co-authors (2001) draw a parallel with the F-test in regression analysis: the rejection of the joint null hypothesis does not necessarily mean that all individual coefficients are statistically significant. Analogously, rejecting the null hypothesis of a unit root does not imply that all observed series are stationary.

Unlike such conventional approaches, panel SURADF tests allow for testing individual null hypotheses for each series separately, thereby

precisely identifying which and how many series within the panel exhibit stationary behavior. For this reason, the SURADF methodology—with and without the Fourier function—was applied in this paper to test the long-term validity of PPP among the Western Balkan countries.

Chang, T., P. I. Chou, C. H. Lee, and S. C. Wang (2010) applied the SURADF test to monthly real exchange rate data (1980–2008), constructed from CPI indices and nominal exchange rates against the USD, and demonstrated that PPP holds for most G-7 countries (except Canada and Italy). Similarly, Chang, T., Lee, C. H., Chou, P. I., and Wang, S. C. (2012) used the panel SURADF test with a Fourier function for nine transition economies (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Russia) for the period January 1995–December 2008. Their analysis confirmed the validity of PPP in eight of these countries, with Russia as the exception.

The analysis conducted in this paper relies on the methodological approaches of the aforementioned authors. For the initial examination of the stationarity of real exchange rates by country, univariate tests—ADF, PP, and KPSS—were employed. However, considering their limited power and sensitivity to structural breaks, panel SURADF tests (both with and without the Fourier function) were additionally applied, allowing for a deeper understanding of the time-series dynamics.

Finally, it is important to emphasize that this research represents one of the first systematic empirical investigations of the Purchasing Power Parity theory in the context of Western Balkan countries, thereby contributing to the expansion of the existing literature on this topic.

In this context, the present study aims to empirically examine the long-run validity of the Purchasing Power Parity hypothesis for the Western Balkan countries—Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and Albania—using a set of advanced time-series and panel econometric techniques. In addition to standard univariate unit root tests (ADF, PP, and KPSS), the analysis applies the panel SURADF test in both its classical and Fourier-augmented forms. By allowing for smooth nonlinear structural changes, the Fourier-SURADF approach enables a more accurate identification of mean-reverting behavior in real exchange rates. The contribution of this paper lies in providing new empirical evidence for the region based on a methodology that explicitly accounts for the complex and nonlinear dynamics characterizing transition economies.

2. THE REAL EXCHANGE RATE MODEL AND THE THEORY OF PURCHASING POWER PARITY (PPP) – THEORETICAL IMPLICATIONS

The real exchange rate represents the relative price of domestic goods in terms of foreign goods, expressed in the same currency. The general formula is:

$$r_t = e_t \times (p_t^*/p_t)$$

where e_t is the nominal exchange rate of the domestic currency against the foreign currency, r_t is the real exchange rate, and p_t^* and p_t represent the domestic and foreign price levels, respectively.

The main prediction of the Purchasing Power Parity (PPP) theory is that the real exchange rate remains constant and is therefore used to quantify deviations from PPP as well as to analyze macroeconomic conditions of supply and demand in open economies. It also reflects the competitiveness of domestic goods relative to foreign ones when taking into account the exchange rate and price levels in both countries.

In the conducted research, the logarithmic values of the real exchange rate were used. Starting from the general specification of the real exchange rate:

$$r_t = e_t \times (p_t^*/p_t)$$

taking natural logarithms of both sides yields:

$$\ln(r_t) = \ln(e_t) + \ln(p_t^*) - \ln(p_t)$$

which can be written in a simplified log-linear form as:

$$r_t = e_t + p_t^* - p_t$$

where lowercase variables denote the natural logarithms of the corresponding uppercase variables.

From a statistical perspective, testing the validity of the Purchasing Power Parity (PPP) theory reduces to examining the existence of a unit root in the time series of the real exchange rate r_t . If the presence of a unit root is confirmed, this implies that PPP does not hold in the long run, meaning that there is no stable long-term relationship between the nominal exchange rate and relative price levels. Conversely, the stationarity of the real exchange rate indicates that the nominal exchange rate adjusts to inflation differentials over the long term, thereby confirming the theoretical foundation of PPP.

The non-stationarity of the real exchange rate carries important macroeconomic implications. Dornbusch, R. (1987) emphasized, among other

things, that the depreciation of the real exchange rate can increase international competitiveness, potentially leading to a reallocation of employment in favor of the country whose currency is weakening. Therefore, determining the empirical sustainability of PPP is of crucial importance for economic policies that rely on exchange rate stability.

Additionally, one of the key effects of the non-stationarity of the real exchange rate is the possibility of persistent arbitrage profits in goods trade. Parikh, A. and Williams, G. (1998) warn that such exchange rate dynamics may lead to serious macroeconomic imbalances, which often require corrective devaluation to restore external equilibrium.

3. DATA

The conducted empirical analysis covers the following five countries of the region: Albania, Bosnia and Herzegovina, Serbia, North Macedonia, and Montenegro. Monthly data were used, and the analyzed period spans from July 2006 to December 2023 (a total of 210 months). All data, including the Consumer Price Index (CPI) with a 2010 base year and nominal exchange rates of the countries' currencies against the U.S. dollar, were obtained from the International Monetary Fund – International Financial Statistics (IFS).

Before conducting the econometric analysis, all CPI and nominal exchange rate data were transformed into natural logarithms. A summary of the data statistics is presented in Table 1 below. The obtained standard deviations indicate relatively low dispersion across all series, with the highest variability observed in Bosnia and Herzegovina (0.1493) and the lowest in Albania (0.0905). The Jarque–Bera normality test indicates that the nominal exchange rates for all countries are normally distributed.

As a robustness consideration, alternative specifications using the euro as the reference currency may be explored in future research to assess the sensitivity of the results to the choice of numeraire.

All macroeconomic data required for the empirical analysis were obtained from official international statistical sources. Consumer Price Index (CPI) series are expressed with a common base year (2010 = 100), ensuring cross-country comparability, while nominal exchange rates are defined as units of domestic currency per U.S. dollar. The choice of the U.S. dollar as the numeraire follows the standard practice in the empirical PPP literature and facilitates international comparability of the results.

Table 1. – Data Description and Sources

Variable	Description and Source
CPI	Consumer Price Index (2010 = 100), IMF – International Financial Statistics
ER	Nominal exchange rate (domestic currency per USD), IMF – International Financial Statistics
RER	Real exchange rate constructed by authors
Period	Monthly data, July 2006 – December 2023

Source: Author's calculations

Table 2. - Summary Statistics

Country	Skewness	Kurtosis	Std. dev.	Min	Max	JB-stat	Prob
B&H	0,2991	0,0	0,1493	0,2291	0,7713	3,1311	0,209
Serbia	0,002	0,4381	0,1113	4,0514	4,5633	1,6795	0,4318
Montenegro	0,0982	0,0	0,1032	-0,4181	-0,0135	0,3375	0,8447
North Macedonia	0,0941	0,0	0,1134	3,6497	4,0881	0,3099	0,8565
Albania	0,1174	0,2568	0,0905	4,3882	4,8434	1,0594	0,5888

Source: Author's calculations

4. METHODOLOGY

Breuer and co-authors (2001) developed the SURADF tests, which represent an extended version of the ADF tests based on panel estimation using the Seemingly Unrelated Regressions (SUR) method.

For each panel member, the augmented Dickey–Fuller (ADF) regression estimated within the SUR framework can be expressed as follows:

$$\Delta X_{1,t} = \alpha_1 + \beta_1 X_{1,t-1} + \sum_{j=1}^{k1} \theta_{1,j} \Delta X_{1,t-j} + \varepsilon_{1,t}$$

$$t = 1, 2, \dots, T$$

$$\Delta X_{2,t} = \alpha_2 + \beta_2 X_{2,t-1} + \sum_{j=1}^{k2} \theta_{2,j} \Delta X_{2,t-j} + \varepsilon_{2,t}$$

$$t = 1, 2, \dots, T$$

$$\Delta X_{N,t} = \alpha_N + \beta_N X_{N,t-1} + \sum_{j=1}^{kN} \theta_{N,j} \Delta X_{N,t-j} + \varepsilon_{N,t}$$

$$t = 1, 2, \dots, T$$

Following the approach proposed by Perron (1989), the lag length p_i is selected individually for each country in order to avoid size distortions arising from imposing a common lag structure across panel

members. The optimal lag length is determined using standard information criteria, including the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). The system of ADF equations estimated here allows for individual testing of the null and alternative hypotheses for each panel member, with test statistics obtained from the SUR estimations of the specified system.

The authors emphasized that applying a uniform lag structure for all panel members could lead to biased results; therefore, the lag structure is determined separately for each equation, in accordance with the approach proposed by Perron (1989).

The key difference between the panel SURADF test and other panel unit root tests—such as the multivariate augmented Dickey–Fuller (MADF) test proposed by Sarno, L. and Taylor, M. P. (2002)—lies in the formulation of the null hypothesis. Specifically, while the aforementioned tests jointly examine the existence of a unit root for all panel members, the SURADF test allows for separate testing of the null hypothesis for each individual member. This enables clear identification of which series within the panel exhibit stationary properties and how many satisfy the conditions of stationarity.

Each of the N null and alternative hypotheses is tested separately:

$$H_0^1: \beta_1 = 0; H_A^1: \beta_1 < 0$$

$$H_0^2: \beta_2 = 0; H_A^2: \beta_2 < 0$$

$$H_0^N: \beta_N = 0; H_A^N: \beta_N < 0$$

In this study, a system of ADF equations that includes a Fourier function was also estimated.

The introduction of the functions $[\sin(2\pi kt/T), \cos(2\pi kt/T)]$ is justified by the fact that the Fourier approximation allows for a very precise representation of any absolutely integrable function, where k denotes frequency, and the coefficients $[a_i, b_j]'$ determine the amplitude and phase shift of the frequency component. The presence of at least one frequency component indicates the existence of a structural break in the series.

Numerous studies, including those by Becker et al. (2004), Enders and Lee (2004), Gallant (1981), and Pascalau (2010), show that the Fourier approximation can reliably describe even functions that are not necessarily periodic.

The authors emphasize that, for conducting the test, it is sufficient to appropriately select the frequency within the model. This reduces the number of estimated parameters, thereby improving the size and power properties of the test, regardless of the timing and shape of possible structural breaks.

Since the form of structural changes in the data is not known in advance, a grid-search method is used to identify the optimal frequency, after which the test statistics are calculated based on the SUR estimates of system (1).

Furthermore, Breuer et al. (2001) showed that imposing the same lag structure for all panel members can result in biased tests. Therefore, the number and order of lags are chosen separately for each equation, following the approach proposed by Perron (1989).

The system of ADF equations with the Fourier function estimated in this study is as follows.

To account for potential smooth structural changes, the ADF regression is augmented with a Fourier function and can be written as:

$$\begin{aligned} \Delta X_{1,t} = & \alpha_1 + \beta_1 X_{1,t-1} \\ & + \sum_{j=1}^{k1} \theta_{1,j} \Delta X_{1,t-j} \\ & + a_1 \sin\left(\frac{2\pi kt}{T}\right) \\ & + b_1 \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{1,t} \end{aligned}$$

$$\begin{aligned} \Delta X_{2,t} = & \alpha_2 + \beta_2 X_{2,t-1} \\ & + \sum_{j=1}^{k2} \theta_{2,j} \Delta X_{2,t-j} \\ & + a_2 \sin\left(\frac{2\pi kt}{T}\right) \\ & + b_2 \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{2,t} \end{aligned}$$

$$\begin{aligned} \Delta X_{N,t} = & \alpha_N + \beta_N X_{N,t-1} \\ & + \sum_{j=1}^{kN} \theta_{N,j} \Delta X_{N,t-j} \\ & + a_N \sin\left(\frac{2\pi kt}{T}\right) \\ & + b_N \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{N,t} \end{aligned}$$

The optimal Fourier frequency k is selected using a grid-search procedure that minimizes the sum of squared residuals, allowing the model to flexibly capture smooth structural changes of unknown form and timing. The selected frequency values for each country are reported in the Appendix.

5. EMPIRICAL RESULTS

In the first phase of the analysis, the stationarity of the real exchange rate was tested for five Western Balkan countries—Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and Albania—using standard univariate tests: the Augmented Dickey–Fuller (ADF), Phillips–Perron (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. The results presented in Table 1 indicate that the null hypothesis of a unit root (non-stationarity) cannot be rejected in levels but is strongly rejected after first differencing for all examined countries. Specifically, all ADF and PP tests show highly negative test statistic values after differencing (at the 1% significance level), confirming that all series are integrated of order I(1). For example, the ADF statistic for Bosnia and Herzegovina in differenced form is -11.271 with zero lags, which is well below the critical value at the 1% significance level. Similar findings apply to the other countries—Serbia (-9.679), Montenegro (-11.334), North Macedonia (-11.250), and Albania (-5.601)—indicating a very strong presence of stationarity after differencing. On the other hand, the KPSS tests—which have the reverse null hypothesis (the null assumes stationarity)—further confirm non-stationarity in levels. Specifically, all level series exhibit statistic values well above the corresponding critical thresholds. For instance, the KPSS statistic for Montenegro is 1.4714 , while for Bosnia and Herzegovina it reaches as high as 1.8886 , clearly indicating the rejection of the null hypothesis of stationarity in levels.

Table 3. – Univariate Unit Root Tests (ADF, PP, KPSS)

Country	ADF Level	ADF Diff	KPSS Level	KPSS Diff	PP Level	PP Diff
B&H	-1.121 (1)	-11.271 (0)***	1.8886*** (1)	0.0899 (1)	78.969 (1)	3.075 (0)
Serbia	-2.549 (1)	-9.679 (0)***	1.1131*** (1)	0.0591 (0)	38.940 (1)	5.259 (0)
Montenegro	-1.871 (1)	-11.334 (0)***	1.4714*** (1)	0.1107 (0)	54.617 (1)	3.413 (0)
North Macedonia	-1.715 (1)	-11.250 (0)***	1.6172*** (1)	0.0768 (0)	57.039 (1)	3.419 (0)
Albania	-2.489 (4)	-5.601 (3)***	0.8297*** (4)	0.1159 (3)	41.361 (4)	3.245 (3)

Source: Author's calculation

The failure of conventional univariate unit root tests to confirm the validity of PPP may be partly attributed to the presence of major global and regional shocks during the sample period. In particular, the global financial crisis of 2008–2009 and the COVID-19 pandemic introduced pronounced and persistent deviations in real exchange rates, driven by abrupt changes in capital flows, trade patterns, and domestic price dynamics. Such events are likely to generate nonlinear adjustment paths that standard linear tests are unable to capture adequately.

Based on these findings, it can be concluded that the real exchange rates for all observed countries are non-stationary in levels but become stationary after first differencing.

These results are consistent with previous empirical research suggesting that univariate tests have low power, particularly for time series with high autocorrelation (Taylor, M. P. and Sarno, L., 1998; Im et al., 2003). Accordingly, these results imply that the Purchasing Power Parity (PPP) hypothesis cannot be confirmed when traditional univariate testing methodologies are used.

In the next phase of the empirical analysis, the SURADF test without the inclusion of the Fourier component was applied to further examine the stationarity of real exchange rates in the analyzed countries.

Unlike classical univariate tests, the SURADF methodology allows for the simultaneous estimation of interdependent time series while retaining the individual characteristics of each country (Breuer et al., 2001). The results are presented in Table 4.

It is observed that the t-statistics for most countries (Bosnia and Herzegovina, Serbia, Montenegro, and Albania) exceed the critical value at the 10% significance level, implying that the null

hypothesis of a unit root cannot be rejected. This means that the real exchange rate in these countries remains non-stationary even when cross-sectional dependencies among panel members are taken into account, indicating that PPP does not hold in the long run.

The only exception is North Macedonia, for which the t-statistic is -2.315 , significant at the 5% level (marked with **). Since this value is lower than the corresponding critical value (-1.497), it can be concluded that the null hypothesis is rejected and the alternative hypothesis of stationarity of the real exchange rate is accepted for North Macedonia, thereby partially confirming the validity of the PPP theory.

The estimated β parameter values are negative for all countries, indicating the presence of a medium-term mean-reverting force toward equilibrium. However, their low absolute magnitudes result in high estimated half-lives of adjustment—from 27 months for North Macedonia to as high as 133 months for Albania—implying a very slow convergence process of exchange rates toward long-term equilibrium.

These findings are consistent with those of Breuer et al. (2001) and O'Connell, P. G. J. (1998), who pointed out that standard SURADF tests without correction for structural changes may have limited power in detecting stationarity.

By contrast, the Fourier-augmented SURADF test explicitly allows for smooth structural changes in the data-generating process, making it particularly suitable for economies characterized by gradual institutional reforms and repeated external shocks.

The rejection of the unit root null hypothesis for all countries under the Fourier-SURADF framework suggests that real exchange rates exhibit nonlinear mean-reverting behavior once such structural features are properly accounted for

Table 4. – SURADF Unit Root Test (without Fourier Components)

Country	B	t-statistics	Half-Life (months)	Critical value 1%	Critical value 5% and 10%
B&H	-0.010	-1.586	69.315	-2.687	-1.689 -1.465
Serbia	-0.017	-1.985	39.576	-2.610	-1.555 -1.377
Montenegro	-0.008	-1.234	86.356	-2.571	-1.545 -1.338
North Macedonia	-0.023	-2.315**	27.198	-2.498	-1.497 -1.297
Albania	-0.005	-1.141	132.876	-2.486	-1.488 -1.298

Source: Author's calculation

The estimated half-life values indicate a relatively slow speed of adjustment toward long-run equilibrium, ranging from just over two years in the case of North Macedonia to more than ten years for Albania. These prolonged adjustment periods are consistent with the structural characteristics of Western Balkan economies, including limited market integration, exchange rate management practices, and persistent nominal rigidities. Similar magnitudes of half-life estimates have been reported for other transition and emerging economies in Central and Eastern Europe.

Due to the aforementioned limitations and the low statistical power of conventional tests in the presence of nonlinear shocks or structural breaks, the extended SURADF test with a Fourier component is applied in the subsequent part of the study. This approach allows for more flexible modeling of potential structural changes in the time series (Becker et al., 2004; Enders, W. and Lee, J., 2004).

Unlike the previous tests without the Fourier component, all observed countries—Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and Albania—now exhibit statistically significant negative t-values, all of which are lower than the critical value at the 1% significance level. For example, Serbia's t-statistic is -4.354, compared to

the critical value of -2.336, while Bosnia and Herzegovina's t-statistic is -2.874, with a corresponding critical value of -2.694. Similar results are obtained for the other countries as well.

These findings clearly indicate the rejection of the null hypothesis of a unit root and confirm the stationarity of real exchange rates in all analyzed countries once potential smooth structural breaks are taken into account. In other words, the Purchasing Power Parity (PPP) theory finds empirical support in the long run for all Western Balkan countries included in this analysis.

The estimated β coefficients are all negative and statistically significant, indicating the presence of a medium-term mean-reverting force toward equilibrium. Moreover, the estimated half-lives of adjustment are considerably shorter than in the tests without the Fourier component—ranging between 6.31 months (Serbia) and 10.9 months (Bosnia and Herzegovina)—implying a faster convergence of exchange rates toward long-term equilibrium. This result aligns with claims in the literature that incorporating Fourier approximation enhances test sensitivity and improves the detection of stationarity in the presence of nonlinearities and unaccounted regime shifts (Gallant, R., 1981; Pascual, R., 2010).

Table 5. – SURADF Fourier Unit Root Test

Country	B	t-Statistics	Half-Life (months)	Critical value 1%	Critical value 5% and 10%
B&H	-0.0616	-2.874***	10.9	-2.694	-2.024 -1.700
Serbia	-0.1040	-4.354***	6.31	-2.336	-1.660 -1.326
Montenegro	-0.0974	-3.665***	6.76	-2.223	-1.835 -1.492
North Macedonia	-0.1009	-3.890***	6.52	-2.003	-1.450 -1.165
Albania	-0.0929	-3.732***	7.11	-2.373	-1.766 -1.249

Source: Author's calculation

Compared to the test without the Fourier component, it is clear that this approach provides more robust and informative conclusions, further supported by the findings of Chang et al. (2012), who noted that the Fourier approach significantly improves the test's size and power properties, especially for time series characterized by latent structural breaks.

6. EMPIRICAL SIZE AND POWER OF THE SURADF TEST – FOURIER VS. CLASSICAL APPROACH

To assess the statistical properties of the panel SURADF tests, a simulation analysis was conducted to examine the empirical size and power of the test with and without the Fourier component. The results are presented in Table 6.

Empirical size measures the probability that the test incorrectly rejects a true null hypothesis (Type I error), while empirical power indicates the test's ability to correctly reject a false null hypothesis (Type II error). Ideally, a test should exhibit a low size and high power.

In terms of test size, the SURADF test with the Fourier component shows a slightly higher, yet still acceptable, rate of false rejection of the null hypothesis. For instance, North Macedonia records a size of 0.15, which is slightly above the conventional tolerance level, while for most countries (Bosnia and Herzegovina: 0.06; Serbia: 0.05) the size remains within acceptable limits (up to 0.10). In contrast, the classical SURADF test without the Fourier component displays an almost ideal size (close to zero), but this may make the test overly conservative, thereby reducing its sensitivity.

Regarding power, the results show a clear advantage of the Fourier approach: the test with the Fourier component achieves a power of 1.00 (or 100%) for nearly all countries, including Serbia, Montenegro, North Macedonia, and Albania, while for Bosnia and Herzegovina the power is slightly lower but still very high (0.99). By comparison, the test without the Fourier component demonstrates somewhat weaker performance (e.g., 0.91 for Bosnia and Herzegovina; 0.99 for Montenegro), though still at a satisfactory level.

These findings confirm the claims in the literature (Lau, C. K., 2009; Enders, W. and Lee, J., 2004) that the inclusion of the Fourier transformation significantly improves the statistical properties of the test, particularly in the presence of nonlinear trends or unknown structural changes in time series.

CONCLUSION

The conducted research aimed to examine the long-term validity of the Purchasing Power Parity (PPP) theory using the example of five Western Balkan countries: Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and Albania. By applying modern time-series and panel analysis methods—including univariate ADF, PP, and KPSS tests, as well as panel SURADF tests with and without the Fourier component—the study explored whether real exchange rates in these countries revert to equilibrium levels in the long run. The univariate tests showed that all real exchange rates are integrated of order $I(1)$, that is, they become stationary only after first differencing. This suggests that standard tests do not provide sufficiently strong evidence to confirm the PPP theory, consistent with previous findings in the literature (Taylor, M. P. and Sarno, L., 1998; Im et al., 2003). However, the panel SURADF test without the Fourier component provided additional insights. The results showed that the null hypothesis of a unit root could not be rejected for most countries, except for North Macedonia, indicating partial support for the PPP theory. Nonetheless, the high estimated half-lives of adjustment suggest a slow return to equilibrium, further highlighting the limitations of standard panel approaches in the presence of potential structural changes. The application of the extended SURADF test with the Fourier component represents a crucial enhancement of the analysis. The results clearly indicate the rejection of the null hypothesis for all observed countries at a high level of significance, confirming the stationarity of real exchange rates. These findings suggest that the PPP theory holds in the long run for all countries in the sample, but only when flexible nonlinearities and potential smooth structural breaks—which standard tests fail to detect—are incorporated into the model. Moreover, the Fourier-SURADF approach exhibits significantly shorter half-lives of adjustment compared to the classical version of the test, implying faster convergence of exchange rates toward equilibrium and a stronger medium-term mean-reverting force. This confirms the results of previous studies (Becker et al., 2004; Chang et al., 2012), which found that incorporating the Fourier function improves the statistical performance of the test, particularly in the presence of nonlinear or unspecified structural changes. Overall, it can be concluded that the Purchasing Power Parity theory retains empirical validity for the Western Balkan countries in the long run. However, its confirmation depends on the choice of methodology and the model's ability to capture the complex temporal dynamics of real exchange rate series. This has important policy implications, as it

suggests that exchange rates in the region align with relative price movements in the long term and may serve as an indicator of equilibrium relationships in international trade. From a policy perspective, the obtained results provide relevant insights for exchange rate regime choices and macroeconomic coordination in the context of European integration. The long-run validity of PPP implies that real exchange rates in Western Balkan countries tend to adjust toward equilibrium levels, supporting the use of PPP-based indicators in assessing exchange rate misalignment and external competitiveness. This is particularly important for highly euroized economies and countries operating under managed or fixed exchange rate arrangements, where deviations from equilibrium may accumulate in the form of competitiveness losses or external imbalances. Furthermore, the confirmation of PPP when nonlinear adjustment dynamics are taken into account has implications for euro adoption readiness and the broader EU accession macroeconomic framework. Stable long-run price convergence and mean-reverting real exchange rates are consistent with the requirements of nominal and real convergence embedded in the European Union's accession criteria. In this regard, the results suggest that maintaining macroeconomic stability, fiscal discipline, and credible monetary frameworks is essential for facilitating convergence toward equilibrium exchange rates and supporting sustainable integration into the EU single market.

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ATTITUDE RESEARCH OF THE STUDENT POPULATION ABOUT SOCIAL MEDIA MARKETING

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Abstract: *By combining technology and social interaction, social media play a role in creating personal value for users. Since they enable the exchange of text, photos and videos, social media attract a large number of users whose communication is based on common interests. Thanks to their characteristics and reach, social media have become very popular in the business world. Considering the fact that they are very easily accessible via mobile phones, social media are becoming an almost indispensable subject of strategic planning of marketing activities of almost every company, regardless of its activity. One of the most commonly used social media, in addition to online communities and blogs, are social networks. The aim of this paper is to research the attitudes of the student population about social media marketing. The survey of attitudes is conducted on a sample of students studying at the Faculty of Economics Brčko in Brčko and the Faculty of Business Economics Bijeljina in Bijeljina. There were used methods of generalization, analysis and synthesis, as well as statistical methods.*

Key words: *attitude research, student population, marketing, social media, social networks*

JEL classification: *M31*

1. INTRODUCTION

Radical changes in business and the way people collaborate, primarily driven by the development

of personal computers, the Internet, and online commerce, and further accelerated by the emergence of social media and smartphones, provide great benefits for companies that embrace innovative technologies (Saravanakumar and SuganthaLakshmi, 2012). According to Carr and Hayes (2015) „social media are Internet-based channels that allow users to opportunistically interact and selectively self-present, either in real-time or asynchronously, with both broad and narrow audiences who derive value from user-generated content and the perception of interaction with others“.

From a business and marketing perspective, social media can be a tool for companies to gain new insights into their brands and provide a basis for innovative ways of implementing marketing programs (Assaad and Gómez, 2011). Thus, according to Drury (2008), social media marketing is the use of existing social media platforms to increase consumer awareness of a brand, using the word of mouth principle. According to Li, Larimo and Leonidou (2023), five directions of research on social media in the marketing function can be found in the literature: viewing social media as a tool for promotion and sales, viewing social media as a channel for communication and branding, viewing social media as a source of information, viewing social media as part of customer relationship management (CRM), and viewing social media as a general marketing and strategic tool.

There is no doubt that social media, as one of the phenomena of today, provide a large number of advantages, both for companies and for users, but one should still be aware of the negative effects that social media can cause for the aforementioned actors. Given this, it can be emphasized that managing social media is a very complex task, and as such, it cannot be entrusted to the management of one person in the company, or even one of its departments (Felix, Rauschnabel and Hinsch, 2016).

Some of the advantages or benefits that using social media brings to companies include increased brand recognition, increased brand loyalty, greater opportunity for consumer conversion, higher consumer conversion rates, building a higher level of brand authority, increased visits to the company's main website, reduced marketing costs, better search engine rankings, richer consumer experience, and better insight into consumers (DeMers, 2014). On the other hand, although social media bring many advantages for achieving marketing goals, companies and their brands can also have negative consequences, primarily due to security challenges in protecting customer financial data, employee personal information, and trade secrets, and it is especially difficult to minimize potential damage when negative comments start to spread virally instead of positive reviews and comments (Tuten and Angermeier, 2013).

From a consumer perspective, the benefits of using social media can be hedonic, social, psychological, monetary, and functional (Can and Cetin, 2017). Using social media allows consumers to customize their search for information, use hashtags or direct search services provided by companies, and quickly access the latest news and trends about products and services offered by companies (Wibowo, Chen, Wiangin, Ma and Ruangkanjanes, 2020). When discussing the negative effects of using social media for users, the first thing that can be mentioned is the problems related to how consumers perceive the use of their public data from social media by marketers (Jacobson, Gruzd and Hernández-García, 2020). This problem becomes even more pronounced considering the fact that the consumer-brand relationship is built on trust (Fournier and Alvarez, 2012). In addition to the above, there is also an overload of branded content as well as the intrusiveness of branded ads can significantly affect the saturation of social media (Fernandes and Oliveira, 2024).

In this regard, a special phenomenon that deserves attention are social networks, which are web services that allow individuals to create their own profile within the platform, connect with other

users, or profiles, and view other profiles available to them within the same platform (Boyd and Ellison, 2007). Although they are often used as synonyms, social media and social networks are not completely the same, although we can say that every social network is, in fact, a social media. The term social media is used as an umbrella term that, in addition to social networks, also describes other services such as blogs, business networks, collaborative projects, business social networks, forums, microblogs, social tagging, social games, video sharing and virtual worlds (Aichner & Jacob, 2015). In other words, social network is social media that exists as social networking site (Gligorijević and Veljković, 2022). During the 1990s, certain social networks such as Six Degrees, BlackPlanet, Asian Avenue, and MoveOn appeared, with the primary purpose of enabling people to communicate with each other, and in addition, sites such as Blogger and Epinions were launched, where users can view and write product reviews themselves (Edosomwan, Prakasan, Kouame, Watson and Seymour, 2011).

Sheikh (2026) talks about about 5.66 billion active users of social media worldwide, stating that even 93.8% of all Internet users today have at least one profile on social networks, and the most popular social media platforms are Facebook, Instagram, YouTube, TikTok, X (formerly Twitter), LinkedIn, Pinterest, Snapchat, Reddit, Threads and Bluesky.

In this paper, the research question concerns what attitudes do students from the Faculty of Economics Brčko and the Faculty of Business Economics Bijeljina have toward social media marketing and whether there is a positive association between their social media usage and those attitudes. Following this research question, the research objective is to empirically determine those attitudes and examine the proposed positive relationship, thereby providing an answer to the research question.

The motive for the research can be found in the data that the main users of social networks are younger people, and according to Smith and Anderson (2018), as many as 88% of users in the category of people aged 18 to 29 use social media platforms, to which the student population mostly belongs. In support of giving importance to this population cohort in the context of attitudes towards marketing carried out via social networks, the results of the research by the authors Salari et al. (2025) also speak, where it is stated that the global prevalence of addiction to social media among the student population is 18.4%.

The paper continues with an overview of selected papers in which the authors explore topics related to respondents' (students') attitudes towards

marketing via social media (networks), followed by sections of the paper that relate to the methodology, research results and conclusion.

2. LITERATURE REVIEW

The papers whose main findings are given below were found by searching Google Scholar. In order to ensure that the papers were as relevant as possible, search criteria were used that related to their citation rate, the requirement that the papers be subject to anonymous review before publication, and that they were published in highly ranked scientific journals and proceedings. The following keywords were used during the search: “attitude”, “consumer”, “student”, “social media marketing”, “examination”, “factors”, “influence”. After the search yielded a certain number of papers, the process of selecting the most relevant papers was initiated. In the end, the ten most relevant papers were selected.

Akar and Topçu (2011) conducted a study to determine which factors influence consumers' attitudes towards social media marketing (e.g. Facebook, YouTube). The subjects of the study were undergraduate students from Turkey. After analyzing the collected data, the authors concluded that family income, social media usage, knowledge and monitoring have a significant impact on attitudes towards social media marketing, while gender and online shopping experience do not affect attitudes. A similar study, conducted in India, investigating the factors influencing consumer attitudes, was conducted by Ahmad and Khan (2017). The sample included secondary, senior secondary, graduates and post-graduate students. After obtaining the results, the authors found that usefulness, reliability and quality of word of mouth are key factors in determining the attitude of social media users towards advertisements on social networking sites.

A study on college students' attitudes towards online advertising on social networking sites in Greece was conducted by Antoniadis, Assimakopoulos and Koukoulis (2019). Based on the data collected and subsequent analysis of the results, one of the main conclusions is that entertainment, information and credibility have a significant impact on advertising value. Investigating the effects of social media features on consumer attitudes in Australia, Arli (2017) conducted a study using students. According to the results obtained, the author concludes that entertainment has the most significant impact on consumer attitudes towards marketing via social media (Facebook, Instagram, Twitter, LinkedIn and Google+), followed by informativeness, usefulness and finally irritation. Furthermore, this

attitude affects consumer loyalty, awareness and purchase intention.

Investigating the factors, Hasan and Sheikh (2018) focus their research on factors affecting attitude towards social marketing through social media. For the purposes of the research, the authors formed a sample consisting of undergraduate students in Bangladesh. The research showed that the attitude towards social marketing through social networks significantly affects whether someone will be affected by social marketing campaigns on these platforms. Also, the use of social media and the perception of the reliability of information on social media have a strong effect on the attitude towards social marketing that takes place through social media, while, on the other hand, monitoring social media and concern for privacy on social media do not show a significant impact. Hassan, Fatima, Akram, Abbas and Hasnain (2013) investigate determinants of consumer attitude towards social networking sites advertisement (Facebook) with a focus on the mediating role of advertising value. The research was conducted on a sample of university students in Pakistan. The conclusions reached by the authors relate to the fact that the respondents show a positive attitude towards advertising on social networks. Advertisement value mediates the relationship between infotainment, credibility and irritation on consumers' attitude towards social networking site's advertisement, but it does not mediate the influence of personalized product, price and promotion content on the same attitude. Mir (2014) conducted a study on the effects of pre-purchase search motivation on user attitudes towards online social network advertising (e.g. Facebook, MySpace, Google+) on a sample of students in Pakistan. The results of the study suggest that there is a positive influence of pre-purchase search motivation on attitudes on social network advertising. There is also a relationship between attitude towards social network advertising and social networking sites ad-clicking behavior of users.

Jung, Shim, Jin and Khang (2016) conducted a study on a sample of students in South Korea with the aim of discovering factors affecting attitudes and behavioural intention towards social networking advertising. According to the results of the study, the greatest influence on attitude and behavioural intention across all types of social networking advertising is peer influence. Students in the United Arab Emirates are in the sample formed by the authors Kamal and Chu (2012) with the aim of examining beliefs, attitudes, and behaviours towards advertising on social media. According to the conducted study, the authors conclude that beliefs are positively related to

attitudes, which further have the potential to predict behaviours towards social media advertising. Luna-Nevarez and Torres (2015) conducted a study focusing on consumer attitudes towards social network advertising forming a sample of students in the United States of America. The authors state, among other things, that the technology acceptance model can be useful in explaining attitudes and behavior in the context of social networking, and that those users who find social networking useful, important, and helpful generally express a positive attitude toward this method of advertising.

Based on the literature review, the following hypotheses is formulated and tested in this paper:

H₁: Social media usage is positively associated with attitudes toward social media advertising.

3. METHODOLOGY

The scope of the research is comprised of undergraduate students from Faculty of Economics Brčko and the Faculty of Business Economics Bijeljina. Data were collected using a structured online questionnaire specifically designed for this research. The questionnaire consisted of a total of 17 questions, organized into four sections. The first section included four general demographic questions, followed by a set of five questions related to social media usage. The final two sections focused on key constructs of the study: social media usage (three items) and attitudes toward social media marketing (five items). The questionnaire items related to social media usage were adapted based on previous studies of Hasan and Sheikh (2018), Can and Çetin (2017), as well as Akar and Topçu (2011). Attitudes toward social media marketing were adopted from prior research on social media marketing (Ahmad and Khan, 2017; Akar and Topçu, 2011; Can and Çetin, 2017; Kamal and Chu, 2012; Luna-Nevarez and Torres, 2015; Falcão and Isaías, 2020; Wiese and Akareem, 2020).

The variables related to social media usage and attitudes toward social media marketing were measured using a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Data collection took place during February 2026. An initial screening question was included to ensure that only respondents who use social media were included in the analysis. One respondent indicated that they do not use social media and was therefore excluded from further analysis, resulting in a final sample of 157 respondents. Collected data were analyzed using the IBM SPSS Statistics 24.0 statistical software.

Table 1 provides an overview of the characteristics of the sample.

Table 1. Sample characteristics

Variable		f	%
Faculty attended	Faculty of Economics Brčko	46	29.3
	Faculty of Business Economics Bijeljina	111	70.7
	Total	157	100.0
Gender	Male	35	22.3
	Female	122	77.7
	Total	157	100.0
Year of study	First year	53	33.8
	Second year	41	26.1
	Third year	28	17.8
	Fourth year	35	22.3
	Total	157	100.0
Access to social media	Mobile phone	124	79.0
	Computer	1	0.6
	Both mobile and computer	32	20.4
	Total	157	100.0
Frequency of social media usage	Several times a day	150	95.5
	Once a day	5	3.2
	Two to four times a week	2	1.3
	Total	157	100.0
Social media used	Facebook	88	28.8
	Instagram	153	50.0
	X	21	6.9
	LinkedIn	2	0.7
	Other	42	13.7
	Total	306	100.0
Time spent per visit	Less than 1 hour	68	43.3
	1-3 hours	68	43.3
	4-6 hours	15	9.6
	More than 6 hours	6	3.8
	Total	157	100.0
Numer of BLP (Brand Like Pages)	0-50	130	82.8
	51-100	20	12.7
	101-500	6	3.8
	501+	1	0.6
	Total	157	100.0

Source: Authors' calculation

Out of a total 157 respondents, majority of respondents were students from the Faculty of Business Economics Bijeljina (70.7%), while 29.3% attend the Faculty of Economics Brčko. The sample was predominantly female (77.7% female respondents and 22.3% male respondents). In terms of the year of study, first-year students are

represented by 33.8%, followed by second-year (26.1%), third-year students (17.8%) and fourth-year (22.3%). Most respondents reported accessing social media primarily via mobile phones (79.0%), while 20.4% used both mobile phones and computers, and only 0.6% relied exclusively on computers. The vast majority of respondents (95.5%) indicated that they use social media multiple times per day. Observing the social networks that are used by them the most, respondents indicate that these are Instagram (50.0%) and Facebook (28.8%), while X (6.9%) and LinkedIn (0.7%) are networks used less. Of the other social media, they use (13.7%), respondents mention TikTok, Telegram, Snapchat, Viber, WhatsApp, and Reddit. In terms of time spent per session, respondents were evenly split between those who spend less than one hour (43.3%) and those who spend between one and three hours (43.3%), while fewer reported longer usage durations. Finally, 82.8% respondents follow between 0 and 50 brand pages, with progressively smaller proportions in higher categories.

4. EMPIRICAL RESULTS

Table 2 provides an overview of the values of means and standard deviations of the degree of agreement with 8 statements about social media usage and attitudes toward social media marketing.

Table 2. Statements about social media usage and attitudes toward social media marketing

	Mean	Std. Deviation
Social Media Usage		
I use social media regularly.	4.69	0.715
Using social media is part of my daily routine.	4.57	0.886
I like using social media.	4.41	0.933
Attitudes toward Social Media Marketing		
Social media represent a good platform for marketing	4.69	.637
Social media marketing is very interesting.	4.54	.738
I like social media marketing.	4.39	.815
I believe it is useful to use social media for marketing.	4.76	.634
I think social media marketing represents the future of marketing.	4.71	.653

Source: Authors' calculation

Analysis of internal consistency (reliability) was performed for the questions related to the

statements about social media usage and attitudes toward social media marketing (table 3). For both constructs Cronbach's alfa coefficient exceed the commonly accepted threshold of 0.70 (Nunnally, 1978) and we can conclude that satisfactory internal consistency was achieved for both constructs.

Table 3. Reliability statistics

Construct	N of items	Cronbach alfa
Social media usage	3	0.882
Attitudes toward social media marketing	3	0.867

Source: Authors' calculation

To examine the first hypothesis, which assumes a positive relationship between social media usage and attitudes toward social media advertising, a simple linear regression analysis was conducted. Prior to conducting the regression analysis, the underlying assumptions were examined to ensure the appropriateness of the method. The diagnostic tests confirmed that all assumptions for linear regression were satisfactorily met. Linearity was assessed using a scatterplot which indicated a moderately positive and approximately linear relationship between social media usage and attitudes toward advertising. Independence of observations was ensured through the use of an anonymous online questionnaire, with each respondent participating only once. Homoscedasticity and normality of residuals were evaluated using standardized residual plots and a Normal P-P plot, respectively, which indicated no substantial violations of the assumptions.

Table 4. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.057	1	13.057	55.099	0.000
Residual	36.733	155	0.237		
Total	49.790	156			

Source: Authors' calculation

The regression analysis results (Table 4) indicate that the model is statistically significant ($F = 55.099$, $p < 0.001$).

Table 5. Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.512	0.262	0.257	0.48681

Source: Authors' calculation

The model explains 26.2% of the variance in attitudes ($R^2 = 0.262$), suggesting a moderate level of explanatory power (Table 5). Social media usage emerged as a significant positive predictor

($\beta = 0.512$, $p < 0.001$). The unstandardized coefficient ($B = 0.378$) indicates that higher levels of social media usage are associated with more positive attitudes toward social media advertising (Table 6).

Table 6. Coefficients

	Unstand. Coefficients		Stand. Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.895	0.235		12.301	0.000
Social media usage	0.378	0.051	0.512	7.423	0.000

Source: Authors' calculation

Thus, H_1 is supported, i.e., social media usage is positively associated with attitudes toward social media advertising.

CONCLUSION

Social media has transformed communication between companies and consumers, offering companies advantages such as increased brand loyalty, reduced marketing costs, and richer consumer insights, while providing users with social and functional benefits like customized information access. However, these benefits are in contrast with challenges including security risks, viral negative feedback, consumer privacy concerns, and content overload. The student population with high engagement rate and notable tendency to social media addiction, represents one of the key groups for understanding these social media tendencies. This research on students from the Faculty of Economics Brčko and the Faculty of Business Economics Bijeljina aims to discover their attitudes toward social media marketing. While social media remains an important strategic tool for marketing, communication, and customer relationship management, its successful use requires a balanced approach that lessens intensity of risks and respects consumer trust.

A systematic review of highly relevant, peer-reviewed studies from diverse countries (Turkey, India, Greece, Australia, Bangladesh, Pakistan, South Korea, the UAE and the USA), reveals that student attitudes toward social media marketing are shaped by different factors. Among other, we can mention that entertainment, informativeness, credibility, usefulness, and word of mouth quality emerge as the most significant positive determinants of attitude, while irritation and privacy concerns show lesser effects. Demographic variables such as gender and online shopping experience are not consistently influential, whereas social media usage intensity, peer influence, and

prepurchase search motivation play important roles. Furthermore, positive attitudes are repeatedly shown to predict higher brand loyalty, awareness, purchase intention, and ad-clicking behavior. Students who perceive social media advertising as useful and helpful tend to respond more favorably. These findings underscore that marketers targeting the student population, should prioritize informative and trustworthy content over privacy invasive tactics in order to foster positive attitudes and achieving desired behavioral outcomes.

The results of the descriptive statistics of this research are largely in line with previous studies that confirm the dominant role of Facebook and Instagram as the most frequently used social networks. In the sample, Instagram stands out as the most represented platform (50%), while Facebook also records a significant presence (28.8%). Similar findings are reported by Arli (2017) and Antoniadis, Assimakopoulos and Koukoulis (2019), who identify these platforms as leading. Such results may indicate a shift in user preferences towards visually oriented platforms, especially among the younger population.

When it comes to the time spent on social media, the results are in line with the findings of the authors Antoniadis, Assimakopoulos and Koukoulis (2019), according to which the largest percentage of users spend between one and three hours a day. In this research, the most represented categories are one to three hours (43.3%) and less than 1 hour (43.3%), while a smaller percentage of respondents (13.4%) spend more than four hours per visit. Compared to the research of Hasan and Sheikh (2018), where a higher proportion of users with a particularly long time of use (five to eight and more hours) was recorded, the results in this paper indicate a more moderate intensity of use. The dominance of mobile devices in accessing social networks is clearly confirmed in this research as well. Most respondents use smartphones (79%), while the use of computers is minimal (0.6%), and combined use is present in 20.4% of respondents. These findings are consistent with Antoniadis et al. (2019), who also highlight smartphones as the primary device for accessing social network sites platforms, confirming the trend of mobile dominance.

The high frequency of using social networks is additionally confirmed by the fact that 95.5% of respondents access social networking sites several times a day, which is in accordance with the findings of Mir (2014). This pattern indicates a strong integration of social networks into the daily activities of users. Finally, the analysis of Brand Like Pages (BLP) shows that the majority of respondents follow a relatively small number of

brand pages (0–50: 82.8%), while a smaller percentage is engaged at a higher level. These results deviate from the findings of Hassan et al. (2013), where the dominant category was 51–100 pages. This difference may indicate changes in user behavior, whereby modern users show greater selectivity in following brand content.

This study results confirm that general social media usage is a significant and positive predictor of attitudes toward social media marketing. This finding is consistent with several prior studies, particularly Kamal and Chu (2012) and Hasan and Sheikh (2018), which report that higher levels of social media usage are associated with more favourable advertising attitudes.

The findings offer few recommendations for managers of the companies targeting the student population. Managers should focus their social media marketing primarily on Instagram and Facebook, as these platforms are the most frequently used. Also, all content should be optimized for mobile devices given that nearly all students access social media via smartphones. Regarding that students follow relatively few brand pages and are sensitive to intrusive advertising, marketers should prioritize credible, entertaining, informative and non aggressive content that respects privacy and builds trust. Positive attitudes fostered in this way are likely to enhance brand loyalty and purchase intention, making authentic, value driven campaigns more effective.

While the findings provide valuable insights, several limitations should be acknowledged when interpreting the results. First, the study employed a sample of students from two faculties, which limits the generalisability of the findings to a broader population. For future research, it is recommended to expand the sample to a larger number of respondents, including students from different faculties, in order to improve representativeness and increase the possibility of generalizing the results. The limitation is also that, due to the characteristics of the sample, it was not possible to perform more analyzes and tests, i.e. to set a larger number of research hypotheses (the number of respondents per group was very uneven). Therefore, for future research of this type, it is suggested to create a stratified sample, which would remove obstacles to comparison by group. Finally, the limitation of the research is that the emphasis of the research was placed on social networking sites, as one of the emerging forms of social media. In this regard, the recommendation for future research is that, in addition to social networking sites, research include other forms of social media, such as blogs, social games, video sharing and virtual worlds. Despite these

limitations, the study contributes to a better understanding of how social media usage relate to attitudes toward social media marketing.

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EVALUATION OF COMPARATIVE ADVANTAGES AND TRADE BALANCE IN BILATERAL TRADE BETWEEN SERBIA AND CHINA

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Abstract: This paper analyzes the trade relations between the Republic of Serbia and the People's Republic of China in the period from 2021 to 2025, with the aim of providing a detailed overview of the structure, competitiveness, and balance of bilateral trade in goods. The focus of the research is on understanding key trade patterns between the two countries, as well as identifying sectors with the greatest potential for improving economic relations. The study is based on a quantitative, descriptive analytical approach and includes the application of two mutually complementary international trade indicators: the Revealed Comparative Advantage (RCA) index and the Trade Balance Index (TBI). These indicators enable a comprehensive assessment of export specialization, as well as insight into whether specific sectors are predominantly export or import oriented. The data used in the analysis are classified according to the Standard International Trade Classification (SITC), ensuring consistency and facilitating comparison across different sectors. The research results indicate a pronounced structural imbalance in trade relations between Serbia and China, with Serbia continuously recording a significant trade deficit. The combined application of the RCA and TBI indices allows for precise identification of sectors with strong export potential, as well as those that are highly dependent on imports and require structural adjustments. The findings

provide a relevant basis for formulating recommendations aimed at improving export competitiveness, diversifying the production structure, and reducing the trade imbalance between the two countries. In this way, the paper contributes to a better understanding of contemporary trade flows and the potential for further development of economic relations between Serbia and China.

Key words: Trade in goods, RCA index, TBI index, Serbia, China

JEL classification: F10, F14

1. INTRODUCTION

In the context of increasing globalization and the intensification of international trade flows, bilateral trade relations have become a key determinant of economic development and competitiveness. The relationship between the Republic of Serbia and the People's Republic of China has gained particular importance in recent years, driven by China's growing role in the global economy and Serbia's strategic orientation toward expanding international trade partnerships.

China represents one of the most significant trading partners for Serbia, particularly in terms of imports, while Serbian exports to China have shown notable growth, albeit from a relatively low

base. This asymmetry raises important questions regarding the structure, competitiveness, and sustainability of bilateral trade relations.

Understanding the nature of trade between Serbia and China requires a detailed sectoral analysis that goes beyond aggregate indicators. In this regard, the application of standardized classification systems, such as the Standard International Trade Classification (SITC), enables a more precise evaluation of trade patterns and specialization.

The main objective of this study is to assess the competitiveness and structural characteristics of Serbia's trade with China over the period 2021–2025. To achieve this, the analysis employs two widely recognized indicators in international economics: the Revealed Comparative Advantage (RCA) index and the Trade Balance Index (TBI). These indicators provide insights into the sectors in which Serbia demonstrates export strength, as well as those characterized by import dependence.

The significance of this research lies in its contribution to a better understanding of Serbia's position within global trade dynamics, particularly in relation to a major economic power such as China. The findings may serve as a basis for policymakers and economic stakeholders in designing strategies aimed at improving export diversification and strengthening international competitiveness.

2. LITERATURE REVIEW

The analysis of comparative advantages and trade balance represents a central theme in international trade theory and empirical research. In the context of bilateral trade between transition economies and large global economies such as China, the literature consistently emphasizes structural asymmetries, sectoral concentration, and persistent trade imbalances.

The concept of revealed comparative advantage (RCA), introduced by Balassa (1965), remains one of the most widely used indicators for assessing export competitiveness. It measures a country's relative export performance in a given sector compared to the global average. Despite certain limitations, such as sensitivity to trade distortions and exclusion of import dynamics, RCA continues to be a standard tool in empirical trade analysis (Hinloopen & van Marrewijk, 2001). Empirical studies show that transition economies typically exhibit comparative advantages in resource-based and labor-intensive sectors, while remaining less competitive in technology-intensive industries (Ferto & Hubbard, 2003).

In the case of Serbia, research indicates that export specialization is largely concentrated in traditional

sectors, particularly agri-food products and raw materials. Studies by Matkovski, Zekić, Đokić, Jurjević and Đurić (2021) confirm that Serbia's comparative advantages are predominantly found in low value-added sectors, while higher value-added manufacturing sectors show limited competitiveness. This pattern reflects broader structural characteristics of Western Balkan economies, including limited technological capacity and insufficient export diversification.

Complementary to RCA, the Trade Balance Index (TBI), provides insight into trade orientation by incorporating both exports and imports. The TBI allows for distinguishing between export-oriented and import-dependent sectors, offering a more complete picture of trade structure.

The literature on China's role in global trade highlights its position as a dominant exporter of manufactured and high value-added goods. According to Rodrik (2006), China's export structure is characterized by a high level of sophistication relative to its income level, driven by industrial policy and integration into global production networks. As a result, many countries, including those in Central and Eastern Europe, exhibit trade patterns marked by strong import dependence on Chinese goods and limited export penetration into the Chinese market.

In addition to China's increasingly significant role in global trade, recent years have seen a growing intensification of economic and financial relations between Serbia and China, which aligns with China's broader Belt and Road Initiative framework (Cui, 2025). Within this initiative, infrastructure projects, energy investments, and logistical connectivity have been particularly developed, further strengthening the economic interdependence between the two countries.

Empirical research shows that Serbia's exports to China have recorded strong growth since the early 2010s, primarily driven by copper exports and investments by the Chinese company Zijin Mining in the mining sector. At the same time, the rise in imports from China has led to an increase in Serbia's bilateral trade deficit. As a response to strengthening economic ties, Serbia and China signed a Free Trade Agreement in 2023, which entered into force on 1 July 2024. This made Serbia the first Central and Eastern European country, as well as the first EU candidate country, to conclude such an agreement with China. The agreement provides for the gradual liberalization of trade over a period of 15 years and the improvement of the institutional framework for cooperation.

According to available analyses, its implementation is expected to contribute to the

diversification of Serbia's export structure, particularly in the direction of agri food products, the pharmaceutical sector, and components for electric vehicles (Mitić, 2025).

Recent studies emphasize the importance of global value chains (GVCs) and foreign direct investment (FDI) in shaping trade patterns. Gereffi (2018) highlights that participation in GVCs enables countries to upgrade their production structures and improve export competitiveness. However, for many transition economies, including Serbia, integration into these networks remains uneven, limiting the potential for structural transformation and export diversification (Stöllinger, 2021).

Overall, the literature highlights several key points relevant to this study. Serbia's exports remain concentrated in traditional sectors, with limited competitiveness in higher value-added industries, while trade with China is characterized by structural asymmetry and strong import dependence. RCA and TBI are widely accepted and complementary tools for analyzing trade structure and competitiveness. Building on these insights, this paper provides an empirical analysis of Serbia–China trade relations over the period 2021–2025 using these indicators..

3. METHODOLOGY

This study is grounded in a quantitative and descriptive analytical research approach aimed at examining the structure, competitiveness, and trade balance between the Republic of Serbia and the People's Republic of China over the period 2021 to 2025. The analytical framework is designed to provide a comprehensive understanding of bilateral trade relations by focusing on sectoral dynamics and comparative performance. The analysis is conducted at the level of disaggregated product groups using the Standard International Trade Classification, which enables a detailed and systematic insight into the composition and evolution of trade flows.

The empirical analysis relies on secondary data obtained from relevant international and national statistical sources, including global trade databases and official repositories. The dataset comprises annual values of exports and imports between Serbia and China, classified by sectors, as well as total exports of Serbia and total world exports by sector. Such a structured dataset allows for a consistent comparison of Serbia's trade performance both within the bilateral framework and in relation to global trade patterns.

In order to assess export competitiveness, the study employs the Revealed Comparative Advantage index, which measures the relative

export performance of a country in a specific sector compared to the global average. The index is formally defined as:

$$RCA_{ij} = \frac{\left(\frac{X_{ij}}{X_{it}} \right)}{\left(\frac{X_{wj}}{X_{wt}} \right)}$$

where X_{ij} represents Serbia's exports to China in sector j , X_{it} denotes total exports of Serbia, X_{wj} refers to total world exports in sector j , and X_{wt} represents total world exports.

An RCA value greater than one indicates that Serbia has a revealed comparative advantage in the observed sector, suggesting a relatively higher degree of specialization and competitiveness. Conversely, a value below one implies a comparative disadvantage and a weaker export position in that sector.

In addition to competitiveness, the study evaluates the trade orientation of Serbia by applying the Trade Balance Index, which captures whether the country is predominantly an exporter or importer in specific sectors when trading with China. The index is expressed as:

$$TBI_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}}$$

where X_{ij} denotes Serbia's exports to China in sector j , and M_{ij} represents imports from China in the same sector.

The values of this index range from minus one to plus one. Values approaching plus one indicate strong export specialization and a trade surplus, while values approaching minus one reflect a high level of import dependence and a trade deficit. Values around zero suggest a relatively balanced trade position.

By integrating the RCA and TBI indices, the study establishes a comprehensive analytical framework for evaluating Serbia's trade position vis à vis China. The joint interpretation of these indicators enables the classification of sectors into four distinct groups depending on the presence of comparative advantage and the nature of the trade balance. This classification provides deeper insights into the structural characteristics of bilateral trade and allows for the identification of sectors that serve as key drivers of export performance, as well as those that reveal structural weaknesses or untapped potential.

Furthermore, this methodological approach facilitates a more nuanced understanding of the dynamics of international trade specialization, highlighting not only static comparative advantages but also the broader context of trade imbalances and sectoral dependencies. As such, it provides a robust basis for subsequent empirical analysis and discussion of results, contributing to a more informed evaluation of Serbia's position within the global and bilateral trade system.

4. RESULTS OF THE EMPIRICAL ANALYSIS

This section presents the results of the empirical analysis of trade relations between the Republic of Serbia and the People's Republic of China over the observed period. The analysis is based on selected quantitative indicators used to assess trade structure, competitiveness, and balance at the sectoral level

Particular attention is given to the interpretation of the Revealed Comparative Advantage and Trade

Balance Index, which provide insights into Serbia's export performance and trade orientation. The results are used to identify key sectoral patterns, as well as areas of comparative strength and dependence in bilateral trade relations.

4.1. An Overview of Trade Flows Between Serbia and China

Trade relations between the Republic of Serbia and the People's Republic of China during the period 2021–2025 show a continuous expansion and intensification of bilateral exchange, accompanied by a significant increase in total trade volume as well as a persistent and structural trade deficit on the Serbian side.

According to the data presented in Table 1, total trade between the two countries increased from USD 5,103,270 in 2021 to USD 9,367,050 in 2025, representing almost a twofold increase over the observed period and indicating a strengthening of economic relations.

Table 1: Trade exchange between Serbia and China (in USD)

Year	Export (Serbia → China)	Import (China → Serbia)	Total Trade	Trade Balance (Export - Import)	Export/Import Ratio (%)
2021	944,546	4,158,724	5,103,270	-3,214,178	22.7%
2022	1,166,498	4,982,420	6,148,918	-3,815,922	23.4%
2023	1,238,335	4,867,974	6,106,309	-3,629,639	25.4%
2024	1,945,318	5,552,821	7,498,138	-3,607,503	35.0%
2025	2,095,977	7,271,073	9,367,050	-5,175,096	28.8%

Source: Authors, based on data from the Statistical Office of the Republic of Serbia

The structure of trade remains highly asymmetric throughout the entire analysed period.

Imports from China dominate bilateral exchange and increased from USD 4,158,724 in 2021 to USD 7,271,073 in 2025. In contrast, Serbia's exports to China, although showing growth, remain significantly lower, rising from USD 944,546 to USD 2,095,977 over the same period. This gap clearly indicates Serbia's continued dependence on Chinese industrial goods, machinery, and intermediate inputs.

As a consequence of this structure, Serbia recorded a constant trade deficit throughout the observed period.

The negative balance amounted to USD 3,214,178 in 2021, increased to USD 3,815,922 in 2022, and reached USD 5,175,096 in 2025. These figures confirm that the trade imbalance did not decrease in absolute terms, but rather deepened in certain years.

Nevertheless, certain indicators suggest a gradual improvement in Serbia's export performance. The export to import ratio increased from 22.7% in 2021 to 28.8% in 2025, indicating a slight improvement in export coverage of imports. However, these values still confirm a dominant import oriented structure in bilateral trade.

Overall, the observed period is characterized by a significant deepening of trade relations between

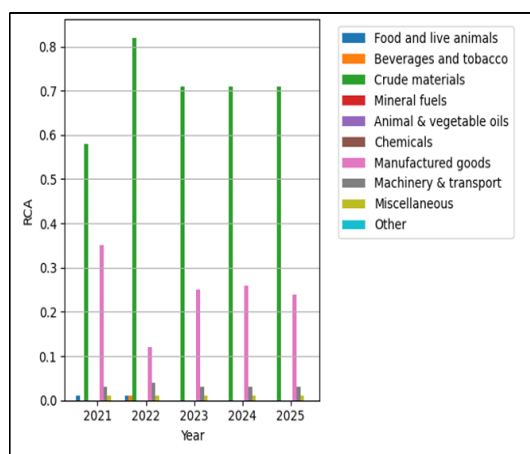
Serbia and China, alongside strong growth in total trade but also a persistent structural imbalance. Although Serbia's exports show gradual growth, they remain insufficient to substantially reduce the trade deficit, confirming that Serbia's trade position vis à vis China is still predominantly import oriented.

4.2. Revealed Comparative Advantage in Trade between the Republic of Serbia and the People's Republic of China

The calculated index of revealed comparative advantage of Serbian exports in relation to the

People's Republic of China is presented in Figure 1. The figure illustrates the evolution of Serbia's export competitiveness in the Chinese market over the observed period, highlighting changes in sectoral advantages and the overall structure of trade performance between the two countries.

Figure 1. RCA Index of Serbia in Trade with China (2021-2025)



Source: Authors' calculations

The analysis of the Revealed Comparative Advantage (RCA) indices for Serbia's trade with China over the period 2021–2025 reveals a structurally weak and narrowly based pattern of export competitiveness. Across all observed SITC sectors, RCA values remain consistently below the critical threshold of unity, indicating that Serbia does not possess a revealed comparative advantage in any product group within the Chinese market. This outcome reflects a limited degree of specialization and an overall lack of competitiveness relative to global export patterns.

Despite the absence of a formal comparative advantage, certain sectors demonstrate relatively stronger performance compared to others. In particular, SITC sector 2 emerges as the most competitive segment of Serbia's exports to China, with RCA values ranging from approximately 0.58 in 2021 to a peak of around 0.82 in 2022, followed

by a stabilization at levels slightly above 0.70 in subsequent years. Although these values remain below unity, the sector consistently outperforms all other categories, indicating a relatively higher degree of export specialization and suggesting the presence of underlying comparative potential. The stability of RCA values in this sector further points to a certain resilience of export capacity, even in the absence of full competitiveness.

A secondary group of sectors with moderate, yet still insufficient, performance includes SITC sector 6. RCA values in this category are notably lower than in sector 2, fluctuating between approximately 0.12 and 0.35 over the observed period. The highest value is recorded in 2021, followed by a noticeable decline in 2022 and partial recovery in later years, although without reaching earlier levels. This pattern suggests that competitiveness in this sector is unstable and likely influenced by short-term factors such as fluctuations in demand or production capacity, rather than sustained structural strength.

All remaining sectors, including SITC 0, 1, 3, 4, 5, 7, 8, and 9, exhibit extremely low RCA values, in many cases approaching zero throughout the entire period. Such results indicate a near absence of export specialization and confirm that Serbia's presence in these segments of the Chinese market is negligible. This lack of competitiveness is particularly evident in technologically intensive sectors, where high entry barriers, capital intensity, and limited domestic capabilities constrain Serbia's export potential.

From a dynamic perspective, the RCA indices do not show significant structural improvement over time. Although minor fluctuations are present across individual years, there is no clear upward trend that would suggest a process of sustained export upgrading or diversification. Instead, the observed stability at low levels reinforces the conclusion that Serbia's export structure toward China remains largely unchanged and concentrated in a narrow range of lower value-added products.

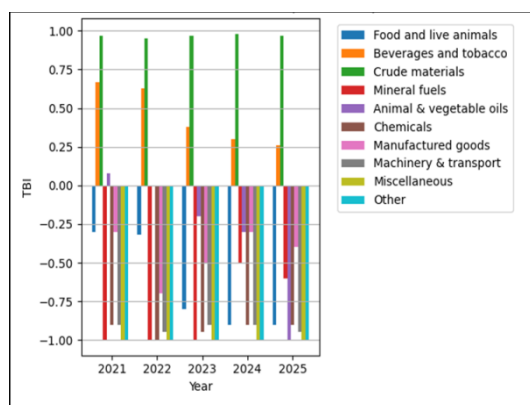
Overall, the RCA analysis highlights a pronounced structural limitation in Serbia's export competitiveness in relation to China. The absence of sectors with RCA values above unity, combined with the concentration of relatively better performance in only one sector, indicates a lack of diversification and insufficient integration into higher value-added segments of international trade. These findings point to the need for strategic improvements in production capacity, technological development, and export orientation

in order to enhance Serbia's long-term competitiveness in the Chinese market.

4.3. Trade Balance Index of the Republic of Serbia's trade with the People's Republic of China

The analysis of the Trade Balance Index (TBI) for Serbia's trade with China over the period 2021–2025 reveals a strongly asymmetric and structurally imbalanced trade pattern, predominantly characterized by import dependence.

Figure 2. TBI Index of Serbia to China



Source: Authors' calculations

The majority of SITC sectors record persistently negative TBI values, indicating that imports from China significantly exceed exports across most product groups. This confirms that Serbia's bilateral trade structure is largely shaped by its reliance on Chinese industrial and manufactured goods.

A clear exception to this general pattern is observed in SITC sector 2, which consistently exhibits strongly positive TBI values, close to 1 throughout the entire period. Such high values indicate a pronounced export specialization, where exports significantly exceed imports. This sector represents Serbia's most stable and dominant export-oriented category in trade with China, reflecting a strong and sustained comparative position in terms of trade balance, even in the absence of full comparative advantage as indicated by RCA results.

SITC sector 1 also shows positive TBI values during the observed period, although with a noticeable declining trend. The index decreases from approximately 0.67 in 2021 to around 0.26 in 2025, indicating that, while exports still exceed imports, the relative strength of this sector is gradually weakening. This suggests a potential erosion of export capacity and a movement toward a more balanced or even deficit position in the future if current trends persist.

In contrast, the majority of sectors, including SITC 3, 4, 5, 6, 7, 8, and 9, are characterized by strongly negative TBI values, often approaching -1 . These values indicate a near-complete dominance of imports over exports, highlighting Serbia's dependence on Chinese products in these sectors. This is particularly evident in manufacturing and technologically intensive industries, where Serbia lacks sufficient domestic production capacity and competitiveness, resulting in a structurally embedded trade deficit.

SITC sector 0 also records negative TBI values, although less extreme compared to other deficit sectors, suggesting a moderate but consistent trade imbalance. The relatively smaller deficit in this sector may reflect a certain degree of two-way trade, but without a clear export advantage.

From a dynamic perspective, the TBI values do not indicate substantial structural improvement over time. While minor fluctuations can be observed across individual years, the overall pattern of strong import dominance remains unchanged. The persistence of deeply negative values across most sectors suggests that Serbia has not significantly reduced its dependence on Chinese imports during the observed period.

Overall, the TBI analysis confirms that Serbia's trade with China is characterized by a high degree of structural asymmetry, where only a limited number of sectors generate trade surpluses, while the majority remain heavily import-dependent. This pattern reflects underlying differences in economic structure, technological development, and industrial capacity, and points to the need for strengthening domestic production and export capabilities in order to achieve a more balanced and sustainable trade relationship.

4.4. Combined Interpretation of RCA and TBI

A joint analysis of the Revealed Comparative Advantage (RCA) and Trade Balance Index (TBI) enables a more comprehensive and nuanced classification of trade sectors in the context of Serbia's trade relations with China. By integrating indicators of export competitiveness and trade balance, it is possible to identify structural patterns across different SITC categories.

Sectors characterized by both comparative advantage and a trade surplus are represented by SITC 2. These sectors reflect Serbia's relatively strongest position in bilateral trade and constitute the primary drivers of its export performance. The simultaneous presence of RCA values above one and positive TBI values indicates both international competitiveness and a favourable trade position in these product groups.

In contrast, sectors without comparative advantage and with a persistent trade deficit include SITC 6, 7, and 8. These sectors demonstrate a structural reliance on imports and a lack of sufficient export competitiveness. The combination of RCA values below one and negative TBI indicators highlights Serbia's weaker position in higher value-added and technologically more complex segments of trade with China.

A third group includes sectors with limited or transitional performance, such as SITC 1. Although this sector still records a trade surplus in certain periods, the indicators suggest a gradual weakening of its competitive position. This implies potential vulnerability and a possible shift towards a less favourable trade balance in the long run.

Overall, this classification confirms that Serbia's trade structure with China exhibits a dual character. Exports are predominantly concentrated in lower value-added goods, while imports are largely composed of technologically intensive and higher value-added products. Such a structure reflects an underlying asymmetry in trade relations and points to persistent challenges in upgrading Serbia's export profile within the bilateral economic framework.

CONCLUSION

The analysis of trade relations between the Republic of Serbia and the People's Republic of China over the period 2021–2025 reveals several important structural characteristics and challenges.

The results of the Revealed Comparative Advantage (RCA) index indicate that Serbia's export competitiveness is highly concentrated in a limited number of sectors, particularly in SITC group 2 (crude materials). This confirms that Serbia's comparative advantages are primarily based on the export of raw materials and low value-added products.

At the same time, the Trade Balance Index (TBI) highlights a persistent trade imbalance across most sectors. While Serbia maintains a trade surplus in a small number of sectors, the majority of industries are characterized by significant import dependence, especially in technologically intensive and higher value-added goods such as machinery and manufactured products.

The combined analysis of RCA and TBI indices suggests that the trade relationship between Serbia and China is structurally asymmetrical. Serbia predominantly exports primary goods, while importing more sophisticated and industrial products from China. Such a pattern reflects underlying differences in economic structure,

technological development, and production capacity.

These findings point to several key challenges for the Serbian economy. First, there is a need to reduce excessive reliance on a narrow range of export sectors. Second, improving competitiveness in higher value-added industries is essential in order to achieve a more balanced and sustainable trade relationship. Third, diversification of export markets and products should be prioritized to mitigate potential external risks.

In the context of the Belt and Road Initiative, Serbia should strategically utilize its comparative advantages in SITC Category 2 not merely through the export of raw materials, but also through the development of domestic processing capacities in sectors such as mining, metallurgy, and agro processing industries. This objective could be achieved through targeted Chinese investments in industrial zones, technology transfer agreements, and joint ventures aimed at increasing the degree of final processing prior to export. Furthermore, the modernization of transport and logistics infrastructure within the framework of China Serbia cooperation could contribute to lowering export costs and strengthening Serbia's integration into regional and global supply chains.

Moreover, Serbia should implement industrial policies oriented toward the promotion of higher value added production through incentives for research and development, workforce specialization, and the adoption of advanced manufacturing technologies. Cooperation in production capacities with Chinese enterprises could additionally facilitate the integration of Serbian companies into broader Belt and Road supply networks, thereby enabling a gradual transition from a resource based export structure toward more technologically intensive and internationally competitive industries.

In conclusion, while trade with China offers significant opportunities for economic growth, it also exposes structural weaknesses that must be addressed through targeted economic policies. Strengthening industrial capacity, encouraging innovation, and enhancing export sophistication represent crucial steps toward improving Serbia's position in international trade.

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FAMILY ENTREPRENEURSHIP IN THE AGE OF UNCERTAINTY

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Abstract: Family entrepreneurship should be recognized as not just a significant type of economic activity, but also crucial social activity. The aim of the research is to review models of family entrepreneurship in various countries, drawing upon open-source data from official sources. The relevance of this research is determined by the fact that family entrepreneurship contributes to the socio-economic stability of countries by providing the population, especially younger generations, with reliable employment, stable income, hands-on business/professional training, and a sense of belonging. We comparatively explore how family entrepreneurship impacts these factors in Republic of Srpska, China, Russia, Vietnam and Mauritania. A significant number of studies prove that family business allows for higher economic efficiency due to the possibility of transferring entrepreneurial skills and abilities to younger family members and the higher motivation of all employees connected by family ties.

Key words: family entrepreneurship, family business, rural entrepreneurship, small enterprises.

JEL classification: L26, D13, O18.

1. INTRODUCTION

As an important part of global economic activity, family entrepreneurship plays a vital role in stabilizing employment, stimulating local economic development, and preserving traditional values (Olumekor et al., 2023; 2024). Studies of Indigenous communities around the world have found that family entrepreneurs often play vital roles in preserving Indigenous cultures, customs, and values (Olumekor et al., 2024).

Moreover, in emerging economies, family enterprises are core pillars of the national economy. For example, family enterprises in Russia, China, Vietnam, Republic of Srpska and Mauritania account for 74%, 85%, 70%-95%, 60% and 80%-90% of the total number of private

enterprises in their respective countries, respectively. These businesses cover key areas, such as manufacturing, agriculture, services and resource development, all of which directly impact the quality of regional economic growth and social stability. In an age defined by geopolitical volatility, economic shocks, and rapid technological change, family entrepreneurs possess a unique advantage as custodians of traditional values (Polbitsyn, 2022). Since the quality of products depends on their geographical origin, the protected designation of origin contributes to the perception among third parties that these products possess specific and distinctive characteristics (Damjanović, 2021). Far from being a relic of the past, principles, such as long-term thinking, loyalty towards the community and stewardship of the family, function as a strategic anchor and compass, providing the stability needed to navigate uncertainty and build resilience across generations.

Consequently, traditional values provide a stable foundation when the external environment is chaotic, allowing family businesses to focus on the long term rather than reacting to short-term noise (Murzina & Poznyakov, 2019). Unlike publicly traded companies pressured by quarterly earnings, family businesses think in generations. This patient capital mindset allows them to make prudent, strategic investments and weather economic storms without rash decisions.

Among family entrepreneurs, businesses are viewed not just as a source of income, but as a legacy to be preserved for their children and grandchildren. This instills a powerful sense of responsibility and a survival instinct that drives decision-making, ensuring the enterprise is protected for future generations. For instance, a conservative approach to finance, characterized by avoiding excessive debt and maintaining healthy cash reserves, is a hallmark of traditional family business values. This financial shield provides the flexibility to survive crises without being forced into desperate measures. Moreover, the emotional bonds within a family enterprise create a rare intangible asset. This loyalty extends to employees, who are often treated as extended family, fostering a culture of mutual support and sacrifice during tough times.

Traditional values are inherently relational, creating a microclimate of trust that is invaluable when external systems fail or become unpredictable. In volatile environments, family relationships and networks create high-trust ecosystems. This social capital enables quicker, more reliable decision-making and collaboration when dealing with partners, suppliers, and customers. Family businesses often act as cultural stewards, preserving and leveraging local heritage

to forge deep, authentic connections with their communities (Olumekor et al., 2024). This closeness to the community often translates into customer loyalty. For instance, local residents often remain steadfast supporters of family-run enterprises during crises due to a sense of shared identity and mutual support. A clear purpose and a well-articulated family story build lasting trust with customers. When a business is known for what it stands for, that loyalty can carry across generations, reaffirming the brand's reliability.

While tradition provides stability, the age of uncertainty also demands adaptation. The key is not to choose between the past and the future, but to purposefully balance tradition with innovation. This is the paradox that powers successful family enterprises. The very strengths of a family business, attachment to legacy and strong identity, can sometimes lead to strategic inertia and risk aversion. Therefore, the goal of this study is to provide an in-depth comparison of family entrepreneurship in Republic of Srpska, China, Russia, Vietnam and Mauritania, and provide dual guidance for policymakers and researchers.

2. COMPARATIVE ANALYSIS OF FAMILY ENTREPRENEURSHIP ACROSS DIFFERENT COUNTRIES

In the following text, an analysis of family entrepreneurship in five different countries (Republic of Srpska, China, Russia, Vietnam and Mauritania) is presented.

2.1. Family Entrepreneurship in Republic of Srpska (Bosnia and Herzegovina)

Monitoring the development of entrepreneurship within an economy entails a comprehensive understanding of the institutional and systemic framework of the state, which shapes and directs the overall entrepreneurial environment. Of particular importance is the level of development of the institutional system, whose primary function is to strengthen entrepreneurial capacities and create a favorable business environment. The significance of entrepreneurship development in contemporary economies is indisputable. In this context, small and medium-sized enterprises (SMEs) play a pivotal role, as they represent one of the most important generators of new employment opportunities (Polbitsyn, 2022).

Small and medium-sized enterprises, which include the majority of family businesses, constitute the backbone of the economy in Bosnia and Herzegovina. According to the Organisation for Economic Co-operation and Development, SMEs account for approximately 99% of all enterprises in the country and provide a substantial share of employment in the business sector

(OECD, 2019). Similarly, data from international reports indicate that SMEs generate more than 60% of GDP and employ over 60% of the workforce in Bosnia and Herzegovina, highlighting their crucial role in the national economy (United Nations, 2022). These enterprises operate across a diverse range of sectors, including trade, manufacturing, agriculture, tourism, and services.

According to data from the Republic Institute of Statistics of the Republic of Srpska, a total of 9.570 active enterprises and 20.354 entrepreneurs engaged in market activities were operating in Republic of Srpska in 2024. These business entities employed 200.474 workers, with the largest share of employment found in industrial activities, which accounted for 37,1% of total employment. When analyzed by sectors, the highest number of enterprises and entrepreneurs were engaged in wholesale and retail trade, as well as the repair of motor vehicles and motorcycles, representing 27,5% of all business entities. This sector also contributes significantly to the generation of total added value in the economy.

When observed by enterprise size, small businesses (employing up to 49 workers) constitute the largest segment of the business structure. They employ nearly half of the workforce and generate a significant portion of total turnover. This fact confirms that small and medium-sized enterprises form the foundation of the business structure and serve as an important driver of economic development in the Republic of Srpska.

Entrepreneurship in Bosnia and Herzegovina has increasingly gained importance in recent years as a key factor of economic development. However, the institutional approach towards new micro, small, and medium-sized enterprises remains unsatisfactory. Entrepreneurs face numerous challenges and limitations in conducting business, while adequate systemic support for the development of entrepreneurship at all levels of government is still lacking (Smailbegović & Arnaut, 2018). Family businesses represent one of the central pillars of economic development and are recognized as a significant factor in economic growth in every economy. Although it is difficult to precisely quantify their prevalence at the global level, available research suggests that family enterprises constitute between 65% and 90% of all active businesses. This statistic highlights the dominant role of family businesses in shaping economic structures and in forming employment policies (Novaković & Macanović, 2019).

Family entrepreneurship represents one of the most widespread forms of business organization in

modern economies. Family businesses are typically characterized by the involvement of family members in ownership, management, and strategic decision-making processes. These enterprises often combine economic goals with family values, long-term orientation, and intergenerational continuity. Because of these characteristics, family entrepreneurship plays a significant role in employment creation, economic growth, and regional development (Hall, Daneke & Lenox, 2010).

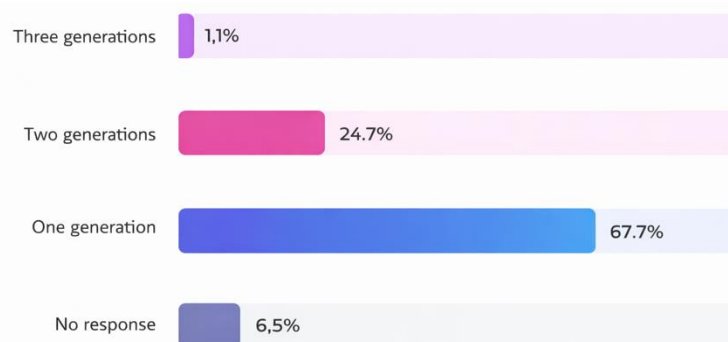
Family entrepreneurship in Bosnia and Herzegovina is closely connected with the structure of the SME sector. Many businesses are established and managed by family members who share resources, knowledge, and responsibilities within the enterprise. This model of entrepreneurship is often characterized by strong interpersonal trust, long-term commitment, and flexibility in decision-making. At the same time, family businesses may face specific challenges related to succession, professionalization of management, and balancing family and business interests. Despite their importance, entrepreneurs in Bosnia and Herzegovina operate in a challenging economic environment. Structural barriers such as limited access to finance, complex administrative procedures, and a fragmented institutional framework often hinder the growth and development of small businesses (Petković & Sorak, 2019). Additionally, many enterprises face difficulties related to market size, competitiveness, and technological development.

According to data from the Education Center (2023), following the war in Bosnia and Herzegovina, many individuals established their own businesses with the support of family members. This led to a significant increase in the number of family enterprises, which today play an important role in the development of the domestic economy. However, despite their considerable significance, Bosnia and Herzegovina still lacks a clear institutional definition of family businesses, as well as official statistics that would accurately reflect their number and characteristics. One of the main advantages of family enterprises is their long-term strategic focus. Unlike many other companies that prioritize short-term results, family businesses often aim to preserve operations for future generations. As a result, family members are willing to reinvest profits and devote additional effort to ensure the stability and growth of the company. Furthermore, family businesses are often characterized by a strong reputation, employee loyalty, and knowledge continuity, as business skills and experience are passed down from generation to generation.

Despite these advantages, family businesses also face specific challenges. One of the greatest issues is succession, that is, the transfer of ownership and management from one generation to the next. Research indicates that a large number of family businesses fail to survive this process – approximately 70% do not endure the transition from the first to the second generation, while as

many as 95% do not survive to the third generation (Figure 1). Moreover, the Education Center Pro Educa (2023) notes in its official report that the lack of systematic data complicates the creation of policies that could support the development of this sector and enhance its contribution to the national economy.

Figure 1. The survival status of family businesses in Republic of Srpska, Bosnia and Herzegovina



Source: Status of family businesses in the Republic of Srpska. (2023). <https://porodicnefirme.com/>

Figure 1 shows how many generations of family firms manage to survive. The results show that the largest number of family firms survive only one generation (67,7%). Two generations manage to maintain business in 24,7% of cases, while only 1,1% of family firms survive through three generations.

Research findings on the status of family businesses in the Republic of Srpska highlight several important characteristics related to their structure, development, and the challenges these enterprises face. Analysis of data collected by the Center for the Development of Family Businesses in the Republic of Srpska indicates that family businesses constitute a significant segment of the economy, while simultaneously facing numerous challenges related to the labor market, business organization, and intergenerational transfer of management.

An analysis of enterprise age shows that a significant number of family businesses have been operating for extended periods, indicating a certain level of stability in this sector. The largest percentage of firms has been operating for between 20 and 49 years (46,2%), while 29% of firms have been active for 10 to 19 years. A smaller number of enterprises have been operating for less than ten years, suggesting that most of the surveyed firms have long-standing market experience and relatively stable business development (Center for the Development of Family Businesses, 2023).

The research also indicates that the majority of family businesses were founded by the current owner. Approximately 71% of firms were established by their owner, 16,1% were inherited, and 6,5% were purchased. These data highlight the importance of individual entrepreneurship in the establishment of family businesses, with founders playing a key role in the development and shaping of the business (Center for the Development of Family Businesses, 2023).

Regarding enterprise size, the results show that family businesses primarily fall into the micro, small, and medium-sized categories. The largest number of firms employs between one and five employees (31,2%), while 15,1% of firms have between six and ten employees. Larger firms with more than 50 employees constitute a significantly smaller portion of the sample. This employment structure confirms that family businesses in the Republic of Srpska predominantly have the characteristics of small enterprises, which often rely on limited resources and flexibility in operations (Center for the Development of Family Businesses, 2023).

Regarding business performance, the research indicates relatively positive trends. Compared to the previous three-year period, 64,5% of firms reported revenue growth, while 18,3% of firms maintained approximately the same revenue. A decrease in revenue was observed in 10,8% of the surveyed firms. These results suggest that a significant number of family businesses have

managed to achieve business growth despite challenges in the operating environment.

One of the most significant challenges faced by family businesses relates to the labor market. The primary issues identified by business owners include finding qualified employees (33,3%), labor shortages (21,5%), and high obligations to the state (19,4%). These findings indicate that human resource-related problems and regulatory burdens are among the key constraints on the further development of family businesses (Center for the Development of Family Businesses, 2023).

The research findings also indicate that the majority of family businesses hold positive expectations regarding future operations. More than half of respondents (54,8%) plan to grow and expand their business within the next year, while 22,6% intend to consolidate their operations. A smaller proportion of firms indicated that their focus in the upcoming period will be on maintaining existing operations and surviving in the market (Center for the Development of Family Businesses, 2023).

A particularly important aspect of family business operations concerns succession planning and the

transfer of ownership. The results show that a large number of owners have not yet defined clear plans for transferring ownership to the next generation. Nearly two-thirds of respondents (64,6%) have not yet considered the division of company shares, while 18,3% have already agreed upon and communicated a plan for ownership distribution. These data highlight the need for a more systematic approach to succession planning in family businesses (Center for the Development of Family Businesses, 2023).

Figure 2 illustrates the degree of autonomy of family members, specifically the children of family business owners, in choosing their future occupation and potential involvement in the family business. The results indicate that the majority of respondents (59,1%) believe that children should independently decide on their future and professional path. Conversely, 28% of owners stated that they would advise their children to join the family business, while a very small number of respondents insist that their children continue working in the family firm (4,3%). Additionally, 1,1% of respondents indicated that they would not wish their children to continue the family business.

Figure 2. Freedom of family members in choosing their career and participation in the family business in Republic of Srpska



Source: Status of family businesses in the Republic of Srpska. (2023). <https://porodicnefirme.com/>

Finally, the results indicate that owners of family businesses generally maintain a relatively positive outlook regarding the future of their enterprises. The majority of respondents (62,4%) believe that their company can successfully continue operations even after the withdrawal of the founder. However, a certain number of owners express uncertainty regarding the long-term sustainability of the business following intergenerational management transfer.

The most common sources of conflict among family members concerning the business are reported as follows (Center for the Development of Family Businesses, 2023):

1. Productivity of family members within the firm
2. Vision for the future of the business
3. Lack of commitment to work
4. Employment policy within the firm
5. Irresponsibility
6. Tardiness to work.

One of the significant challenges in the development of family entrepreneurship lies in the geographical and market positioning of rural family businesses. This specific location often limits access to key resources, markets, and support, which may hinder their growth and competitiveness compared to urban enterprises.

Inequalities in living conditions between rural and urban areas represent a significant global challenge that persists regardless of the level of economic development of individual countries. This phenomenon reflects structural differences in the availability of resources and services, which directly affect the standard of living of the population (Cvijanović & Kočić, 2025).

In this context, Bosnia and Herzegovina is no exception. The population in rural areas and smaller settlements often faces less favorable conditions compared to the urban population, particularly in terms of access to healthcare, educational, and cultural institutions, as well as opportunities for economic development. Limited infrastructure investment, insufficient local budget capacities, and pronounced marginalization of rural communities further exacerbate existing disparities (Cvijanović & Kočić, 2025).

Accordingly, the quality of life in rural areas is increasingly recognized as one of the key indicators of overall social and economic progress.

2.2. Family Entrepreneurship in China

The core driver of China's family entrepreneurship concept stems from the dual empowerment of Confucian cultural inheritance and national policy support, which work in concert to form a development synergy. From the perspective of cultural identity, Confucian culture emphasizes familial duty and collective honor, which profoundly influences the core goals of family entrepreneurship. According to the National Bureau of Statistics of the People's Republic of China (2024), 85% of private enterprises in China are family businesses, contributing to approximately 51% of GDP and 40% of jobs. A close examination of the data shows a core concentration in manufacturing (66.4%), high-tech (10%) and retail (15%). Most enterprises pursue intergenerational succession as a long-term goal.

In China, the value orientation of family-owned enterprises deeply integrates family honor and social responsibility, forming a dual pursuit of family sustainability and social contribution. From the perspective of family honor, intergenerational succession and family sustainability are the core value goals. Data shows that Chinese family enterprises prioritize succession as a long-term pursuit, with an estimated 79 trillion yuan of

wealth to be transferred in the next 30 years, but only 3% of enterprises have formulated family charters, and 60% of enterprises disappear during succession, reflecting the anxiety of family honor orientation regarding succession (National Bureau of Statistics of the People's Republic of China, 2024).

Furthermore, according to the social responsibility perspective of Confucian philosophy, policy guidance and cultural traditions drive enterprises to undertake multiple responsibilities. For example, National policies in China emphasize corporate social responsibility. Meanwhile, family enterprises have made outstanding contributions to employment, innovation, and taxation, sharing the responsibility for promoting socio-economic development. Data shows that 53% of taxes and 62% of GDP come from the private economy (85% of which are family enterprises).

The advantages of Chinese family enterprises lie in strong cultural cohesion, high social responsibility awareness, easy social recognition and policy support, and a good brand image. On the other hand, the disadvantage is that the family honor orientation leads to conservative succession decisions, excessive reliance on family members for management, and insufficient trust in professional managers (only 30%), all of which can negatively impact the success of the business.

2.3. Family Entrepreneurship in Russia

The development of family enterprises in Russia is centered around resource integration and rapid expansion, with a focus on achieving scale and increasing market share. According to the Russian Federal State Statistics Service the core industries of family enterprises in Russia include agriculture (45%), cross-border trade (15%), IT (10%) and private education (10%). The best example of the role of family business can be found in agriculture.

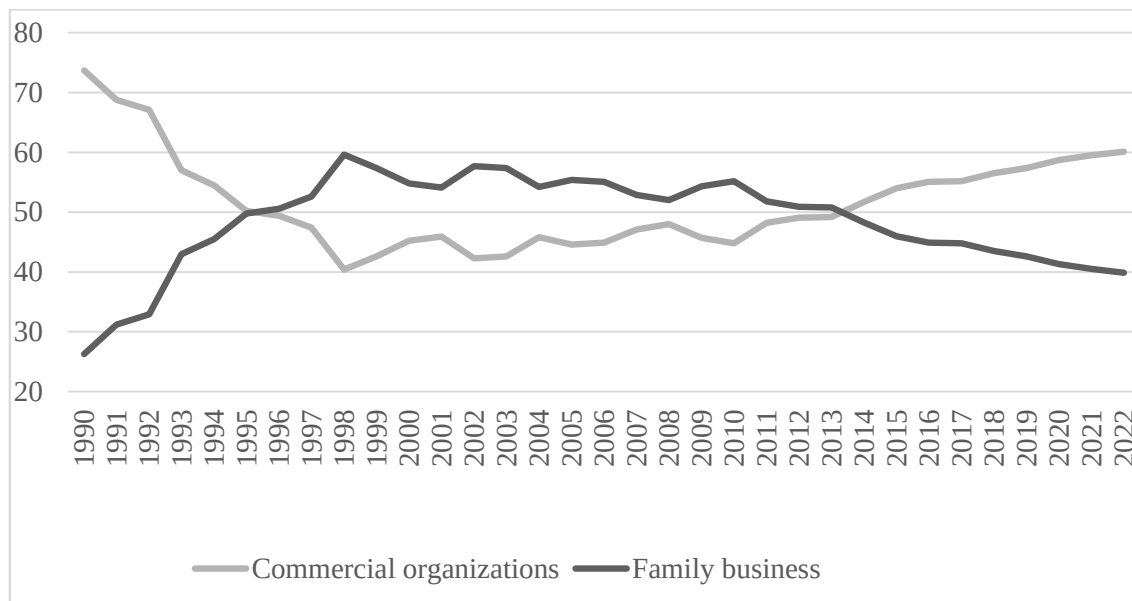
The share of the rural family business in agricultural production in Russia is presented in Figure 3. It provides a good example to demonstrate the importance of family business in Russia. The data in Figure 3 shows that the share and the role of family business in Russia is deteriorating. The value orientation of Russian family enterprises is centered on market efficiency, while also considering policy adaptability, and weakening the emotional factors of family control. From the perspective of market efficiency, enterprises prioritize profitability and scale expansion as core value pursuits. Data shows (Sazonova, 2022), that 55% of Russian family enterprises are run by the first generation, 37% by the second generation, and only 8% by the third generation or above.

To determine the role of institutions in the development of rural family entrepreneurship, we conducted a study to determine the control values of fundamentally important institutions (Polbitsyn et al, 2020):

1. State support institutions	4,33
2. Family institutions	4,10
3. Financial institutions	3,78
4. Taxation institutions	3,65
5. Market institutions	3,58

We argue that the involvement of younger generations of entrepreneurs in family business activities, fosters the development of an entrepreneurial culture, an entrepreneurial way of thinking, and the exploitation of opportunities. These benefits can significantly improve both the economic (i.e., improving the success of family businesses) and social (i.e., improving the family relations) contributions of family enterprises (Leskova & Shalashnikova, 2016).

Figure 3. The structure of agricultural production in Russian Federation (in %%)



Source: Russian Federal State Statistics Service: Key indicators of agricultural production in Russia.

Available at: https://gks.ru/enterprise_economy

The advantages of Russian family-owned enterprises lie in their rational decision-making, high level of professional management, strong market competitiveness, and superior risk-resistance. However, their disadvantages include weak family cohesion, low inheritance willingness, high policy dependence, vulnerability to government intervention, and a lack of a long-term potential.

2.4. Family Entrepreneurship in Vietnam

The core driving force of the family entrepreneurship concept in Vietnam starts from the livelihood demands of people. It is supported by cultural adaptation, forming a practical and flexible development feature. Regarding people's livelihood demands, Vietnamese family businesses closely align with the local market's essential needs. Family businesses account for 70-95% of private enterprises, contributing 22-24% of GDP. These family enterprises provide 87,000 jobs, with 42.1% concentrated in the service industry and

32.6% in manufacturing and handicrafts, all in labor-intensive and low-entry-barrier sectors (General Statistics Office of Vietnam, 2024).

According to the General Statistics Office of Vietnam (2024), the core industries of family enterprises in Vietnam include trade and retail (42%), services (32%), manufacturing and handicrafts (18%) and others (8%). Family businesses in Vietnam are highly concentrated in trade, retail and service activities, which together account for nearly three quarters of all household business units. This confirms the dominant role of family entrepreneurship as an economic pillar in Vietnamese society.

The advantages of Vietnamese family enterprises lie in high market sensitivity, flexible adjustment, and alignment with local consumer demands. However, the disadvantages are the small scale, weak risk resistance, and lack of specialized management, resulting in insufficient innovation and a lack of equity financing channels. Studies

show that small-sized family enterprises in Vietnam face financing costs of 8-12%, which limits scale expansion and makes it difficult to break through the bottleneck of the segmented market (World Bank, 2023).

2.5. Family Entrepreneurship in Mauritania

The core driving force of family entrepreneurship in Mauritania stems from the need for survival and the primary utilization of natural resources to achieve this aim. The development goal is centered around ensuring livelihood. The need for survival motivates people to seek entrepreneurship and pass it on to other family members as a way to alleviate poverty and ensure the livelihood of the family. Data shows that family enterprises account for 80-90% of private enterprises, contributing 30-35% of GDP and 60% of non-public sector employment. 82% of the enterprises have a size of less than 10 people, and their goal is to support the family (AfDB, 2024).

The core industries of family enterprises in Mauritania include trade and retail (35%), agriculture (30%), fisheries (25%) and others (10%) (World Bank, 2024).

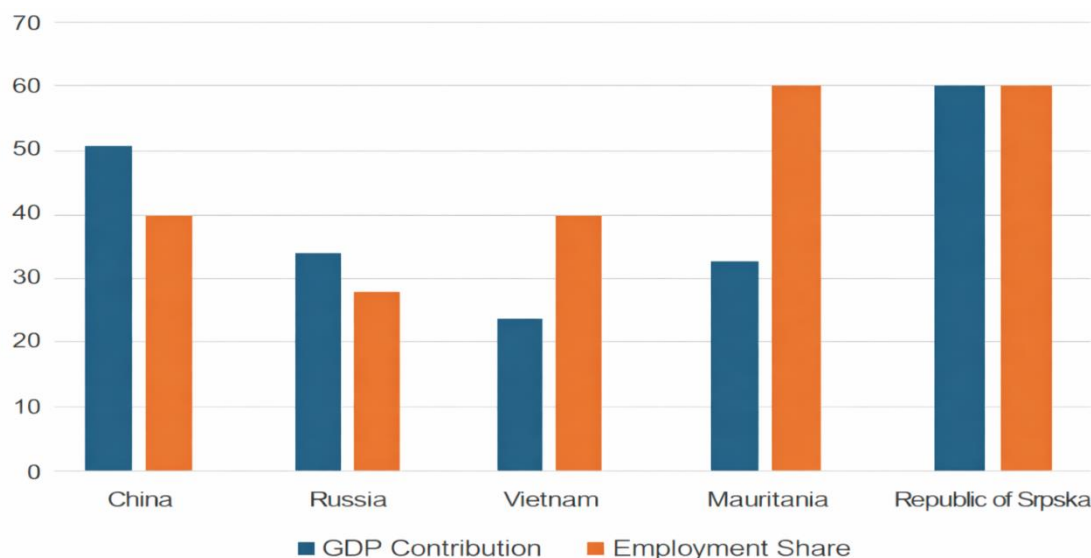
The advantages of family enterprises in Mauritania lie in their strong employment impact, adaptation to local resource endowments, and deep cultural

roots in the community. Nevertheless, there also important shortcomings of family enterprises in Mauritania, including a lack of specialized laws and financing instruments, an inheritance success rate of only 20-25%, an average enterprise lifespan of 8-10 years, and difficulties in developing levels of professionalization. For instance, less than 30% of enterprises had professional managers. Together, these challenges make it difficult to improve the industrial level and output of family enterprises in the country.

3. DISCUSSION

China's family enterprises contribute the highest GDP share (51%) and a stable employment rate (40%), reflecting potential for scale expansion and stable contribution towards socio-economic development. Russia's moderate GDP contribution (35%) and lower employment share (28%) align with its efficiency and capital-intensive development model. Vietnam's 40% employment share, equivalent to China's, highlights its role in absorbing labor, which is consistent with the small-scale but employment-intensive path. Meanwhile, Mauritania's outstanding employment contribution (60%) and moderate GDP share (33%) confirm its function as a basic employment provider in the national economy

Figure 4. Comparison of GDP Contribution and Employment Share of Family Enterprises Across Five Countries



Source: Authors

This study reveals distinct characteristics of family entrepreneurship across the five countries. China's family enterprises, driven by Confucian cultural ideals and targeted policy support, account for 85% of private enterprises, with a dominant

presence in the manufacturing sector (66.4%) and notable advantages in long-term development and innovation. In addition, Russia's family entrepreneurship relies heavily on abundant natural resources and market-oriented efficiency. With 74% of SMEs family-owned and 99% of

agricultural products supplied by family enterprises, Russian family entrepreneurs are key players in the overall Russian economy. However, they face several challenges including resource dependency and high financing costs (19-31%).

Vietnam's family enterprises, centered on livelihood demands and cultural adaptation, make up 70-95% of all private enterprises, contributing 22-24% of GDP and providing 87,000 jobs. Their strengths are in market adaptability, but face weaknesses in professionalization and innovation. Mauritania's family entrepreneurship is rooted in survival needs and primary resource utilization, accounting for 80-90% of all private enterprises. Nonetheless, they suffer from weak legal support, low digitalization, and short enterprise lifespans (8-10 years on average). Finally, in the Republic of Srpska, SMEs generate more than 60% of GDP and employ over 60% of the workforce (OECD, 2022).

CONCLUSION

At a time of global uncertainty, it is proposed strategies for family entrepreneurship rooted in the national context of each country. For example, China should focus on building a dual system of inheritance and governance to address regional imbalances and family centralization, whereas Russia should leverage policy dividends to promote industrial diversification and reduce resource dependency. In Vietnam, policies should seek to strengthen professionalization through talent training and cross-border financing platforms, while Mauritania should develop vital institutional support, such as legal and financial instruments specifically dedicated to family entrepreneurs. Meanwhile, the Republic of Srpska should focus on strengthening the resilience of family business to improve the sustainable development of the country's economic system. These solutions should be verified for feasibility through existing policy frameworks and international experience, forming a problem-solution-path matching system.

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CHALLENGES IN INSURING AGAINST CATASTROPHIC RISKS

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Abstract: This paper addresses the key challenges in insuring against catastrophic risks, with a particular focus on flood risk as one of the most complex and economically significant natural hazards in contemporary conditions. These challenges stem from the increasing frequency and severity of extreme events, the spatial and temporal correlation of losses, high loss severity, as well as methodological difficulties in risk measurement and persistent institutional and market constraints reflected in the protection gap between economic and insured losses. The paper examines the extent to which different flood insurance models can contribute to addressing these challenges. The findings indicate that no single institutional model provides a universally optimal solution. While public models improve accessibility and social protection, and private models enhance risk-based pricing and efficiency, both exhibit significant limitations when applied in isolation. Public-private arrangements, when supported by robust risk assessment and a clear allocation of responsibilities, offer the greatest potential to reduce the protection gap and ensure more sustainable, resilient financial protection against flood losses.

Key words: catastrophic risks, flood risk, insurance, risk measurement, climate change, public-private model

JEL classification: G22

1. INTRODUCTION

Catastrophic risks are gaining increasing economic, social, and developmental significance in contemporary conditions, driven by the rising frequency and intensity of extreme natural events, the growing concentration of population and assets in exposed areas, and the pronounced protection gap between total economic and insured losses. Within this group of risks, floods occupy a particularly important position, both in terms of their frequency and the scale of their consequences, as they simultaneously affect human lives, infrastructure, productive capacities, and public finances. In such circumstances, insurance plays a crucial role as a financial risk management instrument. However, its effectiveness depends on the extent to which risks can be accurately measured and on the existence of an institutional framework capable of providing accessible, sustainable, and long-term protection.

Against this background, the paper addresses the key challenges in insuring against catastrophic risks, with a particular focus on flood risk as one of the most widespread and financially significant forms of natural hazards. The aim of the paper is to assess the extent to which different flood insurance models can contribute to mitigating these

challenges. The paper is organised into three sections. The first section examines the impact of climate change and natural disasters over the past decade, with particular emphasis on the growing importance of hydro-meteorological events. The second section analyses approaches to measuring flood risk as a necessary basis for loss estimation, premium setting, and risk management. The third section reviews the main models of flood risk insurance, public, private, and public-private, highlighting their advantages, limitations, and conditions for effective implementation. The underlying premise of the paper is that the challenges in insuring against catastrophic risks arise not only from changes in the nature of hazards themselves, but also from methodological difficulties in their measurement and institutional constraints in the organisation of effective financial protection.

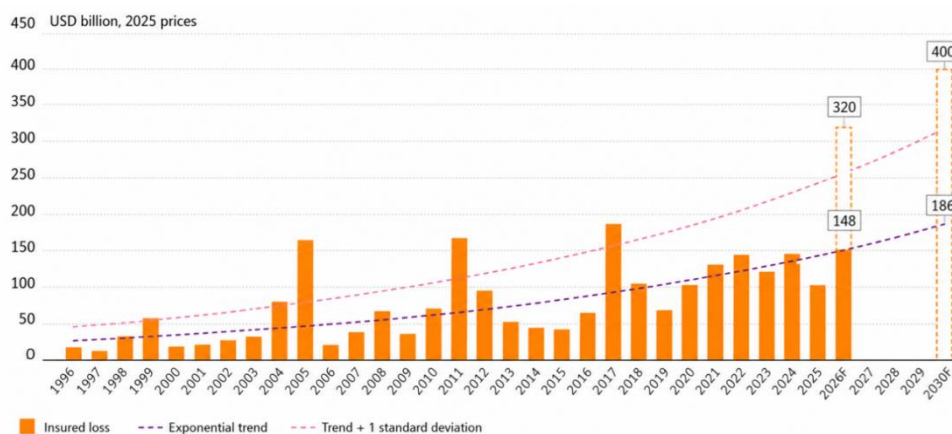
2. CLIMATE CHANGE AND NATURAL DISASTERS OVER THE PAST DECADE

Over the past decade, natural disasters have had significant consequences for human lives, the economy, and the environment, with climate change further amplifying the frequency and intensity of hydro-meteorological events in particular. According to the report by the Copernicus Climate Change Service (C3S) and the World Meteorological Organization (WMO) (2025), 2024 was the warmest year since the beginning of instrumental records, while the period

from 2015 to 2024 comprises the ten warmest years on record. These trends confirm that climate change is not merely a long-term threat but also a factor already influencing the dynamics of natural hazards and increasing the exposure of populations, infrastructure, and economic activities. When climatic threats interact with social and economic vulnerabilities, even relatively common natural hazards can escalate into large-scale disasters, leaving behind substantial material damage, loss of life, and long-term consequences for the living conditions of millions of people worldwide (Tešić, 2025).

The consequences of these changes are particularly evident in the growing significance of hydro-meteorological events, including storms, extreme precipitation, and floods. In Europe, which is warming faster than other continents, 2024 was the warmest year on record, while floods were the most widespread since 2013, resulting in at least 335 fatalities and affecting approximately 413,000 people (C3S & WMO, 2025). At the global level, EM-DAT recorded 393 natural disasters in 2024, causing 16,753 deaths, affecting 167.2 million people, and generating nearly USD 242 billion in economic losses (CRED, 2025). At the same time, the Swiss Re Institute indicates that insured losses from natural catastrophes remained above USD 100 billion in 2025, with increasing importance attributed to so-called secondary perils, including floods and severe storms (Swiss Re Institute, 2026).

Chart 1. Global Insured Losses from Natural Catastrophes: Trends and Projections



Source: Swiss Re Institute. (2026). *Natural catastrophes in 2025: The persistent rise of wildfire and storm risk* (sigma No. 1/2026). Swiss Re.

Chart 1 illustrates that insured losses from natural catastrophes, despite pronounced year-to-year fluctuations, follow a clear long-term upward trend. Although the 2025 value remained below the long-term trend, this does not indicate a reduction in risk. Rather, it reflects the inherent

volatility of catastrophic events and the absence of a major primary peril in that year. According to estimates by the Swiss Re Institute, if current trends continue, insured losses could reach approximately USD 148 billion in 2026 and USD 186 billion by 2030, while in a severe loss year

scenario, they could increase to around USD 320 billion (Swiss Re Institute, 2026). This confirms that contemporary challenges in insuring against catastrophic risks arise not only from the increasing frequency of extreme events but also from the growing concentration of exposures, the increasingly complex financial dynamics of catastrophic losses, and the need to ensure adequate financial protection amid intensifying risks and a pronounced protection gap.

In such an environment, floods are the most widespread type of natural disaster in the contemporary world. According to UNDRR data, they account for approximately 35–40% of weather-related disasters, while the number of recorded flood events has increased by 134% since 2000 compared to the previous two decades (UNDRR, 2025). Available estimates indicate that nearly 19% of the global population is exposed to some form of flood risk (Salhab & Rentschler, 2020), while global data confirm that floods account for about 44% of all recorded natural disasters, with landslides - classified within the same hydrological category - representing an additional 5% (UNDRR & CRED, 2020). Moreover, over the past decade, floods have been responsible for more than one-third of all disaster-related fatalities and, due to their frequency and spatial extent, have generated economic losses comparable to those caused by earthquakes or severe tropical cyclones (Swiss Re Institute, 2023).

These indicators confirm that flood risk management cannot be based solely on post-disaster recovery, but must also encompass more precise measurement, forecasting, and financial absorption of risk. Therefore, examining the possibilities for measuring flood risk represents a key prerequisite for selecting a sustainable insurance model.

3. POSSIBILITIES FOR MEASURING FLOOD RISK

From an insurance perspective, the key issue extends beyond identifying flood hazards to the reliable assessment of both the probability and severity of potential losses. Without such an assessment, it is not possible to adequately price premiums, limit risk accumulation, or design an appropriate system of reinsurance and public support. Unlike frequent, low-severity losses - where non-life insurance can rely on more stable historical experience - floods are characterised by pronounced spatial concentration and temporal simultaneity of losses, along with the potential for very high damages. Consequently, flood risk requires more sophisticated analytical approaches than those applied to standard high-frequency risks.

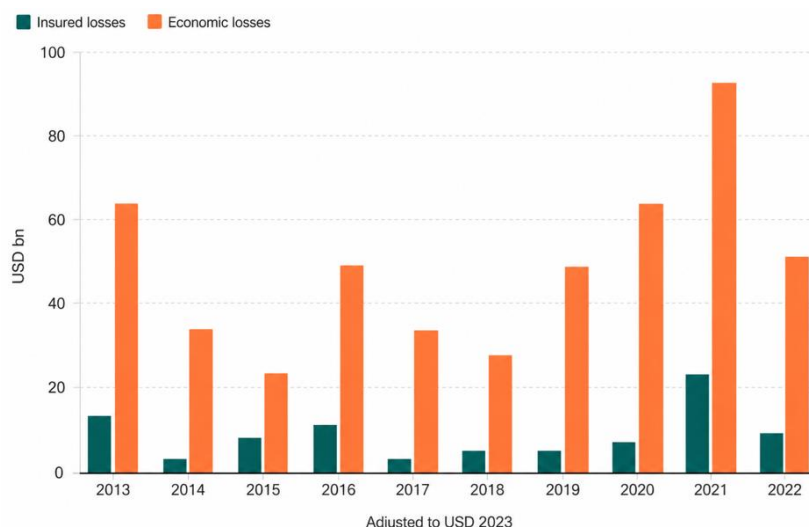
In the academic literature and international practice, flood risk is most commonly viewed as the result of the interaction between hazard, exposure, and vulnerability, with some approaches treating response and recovery capacity as a separate component, while others consider it an integral part of the broader concept of vulnerability (de Moel et al., 2015; Merz et al., 2010; UNISDR, 2017). Such an approach is based on the premise that a severe hazard does not necessarily lead to catastrophic outcomes if exposure and vulnerability are relatively low, whereas the most severe impacts arise when flood hazards coincide with a high concentration of population, assets, and infrastructure, combined with pronounced vulnerability of the affected area (Tešić, 2025). This implies that, in addition to the probability of flooding, it is necessary to assess the scale of exposed assets and population, as well as their sensitivity to different water depths, duration, and flow velocity. In practice, flood risk is measured by combining historical data, hydrological and hydraulic models, geographic information systems, satellite observations, and hazard and risk maps. Based on such assessments, it is possible to derive indicators such as the expected annual loss and loss exceedance probability curves, which are of particular importance for insurance, reinsurance, and capital management. The severity of flood risk is further illustrated in Chart 2, which, using a specific example of flood-related losses, demonstrates what has already been observed for catastrophic risks more broadly, i.e. a significant gap between total economic and insured losses. In other words, the chart confirms that a substantial portion of the financial consequences of floods remains outside the scope of insurance coverage. This pattern is particularly pronounced in countries with lower insurance penetration, but it is not negligible even in developed economies, where floods increasingly exceed the capacity of existing infrastructure and traditional risk assessment models (Tešić, 2025). An additional challenge is that climate change and urbanisation are reducing the reliability of statistical estimates, which is why contemporary approaches increasingly incorporate climate scenarios and early warning systems.

In this context, an additional methodological challenge for insurance is that historical flood data are often limited, heterogeneous, and insufficient to reliably assess rare but devastating events. Consequently, stochastic models and Monte Carlo simulations are increasingly applied in contemporary practice, while Bayesian approaches are used in situations of scarce or incomplete data to estimate loss distributions and quantify uncertainty (Paudel et al., 2013; Shahi et al., 2025). On this basis, loss exceedance probability curves are constructed, enabling a more precise

assessment of the likelihood of extreme losses and having direct applications in premium setting, risk accumulation management, reinsurance design, and capital requirement assessment. In addition, stochastic scenarios allow for stress-testing

portfolios under various assumptions-such as climate change, urbanisation, and increasing exposure-thereby further enhancing the understanding of the uncertainty inherent in flood risk.

Chart 2. Global Economic and Insured Flood Losses, 2013-2022 (in USD billions, adjusted to 2023 prices)



Source: Swiss Re. (2023). *Natural catastrophes in focus: Floods*. <https://www.swissre.com/risk-knowledge/mitigating-climate-risk/floods.html>.

Without such estimates, insurance premiums may be insufficient to cover the assumed risk or excessively high, thereby simultaneously undermining insurers' solvency and the affordability of insurance coverage. It follows that more accurate measurement of flood risk constitutes a necessary foundation for designing appropriate financial protection mechanisms, but is not sufficient in itself in the absence of an institutional and market framework capable of absorbing and distributing such risk. For this reason, the issue of risk measurement naturally leads to the question of selecting an appropriate insurance model, that is, the manner in which the financial burden of flood losses is allocated among the state, the private sector, and policyholders.

4. FLOOD INSURANCE MODELS

Insurance is one of the key instruments for transferring flood-related financial risk, particularly in countries with developed markets and strong institutional capacity. Once a portion of expected losses is reduced through risk identification, assessment, and mitigation measures, the remaining, residual risk can be managed through insurance, which spreads losses over time and across a large pool of participants, alleviates fiscal pressure, and facilitates faster recovery following a catastrophic event (Pollner, 2001). However, flood risk differs significantly

from standard insurable events, as it is characterised by spatially and temporally correlated losses, high loss severity, low frequency, and pronounced uncertainty. As a result, flood protection is not organised uniformly in practice, but rather through various institutional models that differ in the degree of state involvement, the role of the private sector, and the allocation of the financial burden of losses (Kočović et al., 2018). In this context, public, private, and public-private models of flood risk insurance can be distinguished.

The **public model of flood risk insurance** refers to an institutional arrangement in which the state plays a central role in organising and financing protection against flood-related losses. In practice, such an approach is most commonly implemented through dedicated funds, public insurers, or government programmes that provide relatively standardised coverage for flood risks of particular relevance to a given country (Kočović et al., 2018). Its main advantage lies in the fact that, owing to its fiscal capacity and ability to borrow, the state can assume a portion of the risk that the private market cannot cover at sustainable prices, especially in the context of large-scale and spatially concentrated losses (Cummins & Mahul, 2009).

Illustrative examples of such arrangements show that public models, or models with a dominant public role, are most commonly developed where the private market cannot independently provide widely accessible and affordable flood risk coverage. One of the most well-known examples is the *National Flood Insurance Program* (NFIP) in the United States, established in 1968, under which the risk is primarily borne by the federal programme, while private insurers participate in the sale and administration of policies without assuming the underlying risk (Michel-Kerjan, 2010; Grigg, 2019). A similar example of a dominant public role exists in Spain, where the *Consortio de Compensación de Seguros* provides coverage for so-called extraordinary risks, including floods, and is financed through a compulsory surcharge on premiums attached to certain private insurance policies (Paudel, 2012). By contrast, the experience of Hungary shows that the mere establishment of a publicly organised pool is insufficient to achieve the expected level of insurance penetration without appropriate political support and institutional mechanisms for implementation (Linnerooth-Bayer et al., 2005).

The particular importance of the public model becomes evident when it is necessary to ensure broad population coverage and to mitigate problems of adverse selection and voluntary underinsurance. This is often achieved through the mandatory or automatic inclusion of flood protection within certain types of property insurance policies, combined with the possibility of premium subsidies for socially or geographically vulnerable groups (OECD, 2026). In this way, the public model functions not only as a compensation mechanism but also as an instrument of social stability and fiscal protection, reducing the need for ad hoc budgetary assistance following catastrophic events.

At the same time, public programmes can also have a preventive function if their operation is based on compliance with building standards, flood protection measures, and appropriate land-use practices (Cummins & Mahul, 2009). However, this model also entails significant limitations. When premiums are maintained at politically acceptable levels rather than reflecting the actual level of risk, public programmes may become financially unsustainable and dependent on budgetary support or additional borrowing following major flood events (McAneney et al., 2016). Moreover, premiums that do not reflect the true level of risk can weaken price signals, lead to inefficient resource allocation, and reduce incentives for preventive action in high-risk areas (Cummins & Mahul, 2009). The public model can be particularly important where the private market

is unable to independently provide adequate flood protection, but its long-term effectiveness depends on an appropriate balance among social objectives, fiscal sustainability, and incentives for risk reduction.

The limitations of the public model highlight that broad access to flood protection does not necessarily go hand in hand with market efficiency and pricing discipline. For this reason, the private insurance model emerges as an alternative institutional approach, shifting the focus of protection from state fiscal support to market-based risk pricing and allocation.

The **private model of flood risk insurance** is based on the premise that the primary responsibility for risk assessment, underwriting, and risk transfer is borne by commercial insurers and reinsurers, while the role of the state is largely limited to the regulatory framework and, where necessary, support measures for particularly vulnerable groups. In such an approach, insurance is organised on a voluntary and market-based basis, with premiums determined in line with the assessed level of risk, and the sustainability of the system depending on the ability of the private sector to secure sufficient capital, ensure adequate diversification, and allocate losses efficiently (Paudel, 2012).

The main advantage of the private model lies in its ability to promote more accurate risk pricing, differentiate premiums according to the level of exposure and vulnerability, and develop more innovative products and more efficient claims management procedures. In this way, market-based insurance sends clear price signals regarding the actual level of risk, encouraging policyholders to invest in preventive measures, adopt more appropriate land-use practices, and enhance the resilience of their properties. An additional advantage is that the financial burden of flood losses is transferred to a greater extent from the state to insurers, reinsurers, and risk bearers, thereby alleviating the immediate pressure on public finances (Cummins & Mahul, 2009; Sheehan et al., 2023).

However, in the case of floods, the private model faces significant limitations. Due to the spatial and temporal correlation of losses, the potential for very large losses, and the presence of heavy-tailed loss distributions, private insurers must hold substantial capital, thereby increasing the cost of coverage and limiting its affordability (Kousky & Cooke, 2009). At the same time, high premiums and the voluntary nature of insurance uptake further hinder broader insurance penetration, particularly in high-risk areas. Under such conditions, the private market often fails to provide

widely accessible coverage, leaving a significant share of losses uninsured (Perazzini et al., 2022). Therefore, although the private model is important from the perspective of market discipline and pricing efficiency, in practice it rarely constitutes a sufficient solution on its own.

The limitations of the private model demonstrate that market discipline and pricing efficiency, while important, are often insufficient on their own to ensure broadly accessible and financially sustainable flood protection. When premium levels become a barrier to wider insurance penetration and potential losses exceed the capacity of the private sector, public intervention is no longer an exception but a necessary condition for system stability. Accordingly, a third approach to organising flood protection has emerged the public-private model which seeks to combine the advantages of market-based risk pricing with the institutional and financial support of the state.

The **public-private model of flood risk insurance** is based on the sharing of responsibilities between the state and the private sector, aiming to overcome the limitations of both purely public and purely market-based solutions. In such an arrangement, the state typically provides the institutional framework, regulatory support, and financial backing for the highest layers of catastrophic losses, while private insurers and reinsurers undertake risk assessment, policy distribution, premium collection, and claims management (Paudel, 2012). The essence of this model lies in combining the state's fiscal capacity and stabilising role with the market discipline, operational efficiency, and technical expertise of the private sector. In this sense, the public-private model of flood risk insurance can also be viewed as a form of hybrid public good, as its sustainability depends not only on market exchange, but also on collective action, institutional coordination, and the continued involvement of the public sector, given that market mechanisms alone cannot ensure affordable and long-term sustainable protection against catastrophic flood losses (Barry, 2025).

The main advantage of the public-private model lies in its ability to simultaneously enhance the accessibility of insurance, ensure more stable financing of large losses, and improve the allocation of risk among different stakeholders. Compared to a purely private approach, this model allows the most extreme losses to be covered with state support, thereby reducing the likelihood of insurer withdrawal from the market and abrupt premium increases following major flood events. At the same time, the involvement of the private sector contributes to more efficient policy distribution, more accurate risk assessment, and

faster claims settlement, while the public sector provides additional stability through reinsurance and fiscal support. The Cat-Nat system in France demonstrates that such an arrangement can combine the principles of national solidarity, broad population coverage, and rapid compensation by relying on the existing network of private insurers and a state guarantee for the highest layers of risk (de Marcellis-Warin & Michel-Kerjan, 2001). In this way, public-private arrangements can help reduce the protection gap and achieve a more balanced relationship between coverage affordability and the financial sustainability of the system (Perazzini et al., 2022).

However, the effectiveness of such a model depends on a clear allocation of responsibilities, a transparent financial framework, and carefully designed incentives. If the state assumes an excessive share of the burden without adequate premium differentiation and without linking insurance to prevention measures, the public-private model may lose market discipline and evolve into implicit fiscal subsidisation of high-risk areas. Conversely, when public support is primarily used to cover the highest layers of risk, while the private sector retains a central role in risk assessment, distribution, and claims management, it is possible to achieve a more sustainable and resilient system of flood protection (McAneney et al., 2016; Paudel, 2012).

CONCLUSION

In the context of climate change and increasing exposure of populations, infrastructure, and economic activities, catastrophic risks are becoming increasingly complex and economically significant. Their growing importance is reflected not only in the rising frequency and severity of extreme events, but also in the methodological difficulties of risk measurement, the spatial and temporal correlation of losses, high loss severity, and persistent institutional and market constraints, particularly visible through the protection gap between economic and insured losses.

Floods represent one of the most complex and economically significant forms of catastrophic risk. As systemic events, they can affect large geographical areas simultaneously and are among the most frequent natural hazards. Under such conditions, effective flood risk management cannot rely solely on post-disaster recovery, but requires improved risk measurement, more accurate forecasting, and timely financial absorption of losses.

The analysis highlights that the sustainability of flood insurance largely depends on the quality of hazard, exposure, and vulnerability assessments, as well as on the application of advanced analytical

approaches capable of capturing rare but severe events. Historical data, hydrological and hydraulic models, hazard and risk maps, and stochastic simulations constitute a critical basis for premium setting, risk accumulation management, and reinsurance design. Without such assessments, insurance coverage may become either financially unsustainable for insurers or inaccessible to policyholders.

The comparison of institutional models indicates that neither purely public nor purely private approaches provide a universally optimal solution. Public models enhance accessibility and social protection but are exposed to fiscal sustainability risks and weakened price signals. Private models promote market discipline and risk-based pricing but often fail to ensure affordable and widespread coverage in high-risk areas. Against this background, public–private arrangements emerge as the most balanced institutional response, combining the fiscal capacity and stabilising role of the state with the technical expertise and operational efficiency of the private sector. Such arrangements offer the greatest potential for reducing the protection gap, strengthening resilience, and establishing a more sustainable system of financial protection against flood losses.

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According to Petrović (2001), „The application of data warehouses can be of a limited nature, especially if they contain confidential data.“ (p. 201).

Petrović (2001) thinks that „the application of a data warehouse can be of a limited nature“ (p. 201).

He thinks that „the application of a data warehouse can be of a limited nature“, but it does not explain the possible consequences (Petrović, 2001, p. 201).

One author

Boškov (2005) compares access volume...

In another research on the extent of access (Boškov, 2005), it was established...

Two authors

Another study (Jovičić and Stavrić, 2011) concluded that there is a direct relationship between the range of management, on the one hand, and the number of organizational levels and the form of the organizational structure, on the other hand.

Three to five authors

The first in-text citation for the paper of more than three authors includes all of the names of the authors (e.g. Jovanov, Boškov, Perić, Tanasijević and Stakić, 2004).

Subsequent citations include only the first author's surname, followed by et al. and the year.

According to Jovanov et al (2004), when such a phenomenon occurs again, the media usually pay far more attention to it.

When such a phenomenon occurs again, the media usually pay far more attention (Jovanov et al, 2004).

Six or more authors

Yossarian et al. (2004) conclude that...

... not relevant (Yossarian et al, 2001).

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If the work is anonymous or the author is not listed, the in-text citation includes the title in the introductory phrase or the first two words, which should be put in brackets.

The book titles are italicized whereas the titles of papers and chapters are written in quotation marks.

A similar survey was conducted in a number of organizations that have full-time database managers („Limiting database access“, 2005).

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Organization or state entity as an author

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According to the data of the Institute of Statistics Republic of Srpska (2017),...

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Jovičić, M., and Mirković, M. (2017). Dostignuti nivo kvaliteta obrazovanja u funkciji razvoja Bosne i Hercegovine. *Novi Ekonomist*, 11(1), 92-99.

Starčević, V., Subotić, S., and Božičković, S. (2017). Učešće hartija od vrijednosti u razvoju tržišta kapitala Republike Srpske. *Novi Ekonomist*, 11(2), 40-47.

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Papers published in Conference Proceedings

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Books

Surname, initial of the author's first name. (year). The title of the book. Place: Publisher.

Jovičić, M. and Stavrić, B. (2011). Osnovi menadžmenta. Bijeljina: Fakultet poslovne ekonomije Bijeljina.

PhD dissertation

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Master thesis

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- [1] Dollar, D. and Kraay, A., (2001): Trade, Growth and Poverty. Washington: The World Bank, Development Research Group.
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