



International reserves, exchange rate and financial development Insights from CESEE region

Meri Papavangjeli
Bank of Albania

18th South-Eastern European Economic Research Workshop

Tirana, November 2024

The views expressed herein are those of the author and do not necessarily represent those of Bank of Albania.

Outline



Introduction

Literature review

Data & Methodology

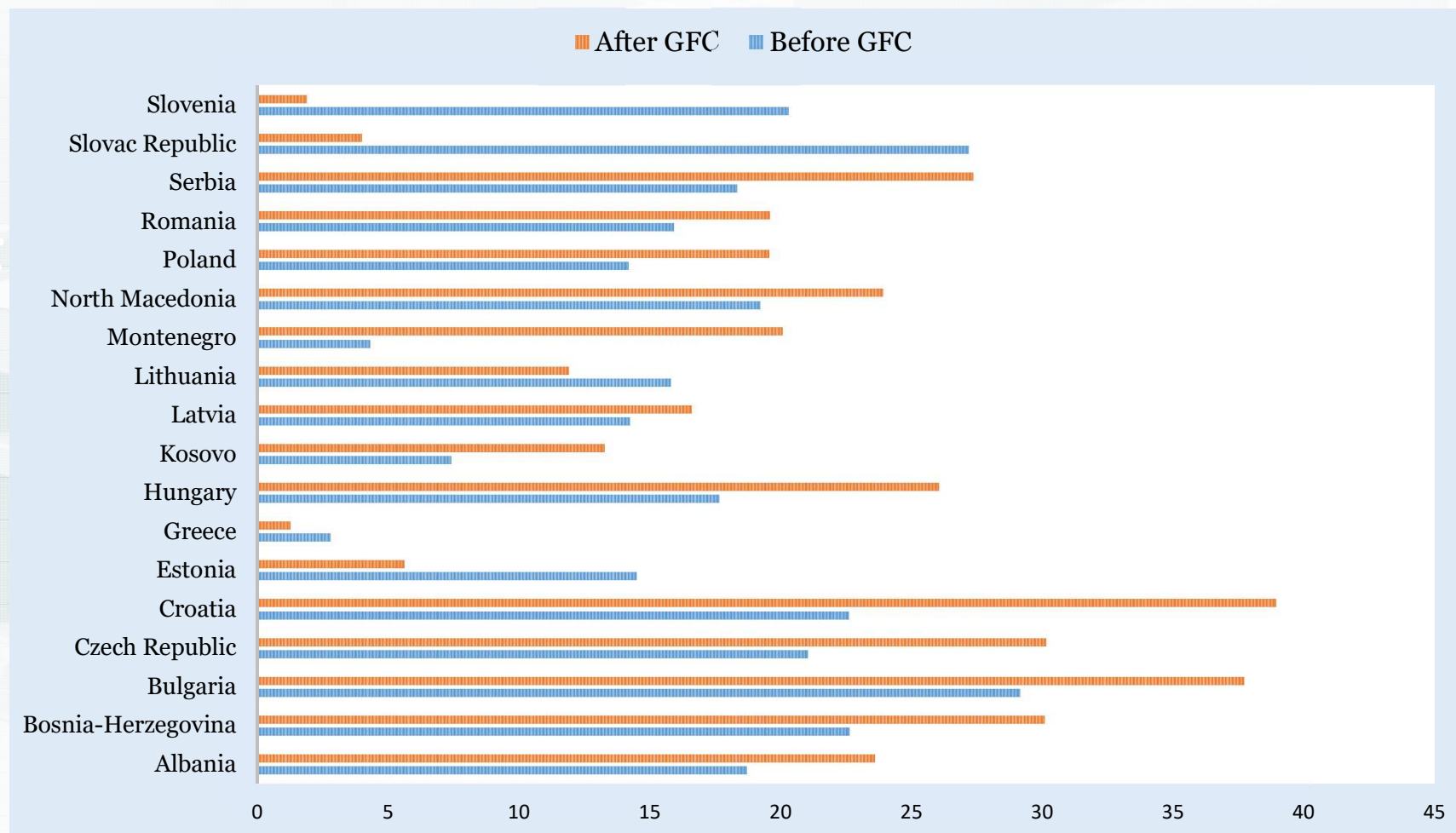
Empirical results

Final remarks

Motivation

- High financial integration and external economic shocks, like terms-of-trade (TOT) fluctuations, create vulnerabilities in emerging markets and developing economies.
- Reserves can act as a "buffer," helping countries stabilize their economies in response to TOT shocks and prevent excessive real exchange rate (RER) volatility.
- Gaps in Literature: Previous studies highlight the buffer effect but often overlook regional heterogeneity and the role of financial market development. In well-developed financial markets, countries might rely less on reserves, because advanced markets provide alternative mechanisms for absorbing shocks.

Figure 1. International reserves holding as % of GDP before and after GFC.



Source: Author's computations.

Objective & Research questions

➤ To analyze how international reserves help mitigate the impact of terms-of-trade shocks on the real exchange rate in the CESEE.

- How effective are international reserves in buffering the real exchange rate against terms-of-trade shocks?
- Does the buffer effect vary by the level of financial development across countries?
- How does financial openness influence the strength of the buffer effect?

Literature review

Buffer Effect of Reserves:

- Aizenman & Riera-Crichton (2008): International reserves mitigate terms-of-trade (TOT) shocks, especially in emerging economies, reducing RER volatility.
- Dominguez (2010): In countries with underdeveloped financial systems, reserves act as a substitute for private-sector underinsurance against external capital shortages.

Regional Heterogeneity:

- Aizenman et al. (2012): TOT shocks affect the RER differently across regions, with stronger buffer effects in Asia due to higher reserve holdings.
- Adler et al. (2018): Countries with high reserves can delay current account adjustments during TOT downturns, highlighting asymmetrical effects.

Role of Financial Development:

- Coudert et al. (2015): Financial market depth influences how TOT shocks translate into exchange rate volatility.

Financial openness & capital control:

- Chinn & Ito (2006): The KAOPEN index measures financial openness, showing the complementarity between reserves and capital controls.
- Steiner (2017): Moderation of capital flows enhances the effectiveness of reserve buffers.

For Albania: Dushku, Shijaku (2017); Shijaku (2012)



Methodology and Data

➤ **Threshold Panel regression analysis (Hansen, 1999)**

➤ **Countries:** Albania (AL), Bosnia-Herzegovina (BH), Bulgaria (BG), Czech Republic (CZ), Croatia (CR), Estonia (ES), Greece (GR), Hungary (HU), Latvia (LA), Lithuania (LI), North Macedonia (NM), Poland (PO), Romania (RO), Serbia (SR), Slovak Republic (SK), Slovenia (SL)

➤ **Dependent variable:** real effective exchange rate (REER)

➤ **Independent Variables:** international reserves (RES), effective terms of trade (TOT) [Aizenman and Riera-Crichton (2008)], capital account openness (KAOPEN) [Chinn and Ito (2006)], GDP per capita (GDPPK), government expenditure as % of GDP (GOV)

➤ **Threshold Variable:** financial development indices [Svirydzenka (2016)]

➤ **Data sources:** IMF, World Bank, Eurostat, National Statistical Offices for CESEE countries

➤ **Frequency:** annual data for 2000-2021

Financial Development Measures & Capital Account Openness

Characteristics of financial markets [[Svirydzenka \(2016\)](#)]:

- depth (size and liquidity of markets),
- access (ability of individuals and companies to access financial systems),
- efficiency (ability of institutions to provide financial services at a low cost and with sustainable revenues).

FD - Aggregated financial development index

FI – financial institutional index

FM – financial market index

Capital account openness (KAOPEN index) [[Chinn and Ito \(2002\)](#)]:

- Measures openness of the capital account.
- Based on data from IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions (AREAR).
- Higher value = fewer capital controls; lower value = stricter controls.

Panel regressions with interaction terms:

$$rer_{i,t} = \mu_i + \beta_1 etot_{i,t} + \beta_2 res_{i,t-1} + \beta_3 etot_{i,t} \times res_{i,t-1} + \alpha' \mathbf{x}_{i,t} + u_{i,t},$$

Panel Threshold Regression [in line with [Aizenman et al. \(2012\)](#)]:

$$rer_{i,t} = \mu_i + \theta_1 etot_{i,t} \times res_{i,t-1} I(k_{i,t-2} \leq \gamma) + \theta_2 etot_{i,t} \times res_{i,t-1} I(k_{i,t-2} > \gamma) + \alpha' \mathbf{x}_{i,t} + u_{i,t}.$$

μ_i - country-specific fixed effects

Threshold Variable (k): Financial development indexes (FD, FI, FM) and KAOPEN index of financial openness.

Indicator Function I(.): Distinguishes between regimes based on the estimated threshold level γ

Use Hansen's (1999) threshold regression to estimate γ and interpret RER stability differences across financial development & financial openness levels.

Empirical results (1)

- Baseline Regression Results:
- **Dependent Variable:** Real Effective Exchange Rate (RER)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
eTOT	0.312***	0.052	6	0.000
Res(t-1)	0.0125**	0.045	2.78	0.006
eTOT × Res(t-1)	-0.023**	0.019	-2.37	0.018
GDPK	0.215***	0.03	7.17	0.000
Gov	0.145***	0.04	3.63	0.000
Constant	0.567**	0.25	-2.27	0.024

Note: Bootstrapped standard errors in parentheses where 10,000 replications have been used. Fixed effects are included. ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Empirical results (2)

- Regional Baseline Regression Results:
- **Dependent Variable:** Real Effective Exchange Rate (RER)

Variable	East Europe	Baltic States	Balkans
eTOT	0.275***	0.348***	0.310***
Res(t-1)	0.110**	0.135***	0.095**
eTOT × Res(t-1)	-0.021***	-0.025***	-0.034**
GDPPK	0.220***	0.240***	0.190***
Gov	0.140***	0.160***	0.125**
Constant	1.050***	1.110***	0.420**

Note: Bootstrapped standard errors in parentheses where 10,000 replications have been used. Fixed effects are included. ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Empirical results (3)

- Threshold Panel Regression Results:
- **Dependent Variable: Real Effective Exchange Rate (RER)**
- **Threshold Variables: Financial Development Indicators**

Variable	FD	FI	FM
eTOT	0.290***	0.250***	0.220***
Res(t-1)	0.100***	0.070**	0.045
eTOT × Res(t-1)	-0.021*	-0.009*	-0.024**
I(k≤y)			
eTOT × Res(t-1)	0.067	0.012	0.034
I(k>y)			
GDPPK	0.210***	0.230***	0.250***
GOV	0.130**	0.120**	0.100*
Constant	-0.520***	-0.460**	-0.390**

Note: Bootstrapped standard errors in parentheses where 10,000 replications have been used. Fixed effects are included. ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Empirical results (5)

- Threshold Panel Regression Results:
- **Dependent Variable: Real Effective Exchange Rate (RER)**
- **Threshold Variables: Financial Openness (KAOPEN)**

Variable	KAOPEN
eTOT	0.118***
Res(t-1)	0.056***
eTOT × Res(t-1)	0.006*
I(k≤γ)	
eTOT × Res(t-1)	-0.011*
I(k>γ)	
GDPPK	0.677***
GOV	0.125**
Constant	0.812***

Note: Bootstrapped standard errors in parentheses where 10,000 replications have been used. Fixed effects are included. ***, **, * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Summary of results

- The coefficient on the interaction term between ex ante international reserves, res , and effective terms of trade, $etot$, is negative and significant in almost all the regressions.
- In most regressions, the buffer-effect coefficient fluctuates around the baseline $[-0.02, -0.035]$.
- The buffer coefficient is not sensitive to the use of lagged values for the explanatory variables.

Final remarks

This paper provides empirical evidence for the buffer effect - the fact that holding international reserves may help stabilize the real exchange rate after terms-of-trade shocks.

International reserves act as a buffer against volatility and appreciation following terms-of-trade shocks, particularly in countries with weaker financial institutions.

Optimal reserve policies may vary by financial openness; higher openness offers the strongest buffer effect, suggesting a strategic mix of reserves and capital control measures.

Several countries could use international reserves as a short-term substitute for sound financial institutions.

Long-term investment in financial institutions and market depth may reduce reliance on reserves for stability.

References

- Ahmed, R., Aizenman, J., Saadaoui, J., & Uddin, G. S. (2023). On the effectiveness of foreign exchange reserves during the 2021–22 U.S. monetary tightening cycle. *Economics Letters*, 233, 111367.
- Aizenman, J., Edwards, S., & Riera-Crichton, D. (2012). Adjustment patterns to commodity terms of trade shocks: The role of exchange rate and international reserves policies. *Journal of International Money and Finance*, 31(8), 1990–2016.
- Aizenman, J., & Hutchison, M. M. (2012). Exchange market pressure and absorption by international reserves: Emerging markets and fear of reserve loss during the 2008–2009 crisis. *Journal of International Money and Finance*, 31(5), 1076–1091.
- Aizenman, J., & Jinjara, Y. (2020). Hoarding for stormy days—Test of international reserves adjustment providing financial buffer stock services. *Review of International Economics*, 28(3), 656–675.
- Aizenman, J., Jinjara, Y., & Park, D. (2015). Financial development and output growth in developing Asia and Latin America: A comparative sectoral analysis. *Working Paper 20917*, National Bureau of Economic Research.
- Aizenman, J., & Riera-Crichton, D. (2008). Real exchange rate and international reserves in an era of growing financial and trade integration. *The Review of Economics and Statistics*, 90(4), 812–815.
- Al-Abri, A. (2013). Real exchange rate volatility, terms-of-trade shocks, and financial integration in primary-commodity exporting economies. *Economics Letters*, 120(1), 126–129.
- Alberola, E., Erce, A., & Serena, J. M. (2016). International reserves and gross capital flows dynamics. *Journal of International Money and Finance*, 60, 151–171.
- Arslan, Y., & Cantú, C. (2019). The size of foreign exchange reserves. In B. for International Settlements (Ed.), *Reserve management and FX intervention* (Vol. 104 of BIS Papers chapters, pp. 1–23). Bank for International Settlements.
- Aslam, A., Beidas-Strom, S., Bems, M. R., Celasun, O., Çelik, S. K., & Koczan, Z. (2016). Trading on their terms? Commodity exporters in the aftermath of the commodity boom. *IMF Working Papers 2016/027*, International Monetary Fund.



**Thank you
for
Your attention!**

Meri PAPAANGJELI
mpapavangjeli@bankofalbania.org

APPENDIX

Table A1. Descriptive Statistics.

	Obs.	Mean	Median	Maximum	Minimum	Std. Dev.
REER	347	4.557	4.590	5.094	3.966	0.131
TO	347	4.665	4.780	5.990	2.884	0.686
TOT	347	4.303	4.604	6.501	-0.934	1.523
ETOT	347	20.80	21.871	36.241	-3.603	9.008
RES	347	8.793	8.720	12.061	5.277	1.463
GOV	347	3.701	3.724	4.098	3.340	0.166
GDPPK	347	9.969	10.08	10.626	8.705	0.418