TEFMJ TRENDS IN ECONOMICS, FINANCE AND MANAGEMENT JOURNAL

Economic Volatility in North Macedonia: ARDL Modelling of the Effects on Economic Growth

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DOI: https://doi.org//10.69648/FDCP2495

Trends in Economics, Finance and Management (TEFMJ), 2025; 7(1): 55-65

ijtns.ibupress.com

Online ISSN: 2671-3365

Application :08.05.2025

Revision :30.05.2025

Acceptance :21.06.2025

Publication :27.06.2025

Kondri, B., & Berisha, N. (2025). Economic volatility in North Macedonia: ARDL modelling of the effects on economic growth. Trends in Economics, Finance and Management Journal, 7(1), 55-65. https://doi.org//10.69648/FDCP2495

Blerta Kondri and Nimete Berisha

Mother Teresa University, Skopje, Republic of North Macedonia

University of Pristina, Republic of Kosovo

Correspondence concerning this article should be addressed to Nimete Berisha,

Email: nimete.berisha@uni-pr.edu

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Blerta Kondri and Nimete Berisha

Abstract

The purpose of this research is to investigate the economic volatility of North Macedonia over the period 1998-2023. The study employs an Autoregressive Distributed Lag (ARDL) model that intends to assess the dynamics of economic volatility over economic growth. Economic volatility is measured as the standard deviation of GDP growth over a rolling window. The empirical results reveal that government budget balance, private sector credit, current account balance, money supply, and economic volatility significantly influence GDP growth, though with varying lag structures and directions. Notably, economic volatility stands out as a critical variable, while it may temporarily correspond with higher growth, its lagged effects are profoundly negative, showing the destabilizing consequences of persistent fluctuations. To mitigate volatility, the government needs to promote sound institutional frameworks, counter-cyclical policies, and structural reforms that enhance resistance to shocks.

Keywords: Economic volatility, GDP growth, Shocks, ARDL

Introduction

North Macedonia has had a difficult pathway with numerous economic challenges characterized by transition, reforms, and resilience. As a newly sovereign state emerging from the breakup of Yugoslavia, the country faced significant political, institutional, and economic transformations. Over more than three decades, macroeconomic stability has been shaped by internal reform efforts and external shocks, while economic policies have played a crucial role in guiding the country through various periods of turbulence and recovery.

After the independence, North Macedonia faced a severe economic downturn. The transition from a centrally planned economy to a market-based system was marked by declining industrial output, hyperinflation, and rising unemployment. The Greek trade embargo (1994-1995) further complicated the economic environment. In response, the Government initiated market liberalization policies, launched privatization programs, and introduced a new currency, the denar, in 1992. With support from the International Monetary Fund and World Bank, early stabilization programs aimed to control inflation and restore fiscal order. By the late 1990s, inflation had begun to fall, and the foundations for a more stable macroeconomic environment were laid.

The early 2000s brought new challenges, the ethnic conflict that threatened both political and economic stability. However, the Ohrid Framework Agreement helped restore peace and peeved the way for renewed economic development. Supported by international donors, the government implemented reforms aimed at fiscal discipline, strengthening the financial sector, and improving governance.

The Central Bank maintained a fixed exchange rate regime, anchoring inflation expectations and building public confidence. During this period, North Macedonia recorded steady economic growth, declining inflation, and modest improvements in employment, though structural weaknesses persisted. However, this progress was disrupted by the global financial crisis (2008-2009) when the country faced reduced export demand, declining foreign direct investment, and slower growth. To mitigate the negative effects of this crisis, the government adopted counter-fiscal policies, increasing public investment and introducing tax incentives to stimulate the economy, which measures also contributed to rising public debt levels.

Between 2015 and 2017, the country experienced a period of political instability stemming from corruption scandals and governance concerns. During this period, macroeconomic indicators remained stable, with modest growth and low inflation. Reforms were influenced by the broader objective of European Union accession.

Institutions began aligning more closely with EU standards, and economic policy focused increasingly on transparency, the rule of law, and competitiveness.

As a result of COVID 19 Pandemic, North Macedonia witnessed another unprecedented economic shock. Lockdowns and disruptions in global supply chains led to a contraction in GDP in 2020. The government responded with emergency fiscal packages, including wage subsidies, liquidity support for businesses and increased health spending while the central bank maintained financial stability. Recovery began in 2021, aided by global reopening and ongoing fiscal support.

As of the 2023-2025 period, North Macedonia faced with the similar challenges as other regional and European countries. The country confronted inflation pressures in 2022 due to energy and food price shocks. Economic growth has resumed, although at a moderate pace. Policymakers were focused on consolidating public finances, advancing digital and green transitions and strengthening the resilience of the economy.

The period of more than three decades from 1991 to 2025 reveals that the macroeconomic stability of North Macedonia has evolved through phases of deep crisis, gradual reform, and cautious recovery. While external shocks and political instability have posed recurrent challenges, sound economic policies have played a central role in navigating these periods. Prudent fiscal and monetary policies were essential in maintaining economic stability and economic growth for the country. Considering these enlightenments, the purpose of this study is to empirically analyze macroeconomic volatility in North Macedonia by reflecting the most important macroeconomic indicators and analyzing the changes they have undergone over the years as a result of various fluctuations that the country has experienced since its independence until today.

Literature Review

Several scientific studies related to the impact of macroeconomic volatility on economic growth examine economic growth from the perspective of various influencing factors. Large number of scholars date back to the initial stages of economic and political transformation for Eastern European countries studied the causes of the initial recession, the advantages and drawbacks of gradual adjustment and the role played by the liberalization and democratization, providing useful insights about the economic condition in these countries (Campos & Coricelli, 2002; Popov, 2007; Lazarov & Simeonovski, 2023; Bilenko, 2024).

The problem of economic growth and macroeconomic stability is particularly important in moments of recession and economic downturn, as well as post-crisis periods, and there are many such situations that countries have gone through, including North Macedonia. Some authors attributed the initial recession to weakened consumer demand (Blanchard et al., 2010), although most researchers attribute the decline in production to supply-side factors. The collapse of the previous central planning system brought about a change in the reallocation of resources (Popov, 2007).

Regarding the connection between business cycles and economic growth, the study of Fatas (2002) reveals that characteristics of the business cycle are not independent of the growth process, and the volatility associated with the business cycle is negatively related to long-term growth rates. Based on a cross-country analysis of the relationship between macroeconomic volatility and long-run economic growth, Hnatkovska and Loayza (2005) have found that macroeconomic volatility and long-run economic growth are negatively related. The analysis is conducted for poor and institutionally underdeveloped countries, and this is due to recessions rather than normal cyclical fluctuations. However, according to Martinez and Sachez–Robles (2009), through panel data analysis for 13 countries, macroeconomic stability accompanied by low inflation rates and a low level of public deficit are positively related to economic growth. Furthermore, Imbs (2002) confirmed that growth and volatility are negatively related across countries. In fact, he argued that this relationship can be positive or negative depending on the mechanisms that transmit it. Also, Lazarov and Simeonovski (2023), using the ARDL model and quarterly data for the period 2007-2022, find that high GDP volatility has a negative impact on economic growth at the level, but positive in the time lag.

Methodology and Data

The aim of this research article is to analyze the volatility and shocks to economic growth. For this purpose, first a multiple regression model is used, estimated by OLS, and second, an Autoregressive Distributed Lag (ARDL) model is applied. To estimate the response of economic growth to volatility and shocks related to three significant crises, the econometric model is specified as in the following form:

$$ECONG_t = \beta_0 + \beta_1 INFLATION + \beta_2 M2 + \beta_3 CREDITS + \beta_4 GOV + \beta_5 CAB + \beta_6 FDI + \beta_7 VOLATILITY + \delta_1(2001) + \delta_2(GFCRISIS) + \delta_3(COVID19) + \varepsilon_t$$

Where the dependent variable is economic growth or GDP growth and as independent variables are inflation rate, the growth of monetary aggregate M2, bank and savings houses credits to the private sector growth rate (CREDITS), government budget balance (GOV), current account balance (CAB), foreign direct investment (FDI) and volatility which refers to economic growth volatility. It was calculated from the standard deviation of the GDP growth rate over a moving time window. Also, three dummy variables are included in the model considering the 2001 armed conflict, the global financial crisis, and recently the COVID-19 crisis, respectively. This relationship is estimated through OLS, whereas the effect of volatility is estimated using Autoregressive Distributed Lag (ARDL) model which is an econometric approach used to analyze the dynamic relationship between a dependent variable and one or more independent variables in both the short run and long run, when the used variables are of mixed order of integration (i.e., I(0) or I(1), but not I(2)). It combines lags of the dependent variable (autoregressive terms) and current and lagged values of the independent variables (distributed lag terms) to capture temporal dynamics. The ARDL model is particularly useful in small samples and allows for estimating both short-term fluctuations and long-run equilibrium relationships through the bounds testing approach to cointegration developed by Pesaran et al. (2001). Once a long-run relationship is established, the model can be reformulated into an Error Correction Model (ECM) to examine how quickly deviations from long-run equilibrium are corrected. However, in this study, the standard ARDL model will be used, not yet reparametrized into its error correction form (ECM). Thus, the coefficients reflect short-run dynamic relationships rather than distinguishing explicitly between short-run and long-run effects. This type of model is adequate for this analysis since the sample size is small as well as the variables have mixed order of integration (Table 1). In the ARDL model, the dummy variables are excluded from the model due to collinearity problems.

The annual data are used and are provided from National Bank of Republic of North Macedonia and State Statistical Office for the time spin 1998-2023.

The table below displays the results of the stationarity test, where the null hypothesis (H_0) is that the variable has a unit root (i.e., non-stationary). The alternative hypothesis (H_1) is that the variable is stationary. If the test statistics are more negative than the critical value, we reject the null hypothesis (i.e., the series is stationary). The results clearly show that for GDP growth, inflation, current account balance, government budget balance, M2 and economic growth volatility, we reject the null hypothesis of non-stationarity, meaning that they are stationary at levels,

i.e. I(0) whereas for credits and FDI we fail to reject the null hypothesis at level, but it was rejected at the first difference, so the order of integration for these variables is I(1). This test justifies the application of the ARDL model for these variables and the number of measurements.

Table 1

Stationarity Test based on DF-GLS

Variables	**Optimal Lag**	**DF-GLS**	**5% Critical Value**	**Decision**	**Order of integration**
GDPG	2	-3.614	-2.927	Reject H_0 at 5%	I(0)
INFLATION	1	-3.743	-2.946	Reject H_0 at 5%	I(0)
M2	2	-5.041	-3.498	Reject H_0 at 1%	I(0)
CREDITS	2	-1.026	-2.946	Fail to reject H_0	I(1)
D_CREDITS	**2**	**-3.566**	**-3.033**	Reject H_0 at 5%	
GOV	1	-3.952	-3.452	Reject H_0 at 5%	I(0)
CAB	2	-4.395	-3.498	Reject H_0 at 1%	I(0)
FDI	4	-1.740	-3.014	Fail to reject H_0	I(1)
D_FDI	**2**	**-4.031**	**-2.950**	Reject H_0 at 1%	
VOLATILITY	1	-5.312	-3.505	Reject H_0 at 1%	I(0)

Empirical Estimation

The OLS regression results are displayed in Table 2, indicating that several macroeconomic and shock-related variables (dummy variables) have statistically significant impacts on GDP growth. Notably, M2 monetary aggregate growth, credits, and foreign direct investment (FDI) have positive and statistically significant coefficients, suggesting that increased money supply, higher lending activity, and FDI inflows are associated with stronger economic growth. The current account balance shows a negative effect on growth, significant at the 10% level, indicating that smaller deficits may correspond with lower growth, possibly reflecting weak domestic demand. The COVID-19 and 2001 conflict dummy variables have strong negative and significant impacts, pointing out the sharp contractions caused by these crises. However, variables like inflation, government budget balance, and volatility are statistically insignificant in this specification, suggesting limited explanatory power for GDP growth within the sample period.

Table 2

OLS regression results

Variable	Coefficient	Robust Std. Error	t-Statistic	P-Value	Significance
INFLATION	-0.1048	0.0798	-1.31	0.214	Not significant
GOV	0.2720	0.3646	0.75	0.470	Not significant
CAB	-0.2500	0.1208	-2.07	0.061	*
M2	0.0836	0.0305	2.74	0.018	**
D_CREDITS	0.8147	0.3189	2.55	0.025	**
D_FDI	0.3350	0.1371	2.44	0.031	**
VOLATILITY	0.5583	0.4584	1.22	0.247	Not significant
Conflict 2001 Dummy	-9.0674	1.9208	-4.72	0.000	***
Global Financial Crisis	-1.7117	1.1572	-1.48	0.165	Not significant
COVID-19 Dummy	-5.8052	2.0775	-2.79	0.016	**
Constant	2.9874	1.4191	1.11	0.177	-

Note: Significance levels: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; Robust standard errors used to correct for heteroskedasticity.

Overall, the OLS model highlights the importance of monetary conditions, external investment, and crisis events in explaining growth fluctuations. The coefficient for economic volatility (measured as the standard deviation of GDP growth) is positive (0.558) but not statistically significant (p = 0.247), indicating that while there appears to be a positive association between volatility and economic growth, this relationship is not robust enough to be considered reliable in a statistical sense. This could suggest that in periods of higher growth fluctuations, GDP growth may sometimes increase, perhaps due to rapid recoveries following downturns, but this effect is not consistent across the sample.

The results of the standard dynamic ARDL model are presented in Table 3, considering a maximum of 2 lags, based on the optimal number of lags presented in Table 1, as well as bearing in mind the small number of observations. Basically, the ARDL

(2,1,1,2,2,2,1) model reveals a strong and statistically significant dynamic relationship between GDP growth and key macroeconomic variables, excluding FDI and dummy variables from the model due to collinearity.

Table 3

ARDL model results

Variable	Coefficient	t-Statistic	P-Value	Significance
GDP Growth (L1)	0.1067	1.34	0.250	Not significant
GDP Growth (L2)	0.1153	1.93	0.079	*
INFLATION (current)	–0.0407	–1.82	0.143	Not significant
INFLATION (L1)	0.0461	2.08	0.106	*
GOV (current)	1.1478	21.38	0.000	***
GOV (L1)	–0.7932	–8.00	0.001	***
CREDITS (current)	–0.0408	–1.77	0.151	Not significant
CREDITS (L1)	0.3327	10.13	0.001	***
CREDITS (L2)	0.1013	4.42	0.011	**
CAB (current)	0.0516	1.03	0.360	Not significant
CAB (L1)	0.2983	7.47	0.002	***
CAB (L2)	0.3449	6.20	0.003	***
M2 (current)	-0.1195	–4.17	0.014	**
M2 (L1)	–0.2116	–8.66	0.001	***
M2 (L2)	–0.1301	–5.34	0.006	***
VOLATILITY (current)	0.9167	5.02	0.007	***
VOLATILITY (L1)	–1.3928	–9.18	0.001	***
Constant	7.3566	11.65	0.000	***

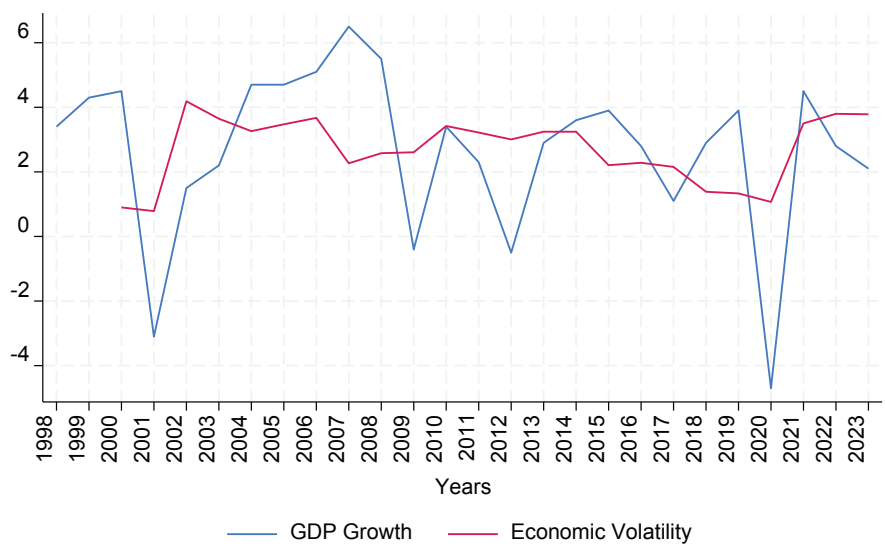
Note: Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

The results disclose that government budget balance (GOV) has a highly significant and positive immediate effect on growth, while its lagged value has a strong negative coefficient, suggesting short-run stimulus but possible long-term fiscal burden. Credit to the private sector significantly contributes to growth with lagged effects, emphasizing delayed but positive financial deepening. The current account balance positively affects GDP growth with significant lags, indicating that external balance improvements translate into growth over time. Unlike the OLS results, the coefficient of M2 growth in this model has consistently negative and significant coefficients, implying inefficient liquidity effects.

In the ARDL model, economic volatility emerges as a crucial determinant of economic performance, with both its current and lagged values being statistically significant. The positive and significant coefficient on current volatility (0.917, p = 0.007) suggests that in the short run, periods of heightened growth variability may coincide with or even stimulate higher growth, possibly due to post-shock recoveries or cyclical rebounds. However, the large negative coefficient on its lagged value (–1.393, p = 0.001) highlights the destabilizing effect of prolonged or persistent volatility on future growth. This asymmetric dynamic implies that while the economy may temporarily benefit from volatile periods, such fluctuations can weaken longer-term growth trajectories by increasing uncertainty, discouraging investment, and weakening macroeconomic planning. Additionally, Graph 1 illustrates the relationship between GDP growth and economic volatility from around 1998 to 2023. GDP growth exhibits significant fluctuations, with notable downturns in 2001, the 2008–2009 global financial crisis, and a sharp contraction in 2020 due to the COVID-19 pandemic, followed by a strong rebound in 2021. In contrast, economic volatility shows a smoother pattern, with increases during periods of uncertainty such as the early 2000s and the pandemic years. While volatility generally rises during economic downturns, it remains relatively stable in other periods, indicating that while growth is cyclical and shock-sensitive, volatility is more persistent and may reflect broader macroeconomic uncertainties.

Graph 1.

Relationship between GDP growth and Economic Volatility



These findings expose the importance of managing economic volatility not only as a symptom but as a key structural factor that can shape both the resilience and the sustainability of growth. Based on these results, the government should improve fiscal discipline, strengthen the institutions, and diversify the economy to reduce vulnerability to shocks. Overall, the graph highlights an inverse relationship between growth and volatility in times of crisis, with volatility serving as an indicator of underlying economic instability.

Conclusions

In this research paper, the effects of economic volatility on economic growth using OLS and ARDL estimation models were examined. The findings from both models are quite different; however, robust results are considered those obtained through the ARDL model, which reveal that government budget balance, private sector credit, current account balance, money supply (M2) growth, and economic volatility significantly influence GDP growth, though with varying lag structures and directions. Notably, economic volatility stands out as a critical variable, while it may temporarily correspond with higher growth, its lagged effects are profoundly negative, showing the destabilizing consequences of persistent fluctuations. Regarding the dummy variables included in the OLS model, one can conclude that the 2001 conflict and COVID-19 dummy variables have strong negative and significant impacts, pointing out the sharp contractions caused by these crises. The results from both models highlight the importance of macroeconomic stability, effective fiscal management, and financial development in supporting sustained economic performance. Furthermore, the evidence reinforces the need for policymakers to not only stimulate growth but also to mitigate volatility through sound institutional frameworks, counter-cyclical policies, and structural reforms that enhance resilience to shocks.

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