



Macroeconomic Determinants of Stock Price: Vector error Correction Model (VECM) Evidence from Nepal.



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ABSTRACT

Research paper inspects macroeconomic variables effect on stock exchange market price in Nepalese economy employing VECM methodology consisting data from 1994 to 2022. Main independent variables economic output (GDP), Nepalese consumer price index, Treasury bill rates, and broad supply money; while Nepalese stock exchange price as the dependent variable. Investigation found positive relationship between interest rate of treasury bill as well as consumer price index with Nepalese stock exchange prices in short run, whereas GDP and broad supply money have negative effect. In long run, economic output, broad supply money, and rate of treasury bill exhibit positive effect on stock prices, while Nepalese consumer price index shows significant negative effect. The findings recommend the government should stimulate economic activities through fiscal and monetary policies. Central bank (NRB) should carefully manage the money supply using monetary policies that macroeconomic stabilize through price level and interest rates of Nepal's economy.

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Introduction:

Capital market is market where long-term debt securities are traded (Phuyal,2016). The stakeholders of market include different institutions like: mutual funds, agents, brokers, dealers, borrowers, long-term debt and equity capital. Capital market is not a compact unit but consists of two major parts: primary market and secondary market (Shrestha, 2014). Capital market plays significant role for achieving economic growth. Capital

market is considered as a mirror for the economic activities and necessarily to study the macroeconomic indicators of an economy (Park, 2018).

Stock market helps to obtain capital and create efficient market business transactions as well as helps to stimulate economic development. Stock market also helps to maintain alternative debt financing. Adjasi and Biekpe (2009) examined that funds generated in the stock

market can be channelized to projects that help stimulate investment activities and lead to the promotion of sustainable investment and economic growth as well as development. According to Chen, Roll and Ross (1986), there is a long-run economic equilibrium relationship between stock prices and macroeconomic variables.

Primary market issues new long-term securities from general public to raise fund in an economy. In contrast, the secondary market, commonly referred to stock exchange market, where long-term financial instruments are traded. A well- functioning stock market is crucial for modern market economy which generates liquidity in primary market. Capital market is broadly divided into three categories: companies issuing securities and includes new companies, existing unlisted companies and the existing listed companies (Naik & Padhi, 2012).

Stock exchange market plays a vital contribution on country's financial system through effectively channeling resources. Government and industries raise liquidity for the new investments. In developing economies, stock exchange market is sensitive to various macroeconomics factors: economic output, broad money supply, interest rates, inflation and inflow remittances. Increase demand for financial product indicates development of stock exchange market. Thus, macro-economic variables tend to affect stock market developments (Pant, 2000).

Theoretically, integration among stock exchange and main macro variables economic

output (GDP) which stimulate savings rate and investment rate in economy which enhances stock market activity (Alam,2020). An increase in overall income enhances financial intermediation by the stock exchange market further promoting both economic activities and stock exchange market development. This reciprocal interaction suggests that stronger economic performance encourages greater participation in financial markets, which then supports ongoing economic advancement and market expansion

The organized and fully developed Nepal stock exchange (NEPSE) started in 1993 and trading activities in 1994. Although still evolving, Nepal's stock market has experienced significant growth since its inception. It was established to provide an alternative capital mobilization channel outside traditional banking sector, with aim of promoting country's economic growth and development (Shrestha and Subedi,2014). Purpose of reach is discovery relationship among macro variables and stock exchange price of Nepal for time period 1994 to 2022.

2. Literature Review

Review consists of theoretical and empirical.

2.1. Theoretical Review of Literature

Theoretical review reviews show theoretical concept of macro variables and stock exchange price. The commonly used theoretical review as follows.

Efficient Market Hypothesis (EMH)

Fama (1981) presented term "Efficient Market" for information. Efficient-market

hypothesis (EMH) claims financial market has information of risk and returns but difficult to obtain return constantly. Investors try to average risk and returns in efficient market. However, most empirical research has assessed market efficiency by examining the independence of successive price changes rather than directly testing how quickly prices adjust to specific new information. Consequently, there has been limited investigation into the speed at which markets incorporate various types of new information.

Effect of Inflation Rate on Stock Returns

Fisher (1930) originally proposed nominal stock returns act like hedge against inflation rate. Increases expected and actual inflation raise expected nominal dividend payments. Gordon (1959) argued that the discount rate for stocks reflect the returns of investors expect from dividend yield or capital gains. Consequently, higher inflation expectations and actual inflation rate lead to increased expected future nominal dividends, which turn causes an upward adjustment of stock prices.

2.2. Empirical Review of Literature

Venkatrja (2014) investigated relationship of stock price exchange market performance and macroeconomic variables of India such as: industrial output index, wholesale price index, gold price, foreign investment and real effective exchange rate consisting data from 2010 to 2014. Wholesale price, industrial output index, real effective exchange rate and foreign institutional investment shows positive while gold price negative effect on stock market price. Investigation concluded as inflation, foreign investment, exchange rate

and gold price meaningfully effect to stock exchange price of India.

Alam (2020) examined the effect of macroeconomic variables on the stock exchange market returns of five of South Asia countries consisting data period from 1993 to 2019. The main variables of study are: Study consists of stock exchange market is explained variable and real interest rate, stock market, inflation rate, gross domestic product growth rate, fiscal deficit, foreign direct investment to GDP ratio and exchange rate explanatory variables. Study found that gross domestic product growth, fiscal deficit, real interest rate and inflow foreign direct investment has positive impact on stock market price while inflation and exchange have adverse effect on stock price. The paper decided that increase in government expenditure, increase inflow foreign direct investment leads to rise output fall inflation rate and rise in real interest rate so government should manage positive real interest for healthy economy.

Karki (2018) examined on stock exchange market price responses to macroeconomic dynamics model for testing long- run equilibrium in Nepal consists of data from 1994 to 2016. Study consists of stock market price explained variable while real gross domestic product, inflation, interest rate and high-power money are explanatory variables. Study applied cointegration test, error correction model. Study found high power money supply shows long run positive and short run adverse effect on stock market price. Gross domestic product has adverse outcome on stock market price in long run. Inflation has

negative effect on stock price both short to long run. Study concluded short run stock price are not integrated with gross domestic product and monetary authority should manage stable inflation rate in economy.

Panta (2020) investigated on macroeconomic variables of stock exchange market price in Nepal consisting period of data from 1994 to 2019. Paper consists explained variable stock market and explanatory variables are: real gross domestic product, money supply, interest rate, inflation and exchange rate. Investigation applied unit root test, co-integration methods. Paper investigated fluctuation of stock price exchange index strongly associated with macroeconomic variables in long run. Government should be made macroeconomic policies for stabilization in economy.

Ranjit (2023) has analyzed the contribution on stock exchange market development with economic growth of Nepal using secondary data 1994 to 2021. Gross domestic output is explained and market capitalization, broad supply of money, listed company, stock exchange market price is explained variables. Investigation applied econometric tools error correction model and bound test. Investigation found market capitalization, broad money supply as well as stock exchange price index significant high effect on short and long-run run while stock market exchange price and market turnover have weak effect on real gross domestic product. Study found long run integration among stock exchange market development and economic activities. Policy makers should be considered the problem of stock exchange market and formulated

sectoral policies.

3. Methodology

The study consists of following methodologies as given below:

3.1. Source of Data

Research paper has employed secondary data from 1994 to 2023, for this annual data are taken from Nepal Rastra Bank Quarterly Bulletin (2023AD), Central Bureau of Office (CBO), and Ministry of Finance (MOF) of Nepal.

3.2. Model specification

Several economic variables exchange rate, remittance, output, interest rate, consumer price, High-power supply, interest of treasury, foreign investment, etc. However, this paper only includes stock exchange price, gross domestic product, treasury bills, High-power supply and consumer price index. Paper uses specified variables to remove problems of multicollinearity among independent variables. The study assumed stock price is explained variable and gross domestic product, treasury bills, broad money supply and consumer price index are explanatory variables. All variables are converted into log value for interpretation into percentage and correction heteroskedasticity problems.

Econometric model is given below as:

$$\text{LNNEPSE}_t = \lambda_0 + \lambda_1 \text{LNRGDP}_t + \lambda_2 \text{LNM}_t + \lambda_3 \text{LNINTB}_t + \lambda_4 \text{LNCPI}_t + \pi_t \dots (1)$$

Where,

LNNEPSE_t = Log NEPSE Stock Price Index

LNRGDP_t = Log Gross Domestic Product

LNMT_t = Log Broad Money Supply

LNINTB_t = Log Treasury Bills

LNCPI_t = Log Consumer Price Index

π_t = Error Term,

t = Time Series,

λ_0 = Constant

$\lambda_1, \lambda_2, \lambda_3$, and λ_4 , are parameters

3.3 Estimation Procedure

To examine influence of macro variables on stock exchange price, study has been applied Augmented Dickey- Fuller (1981) and Phillip-Perron (1998) for unit root. Study has applied Vector Auto-Regressive Model (VAR), Johansen cointegrated test of Maximum Eigynne and Trace test. To show short and long-run impact of macroeconomic said variables on stock price index of Nepal. Vector Error Model (Ramsey, 1969) has been applied.

3.3.1 Augmented Dickey-Fuller Test (ADF)

Dickey and Fuller developed unit root test in 1970 and known as Dickey-Fuller test. Augmented Dickey- Fuller test follows:

Null Hypothesis (H_0): $\delta = 1$, non-stationary

Alternative Hypothesis (H_1): $\delta < 1$, stationary

3.3.2 Vector Autoregressive (VAR) Model

Endogenous and exogenous or predetermined variables are identified under study. The decision of such differentiation is criticized by Sims (1980). According to Sims (1980) simultaneous number variables should be treated in same direction. It means, there should no discrepancy between endogenous and

exogenous variables. Moreover, all variable should be treated as endogenous variables. A simple bivariate model is given as:

$$Y_t = \beta_{10} - \beta_{12}X_t + \mu_{11}Y_{t-1} + \mu_{12}X_{t-1} + U_{yt} \dots (2)$$

$$X_t = \beta_{20} - \beta_{21}Y_t + \mu_{21}Y_{t-1} + \mu_{22}X_{t-1} + U_{xt} \dots (3)$$

Where, X_t and Y_t are stationary and U_{xt} and U_{yt} are not autocorrelated. Both models are first order VAR with longest lag is unity. The rewrite the equations as matrix form given below:

$$\begin{pmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{pmatrix} \begin{pmatrix} Y_t \\ X_t \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix} + \begin{pmatrix} \mu_{11} & \mu_{12} \\ \mu_{21} & \mu_{22} \end{pmatrix} \begin{pmatrix} Y_{t-1} \\ X_{t-1} \end{pmatrix} + \begin{pmatrix} U_{yt} \\ U_{xt} \end{pmatrix}$$

$$\text{or, } BZ_t = r_0 + r_1 Z_{t-1} + u_t \dots \dots \dots (4)$$

Where,

$$B = Z_t, \quad Z_t = \begin{pmatrix} Y_t \\ X_t \end{pmatrix}, \quad r_0 = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix}, \quad r_1 = \begin{pmatrix} \mu_{11} & \mu_{12} \\ \mu_{21} & \mu_{22} \end{pmatrix} \text{ and}$$

$$u_t = \begin{pmatrix} U_{yt} \\ U_{xt} \end{pmatrix}$$

3.3.3 Johansen Cointegration Test

Johansen cointegration test has utilized to show long-term correlation among explained and explanatory variables. For this purpose, all variables are stationary order (I). Johansen and Juselius (1990) given two likelihood ratio tests to obtain the number of cointegrated vectors tests trace and maximum eigen test.

3.3.4 Vector Error Correction Model

VECM shows movement amid variables. It is used for long run causality among exogenous and endogenous variables.

General VECM Model:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta Y_{t-i} - 1 + \sum_{i=0}^p \delta_i \Delta X_{t-i} - 1 + \phi Z_t - 1 + u_t \dots (7)$$

$$\Delta Z_t - 1 = Y_t - 1 + \beta_0 + \beta_1 X_t - 1 \dots (8)$$

Where, equation (7) and (8) represented by the different operator Y_t refers to dependent variable X_t is independent variable. u_t is error

correction while ϵ_t is error term generated by using Johansen cointegration test, and α are coefficients of variables and β is coefficient of error terms U_t .

4. Results and discussion

Results discussion consists of following methodologies.

Table: 4.1:
Results of Unit Root

	ADF – test		Phillips - Perron test	
	Order (0)	Order (I)	Order (0)	Order (I)
LNPS	0.8487	0.0021	0.9224	0.0000*
LNTB	0.1947	0.0000*	0.1570	0.0000*
LNGDP	0.9460	0.0067*	0.9416	0.0067*
LNLM	0.9913	0.00074*	0.9942	0.0008*
LNCPI	0.9371	0.0035*	0.9159	0.0051*

Sources: Authors' calculation from E-views 10 Software

* at one percent level & ** at 5 percent level significant

4.2. Selection of Lag Criterion

Given result shows selection of lag methods for VAR model. Final prediction error (FPE), Sequential modified (LR) test statistic, and Hannan-Quinn information criterion

(HQ) indicates two lags is appropriate while Schwarz information criterion (SC) indicate 1 lag and Akai Information Criteria (AIC) indicates three lags. Under this VAR model most criteria suggest two lags.

Table 4.2:
Selection of lag criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2.223843	-	8.45e-07	0.205641	0.445611	0.276997
1	130.9097	200.1780	4.05e-10	-7.474790	-6.034972*	-7.046657
2	166.8129	42.5520*	2.24e-10*	-8.282439	-5.642771	-7.497527*
3	195.3342	23.23960	3.27e-10	-8.543277*	-4.703761	-7.401588

* indicates selection of lag criterion

4.3 Johansen's Cointegration Test

VECM model is used for long run relationship among stock market price and macroeconomic variables. Before using VECM model,

Johansen cointegration test is employed for long run relationship between explained and explanatory variables. Trace statistic and Maximum Eigen statistics are tested.

Table 4.3(a):

Cointegration Rank (Trace) Test

There is no cointegration Eq.	Eigenvalue	Statistic	Critical Value	Prob.**
None Eq.*	0.81	98.28	69.81	0.0001
At most one *	0.62	52.54	47.85	0.0170
At Most two	0.51	26.42	29.79	0.1166

Source: Authors' calculation using E-views

Trace Statistic two equations are cointegrated 5 percent which is indicated by trace are more than critical value and significant at five percent.

Table 4.3(b):

Cointegration Rank (Max-Eigen) Test

There is no cointegration Eq	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.816	45.73	33.87	0.0013
At most one	0.62	26.12	27.58	0.0759
At most two	0.51	19.63	21.13	0.0800

Source: Authors' calculation using E-views

Maximum Eigen statistic is more than critical value one percent and indicates one equation is cointegrated.

4.4 Long Run Model

$$\text{LNNEPSE} = 3.15 + 1.9 \text{ LNRGDP} - 0.54 \text{ LNM2} + 0.18 \text{ LNINTB} - 0.74 \text{ LNCPI}$$

Coefficient of RGDP is 1.90 indicates one percent increase real GDP causes to increase stock price by 1.9 percent in long run while keeping other constant. Coefficient of money supply is -0.54 indicates one percent rise money supply causes decrease in stock market price by 0.54 percent while keeping other constant.

Coefficient of INTB is 0.18 indicates one percent rise treasury bills causes increase in stock price by 0.18 while keeping other constant in long run. Coefficient of LNCPI is -0.74 indicates one percent increase consumer price index causes decrease stock price by 0.74 percent while keeping other constant.

4.5 Short Run Model (VECM Results)

Coefficient VECM of LNNEPSE -0.57 which is negative statically significant 1 percent. It gives speed of adjustment which model restores equilibrium from error terms/ disturbance terms. The speed of adjustment coefficient is 57 percent indicates 57 percent of

error terms are corrected within same period.

Moreover, it shows the long run causality between LNGDP, LNTB, LNM and LNCPI to LNNPSE. The coefficient of NPSE is (C2= 0.56) which indicates that increase stock price one period back by one percent causes increase current stock price by 0.56 percent while keeping other constant in short run which is statistically significant at one percent. C

oefficient LNTB is (C3= 0.12) which indicates increase interest rate of treasure bills by one percent causes increase stock price by 0.12 percent while keeping other constant in short run which statistically significant at 10 percent. Coefficient LNGDP is (C4 = - 4.22) indicates increase GDP by one percent leads to decrease in stock price by 4.22 percent while keeping other constant in short run which is

statistically significant at one percent.

However gross domestic product doesn't support Nepalese stock market. The coefficient of LNM is (C5=0.007) indicates increase broad money supply by one percent leads to increase stock price by 0.007 while keeping another constant which statistically not significant. The coefficient of LNCPI is (C6 = 4.67) indicates that increase stock price by one percent leads to increase in stock price by 4.67 percent while keeping other constant in short run which is statically significant at five percent level.

Explained variable depends explanatory variable by 62 percent indicates value of R squared. Pro. of F statistic significant at 1 percent shows model is overall good fit.

Table 4.5:

Short run results

	Coeff.	S. E.	t-Stat	Prob.
C1	-0.572754	0.143515	-3.990888	0.0007
C2	0.569619	0.196009	2.906091	0.0084
C3	0.120184	0.066622	1.803975	0.0856
C4	-4.227740	1.000507	-4.225597	0.0004
C5	0.007390	0.612914	0.012058	0.9905
C6	4.676879	2.049054	2.282458	0.0330
C7	0.215563	0.153720	1.402309	0.1754
R-sq.	0.620749	F-stat		5.72870
Adj.R-sq.	0.512391	Pro.(F-stat)		0.00116

Source: Authors' own calculation using E-views 10 version

4.6 Variance Decomposition/ Forecaster Error Variance

The table below gives the results of variance decomposition (Cholesky Ordering). The variance decomposition in short run or forecaster error variance in case of LNNPSE is 100 percent. It means 100 percent of

variation of LNNPSE is explained by stock price itself and none of independent variable affects stock price in short run. It means 100 percent focused error variance of stock price itself and other variable don't have strong influence to stock price. In short run period two variance contribution roles is 89.96

percent and contribution of LNRGDP is 4.3 percent, LNINTB is 4.5 percent, LMM2 is 0.6 percent and LNCPI is 1.02 percent. In long run the contribution of LNNEPSE is gradually decreased from 100 percent to 79 percent. The contribution of LNRGDP is increase and decrease from 4.44 percent to 3.70 percent in

tenth period. The contribution of LNINTB increases from 4.07 percent to 5.36 at tenth period. The contribution of LNM2 is slowly increases from 0.6 percent to 5.7 percent in tenth period. The contribution of LNCPI increases from 1.02 percent to 6.14 percent in tenth period.

Table 4.6:

Variance Decomposition/ Forecaster Error (LNNEPSE)

Period	S.E.	LNNEPSE	LNRGDP	LNINTB	LNM2	LNCPI
1	0.267786	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.454436	89.96844	4.331295	4.076281	0.601444	1.022537
3	0.497403	86.67925	5.273027	4.384472	2.011821	1.651428
4	0.513056	84.30424	5.037977	5.006694	3.312355	2.338738
5	0.526119	82.70294	4.793414	5.152491	4.243866	3.107287
6	0.545850	81.71073	4.467611	5.232128	4.707291	3.882242
7	0.569670	81.02141	4.201889	5.234728	4.983208	4.558769
8	0.592808	80.33068	4.014473	5.273674	5.238733	5.142436
9	0.613292	79.63731	3.853955	5.322365	5.519794	5.666577
10	0.632186	79.00103	3.701623	5.369795	5.786098	6.141455

Source: Authors' calculation using E-views 10 version

4.7. Diagnostic Analysis

The diagnostic analysis is conducted for accuracy of the results which consists of normality (Jaqu-Bera -JB) for

normal distribution of error terms, serial correlation (LM) test for autocorrelation, heteroskedasticity Brush Pagagn Godfery test for constant variance of error terms.

Table 4.7

Diagnostic Analysis

Tests	Obs*R-sq.	Prob.Chi-Sq. (2)
Breusch-Godfrey test LM	0.894357	0.6394
Heteroscedasticity: B -P-G	19.58568	0.3304
Normality (J.B. Statistics)	0.24 JB value	0.8835

Source: Authors' calculation from E-views

Value of Breush- Godfery LM(1978) tests with Chi-Square test is 63.5 percent which is more than 5 five percent indicates no autocorrelation among disturbance terms. Value of Breush-Pagan Godfery Heteroskedasticity (1979) tests with Chi-Square test is 33.5 percent which is

more than 5 five percent indicates that variance of disturbance terms is constant. Jarque -Bera prob.value is 0.88 which is more than five percent indicates error terms are normally distributed.

4.8 Variance Inflation Factors

Variance inflations factor less than 10 indicate no linear relationship among explanatory variables.

Table 4.8:

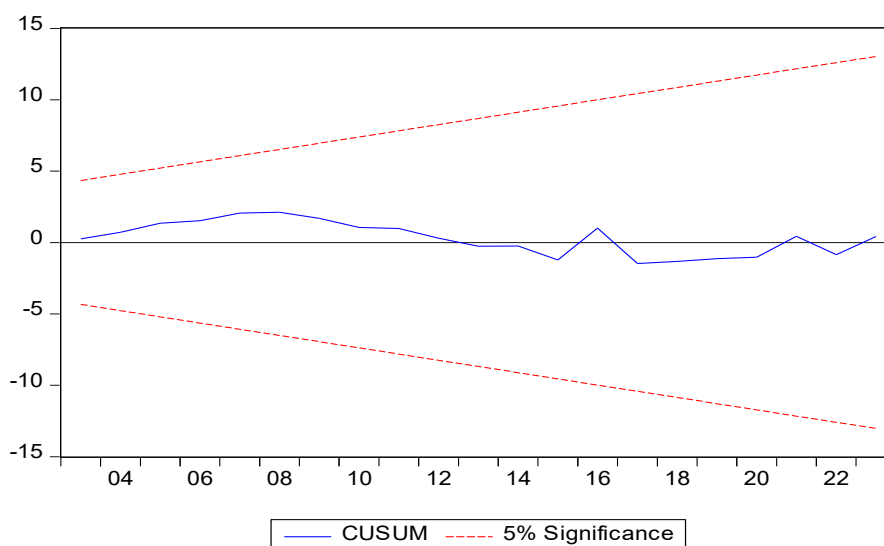
Variance Inflation Factors

Variable	Uncentered	Centered
C(1)	1.965120	1.965120
C(2)	2.157104	2.042065
C(3)	5.053991	1.043363
C(4)	1.325963	1.325962
C(5)	5.968928	1.200122
C(6)	10.13086	1.254259
C(7)	15.11131	NA

Source: Authors' calculation using E-views 10 version

4.9 Analysis of Stability Test Analysis

The study further employed the Cumulative Sum of recursive residuals (CUSUM) developed by Brown, Dublin, and Evans (1975) in testing the stability of the parameters of the model within a 5% level of significance. In addition, no probabilities of spurious regression model since blue line between two lines which confirm that model stable and feasible, throughout the study.



4.10 Policy Suggestion and Conclusions

This research paper explores outcome of macro determinants on stock market price of Nepalese economy consisting data consisting 1994 to 022. Investigation employs treasury bills, consumer price index, gross domestic

product, consumer price index, and broad money supply are taken explanatory variables while stock market exchange price explained variable. Johansen and Vector Error correction theory are utilized to analysis impact of short and long-run.

Research work has found gross domestic product has positive impact of market stock price on long-run period while adverse impact on short-run which means short run gross domestic output not support to stock price. Broad money supply has significant negative effect in long run and meaningful positive effect in short run which is supported to the study of Karki (2018). A treasury bill has both positive impact both short and long run. Similarly, consumer price index has short run positive impact and adverse impact in long-run (Alam, 2020). The Vector Error correction coefficient suggested that 57 percent error

terms are corrected from disequilibrium to equilibrium indicates long run causality among stock market price to macro variables of Nepal. Investigation suggested that government should be formulated macroeconomic policy which link between gross domestic product with stock market of Nepal and Nepal Rastra should manage money supply and inflation both short and long run using caution monetary policy. Study also suggests micro variables and social and culture factors are not included under study which may be gap for further researchers.

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