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Research Article

NEXUS BETWEEN MONETARY POLICY, EXCHANGE RATE VOLATILITY, INFLATION AND STOCK MARKET

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Abstract

The objective of this study is to examine the relationship between broad money, discount rate, inflation, exchange rate, KSE 100 index, and market capitalization to test the validity of financial theories such as Sharpes' theory of market equilibrium and Fama' s theory of efficient markets using time series data spanning from 1990 to 2020. Market capitalization was dependent variable, while all others were independent variables. Various econometric techniques, such as correlation matrix and Multiple Regression analysis were employed to determine relationship between variables. The findings reveal that broad money, KSE 100 index and discount rate have positive effect on market capitalization, while inflation and real exchange rate have negative impact on it. The performance of stock index is significantly affected by inflation and exchange rate volatility, and, therefore the policymakers should target these two variables to stabilize the stock market.

Keywords: Monetary policy; Exchange rate volatility; Inflation; Capital market; Discount rate; Broad money.

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1. Introduction

The close association between monetary policy, exchange rate volatility, inflation and the stock market are a crucial area of research in the field of financial economics because understanding the complex relationship among these variables is equally important for general investors, market participants and policy makers. According to Friedman (2000) monetary policy plays a pivotal role in shaping the landscaping of capital market as well as overall economy because core variables like money supply growth, price stability and economic growth have close link with one another. The volatility in the exchange reflects the fluctuation in the value of currencies in the international market has significant impact on investment decision, trade flow and economic stability. Inflation, which is key macroeconomic variables, determine the rising of price level over time, exerting significant impact on the purchasing power of consumers, the rate of return on the investment of investors and the operation of business firms as disclosed by Ogbebor, et al., (2021). Additionally, the Stock Market, which is generally considered a barometer of economic condition of a country also highlights the sentiment of investors, performance of corporate sector and general trends of market.

1.1 Theoretical background

1.1.1 Theory of Portfolio selection

The classical economist, Markowitz (1952) wrote an essay on investment in the Stock market which is still recognized as a foundation work in financial industry even today and is known at the “Theory of portfolio selection” or “Modern Portfolio Theory (MPT).” This theory illustrates how an investor builds his portfolio in order gain maximum return on his investment. The prominent feature of this theory is that the investors should build his portfolio in such way that it involves minimum risk. Markowitz assumes that all

investors have the same behavior and they borrow money the risk-free rate and they try to seek high return and they also avoid excessive risk-taking due to fear of heavy losses. In other words, mostly investors desire highest return on their investment but also avoid risk. Markowitz advises the investors not to concentrate their investment in a few scripts but diversify their portfolio in order to minimize the risk. The diversification reduces risk and keep the return in balanced.

1.1.2 Theory of Liquidity

Tobin (1959) presented this theory which states that how individuals manage their portfolios in high level of risk and uncertainty in the market. Generally, people adjust their holdings of liquid assets based on their perception of the degree of risk and their level of risk tolerance. When there is high risk involves in investment in financial markets, the individuals prefer to hold liquid cash and allocate larger portion of their portfolio to that class of assets that can be easily converted into cash with lower loss in value. They forego potential returns in exchange for more flexibility and safety of investment. In contrast, when the confidence of investors in the economy and financial markets is high and perceived level of risk is low, they prefer to invest in the stock market to gain high return.

1.1.3 Theory of Market Equilibrium

Sharpe (1964) floated the idea of Capital Asset Price Model under his theory of market equilibrium under conditions of risk in which the market behavior could not predicted in precise matter due to absence of microeconomic theory dealing with risk. A typical capital asset price model is a rigorous description of individual preferences to determine pure interest rate. A market risk premium is also determined with the prices adjusting to their different risks. The investor is in equilibrium when capital asset prices are

adjusted and he obtains high expected rate of return on his investment by bearing additional risk. Actually, market provides two-prices approach: the price of time and the price of risk. The price of time is related to pure interest rate and the price of risk is associated with expected return per unit risk involved in his decision-making. Sharpe (1964) argues that there is no theory which sheds light on price of risk related to the influences of investors preferences and physical attributes of capital assets. Some of the risk inherent in an asset can be reduced through diversification so that its total risk does not affect its price.

1.1.4 Efficient Market Hypothesis

The theory of "Efficient Market Hypothesis (EMH)" presented by Fama (1979) is classical theory which states that the market is so efficient that it absorbs all available relevant information in the prices of scripts and the investors could not outperform the market because the prices of scripts have already incorporated all relevant information. He argues that it is difficult for an investor either to predict or attain extraordinary financial gain. This theory illustrates that all new information relating to the equities are quickly reflected in their prices in the market which makes impossible for investors to beat the market based on specific information. In order words. Fama wants to say that the investors could not beat the market and they should follow the market behavior rather than trying to force the market to follow their way of trade or choosing the scripts.

It means that market is free from individual behavior.

1.1.5 Theory of Monetary Policy

Milton Friedman in his Theory of Monetary Policy (2000) asserts that controlling the growth rate of the money supply is paramount for maintaining price stability and achieving sustainable economic growth. Central to his

theory is the concept of monetary neutrality, which posits that changes in the money supply primarily affect nominal variables in the long run, while real economic variables are determined by non-monetary factors. Friedman advocates for a rules-based approach to monetary policy, where central banks set a fixed rate of growth for the money supply to avoid discretionary interventions that may lead to instability and economic fluctuations. By providing timely information to the market participants about their decisions the central bank can produce stability in the financial market and prevent unhealthy speculation.

1.1.6 Theory of Exchange Rate

Mussa (1984) in his "Theory of Exchange Rate Determination" suggests that exchange is measured on the basis of relative prices of similar baskets of goods in various countries. It considers various determinants of exchange rate differences such as productivity differentials market sentiments and expected changes in future exchange rate. He was of view that exchange rate fluctuates in accordance with future economic scenario and policies. In short, this theory provides a valuable insight for comprehending the determinants of exchange rate over a long period of time and highlights the significance of relative prices, productivity differences and market sentiments in fixing currency values in the global financial market.

In the light of the above theoretical framework, this study can form the main research question of the study as follows: -

"How do monetary policy, exchange rate volatility, and inflation collectively impact the behavior of the investors and performance of the Pakistan stock market, and what implications of the findings of this study provides for investors, market participants, and policymakers to take decision in an uncertain environment.?"

Moreover, the main objectives of the study are to analyze the association between monetary variables such as money supply growth and price stability and the behavior of the Pakistan stock market, besides examining the impact of exchange rate volatility on investor sentiment. Trading activity and behavior of investors in high inflationary condition and interdependence of these variables in dynamic economic environment.

This study contributes to the field of financial economics in a way that it will deepen our understanding of the intricate association among monetary policy, exchange rate volatility, inflation, and stock market behavior in Pakistan. The explanation of close association among these variables, the study offers valuable insights for investors, market participants, and policymakers seeking to navigate and understand the performance of the Pakistan stock market. Additionally, the findings of this research are likely to provide insights for promoting stability, efficiency, and resilience in the Pakistan financial markets, ultimately contributing to the broader economic development and welfare of the country and build overall confidence of investors. The findings of this study provide guidance to the investors how to reduce market risk by opting diversified portfolio approach and the results of the study relating to market risk and diversification of portfolio are not only aligned with economic theories but also provide guideline to the investors and financial institutions of other countries how to invest and how to reduce market risk and what is importance of diversification of portfolio in investment decision making.

2. Literature review and development of hypotheses

Now we find it better to delve into existing literature to understand the relationship between macroeconomic variables and market capitalization and

the versions of other scholars on the issues of stock market and investors' behavior. Let us start the review of relevant studies so that we may be able to formulate hypotheses to test them through time series data.

Gürkaynak, et al. (2022). investigated into the effects of monetary policy on economic growth. It sheds light on the mechanisms shaping Pakistan's macroeconomic landscape. The study's reliance on yearly data spanning three decades provides a robust foundation for its analysis. The identification of the role of monetary policy in mitigating inflationary pressures and promoting growth underscores the importance of effective policy implementation. However, the study's focus on broad macroeconomic aggregates may overlook sectoral dynamics and distributional effects, warranting further exploration to inform targeted policy interventions. Bernanke (2020) argued that traditional monetary policy focuses on short-term interest rate in order to bring changes in the market but the Federal Reserves of the United States and Central Banks of other advanced countries have developed new policy tools that have proved effective in economic recession when mostly monetary could not function efficiently. He illustrated that if nominal interest rate is in the range of 2-3% then the combination of quantity easing and forward guidance can provide the equivalent of about 3% point of policy space and it would largely offset the effect of the lower bound. If the natural rate is much below then overcoming the impact of lower bound may need to target inflation or use tools of fiscal policy to manage the financial market fluctuations and overall financial system. Bhuiyan & Chowdhury, (2020) analyzed the fluctuations in currency rate and its impact on Pakistan's economy. It offers pertinent insights into the dynamics of exchange rate volatility. The study's utilization of a diverse dataset spanning several decades provides a comprehensive view of long-term trends. The identification of positive relationships between real exchange rate

volatility, exports, foreign direct investment, and GDP underscores the intricate interplay between these variables. However, the study's focus on aggregate relationships may overlook heterogeneity within sectors and industries, potentially limiting the applicability of its findings to specific policy contexts. Celebi & Hönig, (2019) scrutinized Pakistan's monetary policy and its impact on economic growth. The study offers valuable insights into the mechanisms driving macroeconomic outcomes. The study's use of unit root tests and annual time-series data provides a robust empirical foundation for its analysis. It identified positive association between money supply and exchange rate and negative association between inflation, discount rate and economic growth, which highlights complex relationship between monetary policy tools and macroeconomic dynamics. Echekoba, et al, (2017) examined the impact of monetary policy on economic growth in Pakistan and sheds light on the country economic dynamics. The study utilized descriptive and correlation analysis to determine relationship between various macroeconomic variables. The findings reveal positive association between core macroeconomic variables and GDP growth. The study also emphasizes effective policy intervention to correct macroeconomic imbalances. However, simple use of descriptive analysis and correlation matrix restrict its findings to be generalized for wider application. Bissoon, et al (2016) conducted long term study using 45 years' time series data to determine relationship between monetary policy and macroeconomic variables in Pakistan. Time series data-set provides a rich source of data for empirical analysis to identify long term behavior of variables. The findings show positive association between inflation, money supply and GDP growth in the long run, underscoring how macroeconomic variables behave in the long run. Friedman (2000) emphasizes that the role of money supply is vital in determining inflation/deflation in the

economy. He claims that monetary policy is more effective tool to manage the economy than fiscal policy. He opines that in order to stimulate economy or control inflation monetary policy plays effective role rather than fiscal policy.

2.1 Hypotheses of study

In the light of the objectives of study and reviewed literature, the following hypotheses are developed to test relationship between variables statistically.

Ho: Broad money is negatively associated with market capitalization.

H_1: Broad money is positively associated with market capitalization.

Ho: Exchange rate volatility is negatively associated with market capitalization.

H_1: Exchange rate volatility is positively associated with market capitalization.

Ho: Money supply is negatively associated with market capitalization.

H_1: Money supply is positively associated with market capitalization.

Ho: KSE 100 index is negatively associated with market capitalization.

H_1: KSE 100 index is positively associated with market capitalization.

2.2 Novelty of study

The study significantly contributes to the existing body of literature on Pakistan's financial markets by highlighting the close association between monetary policy, exchange rates, and stock market performance, focusing specifically on market capitalization. The novelty of this study is that it integrates monetary policy, exchange rate and stock market performance in a single analytical framework. Mostly previous studies examine these variables separately but this study provides a sound holistic approach to understand how these variables jointly affect stock market dynamics in Pakistan. The integrative approach of this study enables us to get a deeper understanding of underlying mechanism that drive stock market dynamism, providing

beneficial feedback to policymakers, investors, and market participants. The 30 years' time series data used in this study allows us to capture long-run trends and patterns of monetary policy, exchange rate and stock market dynamics. It offers insights how these variables evolved over time and can pinpoint future challenges to be faced by Pakistan's financial market.

3. Material and Methods

The objectives of this study are to analyze nexus between monetary policy, exchange rate, inflation, KSE 100 index and market capitalization of Pakistan Stock Exchange, using 30 years' time series data spanning from 1990 to 2020. The data are sourced from the Pakistan Stock Exchange, Pakistan Economic Survey and World Bank Development indicators. The sample of the study is Pakistan Stock Market. Market capitalization is dependent variable, while independent variables include money supply, exchange rate, inflation and KSE 100 index are independent variables. The econometric techniques, such as descriptive statistics were employed to determine the mean value, standard deviation, minimum and maximum values of variables in order to understand normal distribution of data. ADF unit root test was applied to check stationarity among variables, which enable us to use suitable econometric model to analyze the data. Correlation Matrix was used to determine nature of correlation between pair of variables. Multiple regression analysis was used to determine long run relationship between dependent and independent variables. The Variance Inflation Factor (VIF) Test, Heteroskedasticity test and serial correlation test were applied to examine multicollinearity, heteroskedasticity and serial correlation issues in the model of the study. These econometric techniques are most effective to analyze the data and sample of study. In order to understand the nexus between money supply, exchange rate volatility,

inflation, and their impact on stock market, an econometric model is developed. The functional form of the model is as follows: -

Market capitalization= $\beta 0 + \beta_1$(discount rate) + β_2(open market operations) + β_3(money supply) + β_4(inflation) + β_5(KSE100 index) + ε

In this model, market capitalization is dependent variable, while all others are independent variables. The above model is transformed into a mathematical model and is shown in the following equation:

$$Y=\beta o+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4 X_4 + \beta_5 X_5 \ldots\ldots\ldots\ldots \varepsilon$$

Where:

Y = Market Capitalization is dependent variable while the followings are independent variables.

X_I = Discount Rate.

X_2 = Open Market Operation.

X_3 = Money Supply.

X_4 = Inflation.

X_5 = KSE 100 Index.

3.3 Description of variables

3.3.1 Market capitalization:

The value of any company currently trading on the stock market is measured by their market capitalization. Instead of relying on information about sales or total assets, the investment community uses this statistic to assess the size of the organization. Instead of modifying the stock's price, the market capitalization is calculated by looking at the stock price and the entire number of shares issued. Market capitalization reflects whether value of equities is increasing or decreasing over a longer period of time and it also reflects the health of economy and behavior of financial indicators in the long run (Bhuiyan & Chowdhury, 2020).

3.3.2 Discount rate:

It is the interest rate applied to short-term loans borrowed by commercial banks and other financial institutions from the Federal Reserve Bank or Central Banks. Discount rate is implemented at the discount window, a lending facility operated by Fed in the United States and the State Bank in Pakistan. The discount rate helps the bankers determine interest rate and it bring positive or negative change in the economic activity. When discount rate is decreased it motivate the investors to borrow more to investment in their business ventures or in the stock market but when it is high it prevents borrowers from taking credit for investment or business expansion because it involves high risk of defaults. (Jiang, et al., 2024)

3.3.3 Open market operation:

The power to purchase and sell assets in the open market is a crucial tool the federal reserve uses to execute monetary policy. The preliminary goal for the operation of an open market is set forth by the federal market committee. It can also be employed to stabilize the cost of government securities, a goal that occasionally runs counter to the central bank's credit policy. Through open market operation, the central banks all over the world balance between demand and supply of money in the market. If the liquidity in the market is excess then the Central banks suck excessive liquidity from the market in order to control inflation and if there is liquidity crunch the Central bank inject liquidity in the market through open market operation (Bernanke, 2020); Schrank, (2024).

3.3.4 Money supply:

The total amount of money and other readily accessible assets in an economy. It is referred to as the money supply. All legal currency, including all coins and bills, as well as all deposits in banks that can be quickly converted into

cash, make up the total amount of money in circulation. The treasuries of governments, central banks, or a mixture of both, are responsible for minting coins and printing paper money. Increasing the amount of money in the economy creates inflation while decrease quantity of money causes deflation. One of the main functions of the Central banks are to balance money supply in the market. Christos & Kontonikas, 2008)

3.3.5 Inflation:

The phrase "inflation" describes an increase overall price level in the economy and it reduces the buying power of the currency. If inflation increases it affect the purchasing power of salaries class, fixed income people and pensioners as well as the youth which intends to enter labor market after completing their education. Inflation has different types that include cost push, demand pull, mixed, creeping, trotting, running, hyperinflation, and stagflation. One of the core functions of Central banks is to tame inflation in order to stabilize the economy. The producers or manufacturers always like high inflation because it enables them to sell their products and services at higher prices but it reduces the welfare of the consumers because it gets a smaller number of goods and more money for purchasing their desired goods and services. In order to control inflation, the Central Bank increases interest rate, which results in high cost of production and higher prices of goods and services (Mgammal, 2012); (Evbayiro-Osagie & Emeni, 2015).

3.3.6 KSE 100 index:

Karachi Stock Exchange started business with a 50-share index at initial stage. But when market expand, a representative index is required so that it reflects market efficiency and change in the equity prices. KSE 100 index was introduced on November 1, 1991 and it is still regarded as an efficient measure of trading at stock Exchange. The KSE 100 index is consisted of 100

companies which represent 90% of market capitalization. It is basically a capitalization-weighted index. It reflects percentage change in the value of prices in Pak Rupee and also reveal the daily fluctuations in market capitalization. It reaches highest level of 53, 103 in May 2017. However, it rose steeply upward in 2023 and 2024 when it crossed 73,000 points level in the mid of May 2023. However, the data is restricted to study period and as such Table 1 shows yearly changes in the KSE 100 index during 2001 to 2021.

Table 1

Annual changes in KSE 100 Index during 2001-2021

Year	Closing of KSE 100 index	Change in Index (in Points)	Change in Index (in %)
2001	1,273.06	−234.53	−15.56
2002	2,701.42	1,428.36	112.20
2003	4,471.82	1,770.40	65.54
2004	6,218.46	1,746.64	39.06
2005	9,556.61	3,338.15	53.68
2006	10,040.50	483.89	5.06
2007	14,075.83	4,035.33	40.19
2008	5,865.01	−8,210.82	−58.33
2009	9,386.92	3,521.91	60.05
2010	12,022.46	2,635.54	28.08
2011	11,347.66	−674.80	−5.61
2012	16,905.33	5,557.67	48.98
2013	25,261.14	8,355.81	49.43
2014	32,131.28	6,870.14	27.20
2015	32,816.31	685.03	2.13
2016	47,806.97	14,990.66	45.68
2017	40,471.48	−7,335.49	−15.34

Year	Closing of KSE 100 index	Change in Index (in Points)	Change in Index (in %)
2018	37,066.67	−3,404.81	−8.41
2019	40,735.08	3,668.41	9.90
2020	43,755.38	3,020.30	7.41
2021	44,596.07	840.69	1.92

Source: Pakistan Stock Exchange

4. Results

4.1 Descriptive statistics

The descriptive statistics of variables are presented in Table 2

Table 2: Descriptive Statistics results

	M_C	BM	DCR	INF	KSE100	MS
Mean	38.63101	52.40251	9.225000	7.839377	9222.793	6.740000
Median	40.03967	50.91535	9.510000	7.575188	8729.765	7.330000
Maximum	45.73929	58.85769	10.00000	8.862815	13762.46	10.50000
Minimum	32.72540	44.88164	7.510000	7.264319	5269.180	1.70000
Std. Dev.	5.656797	7.254845	1.108678	0.740659	3648.818	4.335328
Skewness	-0.189512	0.055326	-0.992966	0.796664	0.314631	-0.158029
Kurtosis	1.628905	1.081905	2.235277	1.982276	1.740182	1.210458
Jarque-Bera	0.337260	0.615222	0.754788	0.595742	0.330519	0.550392
Probability	0.844821	0.735201	0.685646	0.742397	0.847674	0.759423
Sum	158.5240	205.6100	36.50000	31.31751	36491.17	27.00000
Sum Sq. Dev.	95.99806	157.8983	3.687500	1.645726	39941624	56.38520
Observations	4	4	4	4	4	4

Market capitalization is dependent variable, while discount rate, inflation, KSE100, and money supply are independent variables. Market Capitalization has 39.63 mean value, 45.75 maximum value, 32.71 minimum value, its standard deviation is 5.65 and it has a negative skewness -0.18. Probability value of MC is 0.8 which is more than 0.09 and it is insignificant. Next variable is Broad Money which has 51.40 mean value ,58.86 maximum value, 44.89 minimum value its standard deviation is 7.25 and has positive skewness 0.05. probability value 0.73 which is more than 0.09 which is insignificant. Next variable is Discount Rate, which has 9.12 mean value, 10.0 maximum value, while 7.50 minimum value and has negative skewness, which is 0.99, while the probability value is 0.6 that is insignificant. Next variable is inflation, which has 7.82 mean value, 8.87 maximum value, 7.27 minimum value, and the standard deviation is 0.74 and it has a positive skewness 0.79, and the probability value 0.7 that is insignificant. Next variable is 100 index, which has mean value 9122, maximum value is 1377, minimum value is 5279 and has positive skewness 0.31. Next variable is Money Supply which has 6.75 mean value, 10.50, maximum value, minimum value is 1.86 and has negative skewness -0.15. probability value of MS is 0.75 more than 0.09 which is insignificant. In short, the results show that the data of all variables are normally distributed.

4.2 Correlation analysis

Correlation Matrix is employed to determine correlation between pairs of variables, whether the pairs of variables or move in the same or in opposite direction, whether they have positive or negative correlation. The values of correlation lie between -1 and + 1. Table 3 highlights the results of correlation matrix.

Table 3: Correlation Matrix results

	M_C	**BM**	**DCR**	**INF**	**KSE100**	**MS**
M_C	1.000000	0.040709	-0.122431	-0.952238	0.247088	-0.173773
BM	0.040709	1.000000	0.694340	0.262229	0.931187	0.967066
DCR	-0.122431	0.694340	1.000000	0.292273	0.824982	0.801348
INF	-0.952238	0.262229	0.292273	1.000000	0.027519	0.452234
KSE100	0.247088	0.931187	0.824982	0.027519	1.000000	0.897297
MS	-0.173773	0.967066	0.801348	0.452234	0.897297	1.000000

Table 3 shows the correlation between dependent variable, Market Capitalization and independent variables: Broad Money, Discount Rate, Inflation, 100 INDEX, and Money Supply. The 1st variable which is market capitalization shows positive correlation with broad money as its value is 0.04 and this value is greater than the zero which shows a positive correlation. While Market Capitalization shows inverse correlation with Discount Rate and the value is -0.12. The correlation of Broad Money with Discount Rate is positive as its value is 0.69. Inflation has positive correlation with money supply as its value is 0.45. Money Supply and Discount Rate show the positive correlation and the value of correlation is 0.80, which demonstrates a good link between these variables.

4.3 ADF'S Unit Root

The Augmented Dickey-fuller (ADF) test is used to check stationarity among variables in the model because if the variables are stationarity at the same level, we can use OLS method and if they are stationarity at different levels then we can employ ARDL approach. The results of the unit root test are presented in a Table 4.

Table 4 ADF Unit Root test results

Variables	**Intercept**			**Intercept and trend**		
	Level	1st difference	Conclusion	Level	1st difference	Conclusion
M_C	0.16	0.001	I (1)	0.38	0.005	I (1)
BM	0.07	0.004	I (1)	0.48	0.008	I (1)
DCR	0.71	0.01	I (1)	0.93	0.01	I (1)
INF	0.000	0.000	I (1)	0.0001	0.001	I (1)
KSE100	0.71	0.06	I (1)	0.32	0.20	I (1)
MS	0.008	0.000	I (1)	0.008	0.0001	I (1)

The results in Table 4 demonstrate that all variables are stationary at the first difference and we cannot use ARDL approach. Instead, we can employ Ordinary Least Square (OLS) method for further analysis.

4.4 Regression Analysis

We use Multiple Regression analysis to determine long-term relationship between dependent and independent variables. Table 5. illustrated estimated results of Multiple Regression analysis

Table 5 Multiple Regression analysis results

Dependent Variable: M_C				
Method: Least Squares				
Sample: 2000 2022				
Included observations: 22				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

BM	-117924.8	29147.58	-4.045782	0.0008
DCR	576949.8	118993.2	4.848595	0.0002
INF	-45362.64	46391.95	-0.977813	0.3419
KSE100	127.8360	25.48631	5.015870	0.0001
MS	-118023.2	127594.7	-0.924985	0.3679
R-squared	0.778532	Mean dependent var		1365136.
Adjusted R-squared	0.726421	S.D. dependent var		2975349.
S.E. of regression	1556249.	Akaike info criterion		31.55017
Sum squared resid	4.12E+13	Schwarz criterion		31.79814
Log likelihood	-342.0519	Hannan-Quinn criter.		31.60858
Durbin-Watson stat	0.940261			

The results in Table 5 show that Broad money (BM) has a negative association with Market capitalization, and it means one unit increases in broad money (BM) is associated with 11.29 % decrease in market capitalization. Null hypothesis **(Ho)** which states that broad money is negatively associated with market capitalization is accepted and alternate hypothesis **(H1)** is rejected. However, discount rate DCR) has a positive and significant association with market capitalization, which suggests that a one unit increases in discount rate is associated with 57.69% increase in market capitalization. Null hypothesis **(Ho),** which states that discount rate is negatively associated with market capitalization is rejected and alternate hypothesis **(H_1)** is accepted because empirical results support to alternate hypothesis. Inflation (INF) has negative association with market capitalization and, indicates that a one unit increases in inflation rate is associated with a decrease in market capitalization by 45.36% in the long-term. Null hypothesis **(Ho),** which states that inflation is

negatively associated with market capitalization is accepted and alternate hypothesis **(H_1)** because the empirical findings support to null hypothesis.

KSE 100 index has a positive association with market capitalization and, it suggests a one-unit increases in KSE 100 index is associated with an increase in market capitalization by 12.78%. Thus, null hypothesis **(Ho),** which states that KSE100 index is negatively associated with market capitalization is rejected and alternate hypothesis **(H_1)** is rejected because the findings of the study support to alternate hypothesis. However, money supply has a negative association with market capitalization and, one unit increases in money supply (MS) is associated with 11.80% decreases in market capitalization. Thus, null hypothesis **(Ho)** which states that money supply is negatively associated with market capitalization is rejected and alternate hypothesis **(H_1)** is accepted.

The value of R^2 0.778532 shows that 77.86 variations in dependent variable is explained by the combined effect of independent variables. The value of adjusted R^2 72.64% show that the model used in this study is goodness of fit and the results of analysis are robust.

4.5 Multicollinearity test

The Variance Inflation Factor (VIF) is used to check multicollinearity among variables for which we need the coefficients and the R^2 values for each independent variable. Now we calculate the VIF for each variable and Table 6 exhibits results.

Table 6. Results of VIF Test

Variable	Coefficient	R-squared	VIF
BM	-117924.8	0.778532	4.566
DCR	576949.8	0.778532	4.566
INF	-45362.64	0.778532	4.566

KSE100	127.8360	0.778532	4.566
MS	-118023.2	0.778532	4.566

All VIF values are approximately 4.52, which indicates that there is moderate multicollinearity among the independent variables. Typically, VIF values above 10 are considered problematic, so these values do not suggest severe multicollinearity in the model.

4.6 Residual diagnostic tests:

4.6.1 Heteroscedasticity test

Table 7 exhibits the results of the Breusch-Pagan-Godfrey Heteroskedasticity Test, which assesses whether the variance of the errors (residuals) in a regression model is constant across observations.

Table 7 Breusch-Pagan-Godfrey's Heteroskedasticity Test:

F-statistic	0.900260	Prob. F (5.8)	0.5246
Obs*R-squared	5.040930	Prob. Chi-Square (5)	0.4109
Scaled explained SS	2.083239	Prob. Chi-Square (5)	0.8375

The above results demonstrate that the F-statistic is 0.900260 and associated p-value (Prob. F) is 0.5246. Since the p-value is greater than the typical significance level of 0.05, we cannot reject the null hypothesis. It suggests that there is no evidence of heteroskedasticity in the residuals. The value of R-squared and associated p-value is greater than 0.05 and as such we accept null hypothesis and reject alternate hypothesis. The null hypothesis states that there is no Heteroskedasticity and the values of error term is normally distributed.

4.6.2 Serial correlation

Table 8 presents the results of the Breusch-Godfrey Serial Correlation LM Test, which is used to examine whether there is a serial correlation (autocorrelation) in the residuals of a regression model.

Table 8 Breusch-Godfrey's Serial Correlation LM Test:

F-statistic	0.042351	Prob. F (2,6)	0.9588
Obs*R-squared	0.194885	Prob. Chi-Square (2)	0.9072

The results in the above table show that the F-statistic is 0.042351. Since the p-value associated with this statistic (Prob. F) is 0.9588, which is very high, we fail to reject the null hypothesis. It suggests that there is no evidence of serial correlation in the residuals. The Oberg-squared value is 0.194885. The associated p-value (Prob. Chi-Square) is 0.9072, which is also very high. Similarly, we fail to reject the null hypothesis based on this statistic. In this way, both statistics suggest that there is no significant serial correlation in the residuals of the regression model.

5. Discussion

5.1 Main Findings

The purpose of the study was to determine the nexus between broad money, exchange rate, inflation and KSE 100 index and money and their impact on market capitalization of Pakistan Stock Market, using 30-year data from 1990 to 2020. Market capitalization was dependent variable, while Broad Money, Discount Rate, Inflation, KSE100 and Money supply were independent variables. Different statistical techniques, such as descriptive statistics, correlation matrix, ADF test, Multiple Regression Analysis, Inflation variance

Factor (IVF) test, Heteroscedasticity test and serial correlation test were used to draw the results. The descriptive statistics analysis shows that the data of variables in the model are normally distributed. The results of correlation matrix demonstrate that market capitalization shows positive correlation with broad money while it has negative correlation with discount rate. The correlation between Broad Money and discount rate is positive. Similarly, the correlation between inflation and money supply is positive. The correlation between Money Supply and Discount Rate is positive. All variables except market capitalization and discount rate have positive and significant correlation with each other.

The results of Multiple Regression analysis demonstrate that Broad money (BM) has negative association with Market capitalization, while discount rate (DCR) has positive and significant association with market capitalization. Inflation (INF) has a negative association with market capitalization. KSE 100 index also has positive association with market capitalization. However, money supply has a negative association with market capitalization. The R-squared and adjusted R-squared values are 0.778532 and 726421, respectively and it suggests that from variation in dependent variable is explained due to combined effect of all independent variables. Thus, the model used in this analysis is goodness of fit. In order to check multicollinearity in the model, the variance inflation factor (VIF) was used and results indicate that all VIF values are approximately 4.52, which is in tolerance range. The: Breusch-Pagan-Godfrey's Heteroskedasticity Test was applied to check Heteroskedasticity in the model and the results show that the F-statistic is 0.900260 and associated p-value (Prob. F) is 0.5246. Since the p-value is greater than the traditional significance level of 0.05, we cannot reject null hypothesis. It suggests that there is no evidence of heteroskedasticity in the residuals. We also applied

Breusch-Godfrey Serial Correlation LM Test to examine serial autocorrelation in the model. The findings reveal that there is no evidence of autocorrelation in the residuals and we cannot reject null hypothesis. These findings are consistent with Krichene, (2012); Iddrisu, et al. (2017); Ogbebor, et al (2021); Gürkaynak, et al (2022); Schrank, (2024) and Jiang, Tony and Zhongyang, (2024)

5.2 Theoretical contribution

This study provides valuable theoretical contribution by investigating into the nexus between broad money, exchange rate volatility, inflation, KSE 100 index, and money supply and their collective impact on market capitalization. The findings of the study also provide insights for understanding the stock market capitalization in Pakistan.

The results of multiple regression suggests that broad money (BM) has negative relationship with market capitalization, which indicates that investors may adjust their portfolio allocations in response to change in the quantity of broad money. These findings are in line with Markowitz's (1952) *theory of portfolio diversification,* which emphasizes to diversify investment in different class of assets to reduce risk. The empirical results demonstrate that discount rate (DCR) has a positive and significant association with market capitalization. This implies that investors may exhibit lower preference for liquid assets, such as cash, when discount rates are higher. As a result, they may prefer to allocate more fund to their portfolio in the stock market, leading to an increase in market capitalization as well as the value of stocks as suggested by Tobin's (1958) *theory of liquidity*. The findings of this study also support to Sharpe's (1964) *theory of market equilibrium,* which states that investors perceive risk of time and risk of price to attain equilibrium. They avoid investment in stocks when inflation is high and money supply is in

access, which causes inflation to increases and also trigger interest rate. The empirical results reveal negative relationship between inflation and market capitalization, suggesting that high inflation may impact investor behavior and portfolio allocation specifically when a one unit increases in inflation rate is associated with a decrease in market capitalization by 45.36% in the long run. This finding aligns with Milton Friedman's (2000) *theory of monetary policy*, which emphasizes the importance of controlling inflation for maintaining economic stability. Similarly, the exchange rate volatility also affects investors sentiment, and market behavior and it also indirectly affect market capitalization. When exchange rate fluctuates, it produces uncertainty in the markets and investors prefer to adjust their portfolio in response to change in exchange rate. This finding aligns with Mussa's (1984) *Theory of Exchange Rate Determination.* The high values of R-squared and adjusted R-squared suggest that the model of the study is a goodness of fit, suggesting that the relationships between the independent variables (broad money, exchange rate volatility, inflation, KSE 100 index, money supply), and market capitalization are well-explained by the regression model. This also aligns with the Sharpe's (1964) *theory of market equilibrium* (Capital Asset Price Model), which suggests that supply and demand forces interact to determine asset prices and market behavior.

5.3 Policy implications

The findings of this study provide several practical implications for investors, market participants, financial analysts and policymakers. For example, the policy makers can use the findings of this study to frame effective monetary and fiscal policies to trigger growth and stabilize stock market. The policy makers should monitor the excess liquidity in the market through managing money supply because these two variables are negatively

associated. The negative impact of money supply on the market capitalization can be reduced. As the findings of the study show positive association between discount rate and market capitalization, the policymakers can manipulate this tool to stimulate stock market and increase market capitalization. The investors by taking into account the results of the study can take rational decisions to reduce market risk and enhance their return as suggested by Fama (1970). The investors can diversify their portfolio to minimize the risk and balanced returned as suggested by Sharpe (1964). The proactive approach to cope with unpredictable market behavior and sudden economic shocks will enable them to manage market resilience and stability.

5.3 Limitations and suggestions for further research

The study has certain limitations that are as follows: -

- This study relies on time series data spanning from 1990 to 2020, which may not fully capture structural changes in regulatory framework in the financial market. Future research could utilize latest data to improve the accuracy of results and predict about the behavior of market in its true perspectives.
- The findings of this study are based on certain assumptions of econometric modeling, which may not fully measure the complexity of real-world market dynamics. The Researchers should explore alternative modeling mechanism to boost the robustness of results.
- This study just focuses on internal macroeconomic variables and determine their impact on market capitalization by ignoring the impact of external shocks such as global economic conflicts, geopolitical events, and technological disruptions. The new researchers should also include the external factors into their studies to provide a more comprehensive understanding of market dynamics. Comparative analysis of the performance of Pakistan, India, Bangladesh and China can provide valuable insights about the common and

diverse aspects of market capitalization in these countries. Thus, the scholars can improve theoretical understanding of stock market dynamics and provide evidence-based policy decision-making and investment strategies in the emerging economies particularly in Pakistan.

Data statement

The data that supports the findings of this study will be made available on strong request.

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Declaration of competing interests

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