Can macroeconomic variables predict China's stock market returns ? Evidence using Cointegration approach

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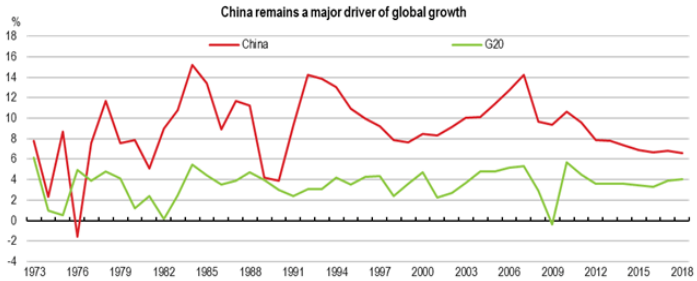
ABSTRACT :

This study aims to investigate the effect of macroeconomic variables on the stock market in China. This study uses monthly data from January2001: December 2019.Johansen Cointergration test is employed to examine the long run relationship of macroeconomic variables namely inflation, interest rate, GDP, money supply, gold price, oil price and exchange rates. The estimation results indicate a long run relationship exists between the stock market and the selected macroeconomic variables.

1.INTRODUCTION:

The relationship between macroeconomic variables and stock prices are gaining importance both empirically and theoretically. Countries are interdependent and thus examining the macroeconomic factors are unavoidable.China is the World's first civilized, World's most populated country and the third-largest country in the area. As per the IMF forecast report, China leads the US in GDP by the year 2030. China needs reforms by addressing the high-quality and sustainable growth and it is a hub to regional and world development issues. The aim of the paper is to assess the how far the macroeconomic variables can help in predicting the stock markets of China.



Source :OECD Outlook

Fig 1.1 Real GDP of China with G20

2.REVIEW OF LITERATURE:

Flannery and Protopapadakis (2005)examined the interaction of return of Newyork Stock Exchange with macro-economic variables like Consumer Price Index, the supply of money, and a significant relationship established between stock market returns with inflation and money growth. Usually, the market reacts to the macroeconomic announcement. The appropriate macro variables benefit the stock returns in two ways. First, it can identify as a hedging opportunity & can constitute a priced factor for investors. Sirucek(2014) investigated the implication of macro-economic variables, namely interest rates, supply of money, Production output from Industry index, oil price, and unemployment on the S&P 500 index& Dow Jones Industrial Average(DJIA).Both the Index establishes a negative relation with inflation rates and unemployment. The supply of money was the least significant element, and the result contradicts the economic theory. Interest rates had a positive impact on the S&P 500, whereas negative relationships resulted in DJIA. As per the economic theory, positive correlation runs between the index and oil prices. The increase in the value of the IIP indicates revenues grow and depress the profits. However, the results of the IIP with both the Index show negative Index. Celebi and Hönig (2019)argued leading economic indicators to impact the German Stock index, DAX30 and the study included 24 economic factors.

Rani (2015)confirmed BSE Sensex had a larger frame of time and bi-directional causality with inflation, supply of money, and exchange rate. BSE Sensex had no evidence of causality with Inflation, FII, supply of money and Exchange rate using Error Correction Model(ECM) from April 2005 to December 2015. The results of correlation analysis show that BSE sensex has a stronger correlation with Rate between exchange of currencies, Inflation, rate between exchange of currencies, and IIP and weak relationship with FII. The author concluded that the Indian economy needs to infuse investment both in the long-run and short-run by retaining inflation and exchange rate at modest rates.Gan et al. (2017)focused on identifying the factors influencing the New Zealand stock Index(NZSE40), considering a set of seven factors, namely inflation rate, long and short term interest rates, rate between exchange of currencies, GDP, Supply of money(M1), and domestic retail oil prices. They developed their research using the Johansen

Cointegration test and found a long-term relationship that exists between the price of stocks and selected macroeconomic variables.Masood, Tvaronavičienė, and Javaria (2019) conducted a study for G-7 countries on the interrelation between the stock market performance with industrial production, oil prices, and short tenure interest rates over the period September 2009 to August 2016. The results of regression analysis reveal crude oil prices and stock market are negative for Germany, France, Italy, and Japan. On the other hand, interest rates negatively affect the stock prices in Canada, UK, US and IIP had positive relationships with the stock market performance of Germany, Italy, Japan, France and UK.Tiryaki, Ceylan, and Erdoğan (2019) made an attempt to determine the asymmetrical and non-linearity of macroeconomic factors on the Stock market of Turkey. The study tried to explore the influence of IIP, Money supply and Foreign currency exchange rates on the stock market returns post the 2001 financial crisis.Bhuiyan and Chowdhury (2019)suggested a cointegration analysis and Error Correction to model the influence of Production output from Industry, supply of money, long term interest rates with bench market index, and different sectoral indices in the US and Canada over the 2000-2018 period.Supply of money established a positive influence and long term interest rate a negative influence with US Stock index.However Canadian stock index S&P/TSX found no cointegrating relationship with the chosen macroeconomic variables. US supply of money and long-term interest rate influence Canadain stock market which show US market as powerful in the world economy. Phylaktis and Ravazzolo (2005) analyzed long and short term linkages between the price of stocks and rate between exchange of currencies. The study was confined to Singapore, Malaysia, Thailand, Hong Kong,and the Philippines from 1990 to 1998.Cointegration and Multi-Granger causality results imply a positive relationship among the chosen variables. US stock market influence greatly on the foreign exchange and local stock markets during the Asian Financial Crisis and found the crisis had a temporary effect on the long-run co-movement.Granger, Huangb, and Yang (2000)applied unit roots and the Cointegration model in Hong Kong, Malaysia, Singapore, Taiwan and Thailand to determine the causality between stock prices and currency exchange rates. The exchange rate leads Korean price of stocks which confirms the traditional approach. Philippines price of stocks lead a negative correlation with exchange rates whereas Hong Kong, Singapore, Thailand and Taiwan, Malaysia had strong feedback and Indonesia and Japan had no relationship.

3.RESEARCH QUESTIONS :

- What is the nature of the relationship between selected macroeconomic variables and US Stock return?
- Is the nature of the relationship long-run or short-run between the stock markets and the macroeconomic variables?

4.RESEARCH METHODOLOGY:

4.1 VARIABLES FOR THE STUDY:

Dependent variable for the study is the stock prices and the independent variables are macroeconomic variables.

Variable		Proxy variable
Dependent	Stock Price	SSE- Composite
Independent	Inflation	Consumer price index(CPI)
	Growth rate	Index of Industrial Production(IIP)
	Interest rate	10-Y Govt Bond rate
	Money Supply	M2
	Gold Price	World Gold price(in ounce)
	Oil Price	Crude Oil Price(Brent)
	Exchange rates	US Dollar exchange rate

Table 4.1: Description of the variable

4.2 DATA:

The stock index value of SSE (Composite) for the period January 2001 to December 2019 are employed and sourced from Thomson Reuters.

4.3 UNIT ROOT TEST:

Most of the economic (GDP, exchange rates etc.,) and financial time series exhibit trends or non -stationarity. The standard method to remove the detrend is the first differencing and time trend regression. The time series is stationary if it has a constant mean and variance, and covariance value depends on the difference between the two periods of time but not the actual period at which covariance is computed (Gujarati, 2009).

$$y_t = y_{t-1} + u_t \qquad (4.1)$$

The series is integrated of order d if y_t is differenced d times to make it stationary and represented as $y_t \sim I\ (d).I(0)$ is stationary at level and $I(1)$ series contains one unit root.

The autocorrelation effect can be augmented using *p*lags of the dependent variables and represented by the following equation

$$y_t = y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + u_t \qquad (4.2)$$

In order to examine the long run relationship among the variables, cointegration tests is performed and Vector Error Correction Model (VECM) to further examine the long run behavior of the variables and combines the short run and long run properties.

Estimation of VAR model under VECM approach can be specified as below

$$\delta X_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i}\, \delta X_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\, \delta Y_{t-i} + \Delta_1 \xi_{1t-i} + \xi_{1t} \qquad (4.3)$$

$$\delta Y_t = \alpha_1 + \sum_{i=1}^{n} \beta_{2i}\, \delta Y_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, \delta X_{t-i} + \Delta_2 \xi_{1t-i} + \xi_{2t} \qquad (4.4)$$

Where Δ_1, Δ_2 are the Coeeficients of error correction model and represents the speed of adjustments of disequilibrium in the period of study

$\xi_{1t-i} \& \xi_{2t-i}$ are the error correction term at lagged value i

γ_{1i}, γ_{2i} captures the short-run influence from changes in X to Y and Viceversa

4.4 ANALYSIS:

4.4.1Summary Statistics:

Descriptive	**LCHSHN**	**LCHCPI**	**LCHIIP**	**LCHIR**	**LCHM2**	**LCHEX**	**LCHGLD**	**LCHOI**
Mean	7.7483	4.4689	4.7151	0.8450	11.0206	4.6341	8.7211	4.2992
Median	7.7823	4.4615	4.7203	0.8109	11.1184	4.6185	8.9015	4.3267
Std. Dev.	0.3778	0.1348	0.0414	0.2969	0.7528	0.1451	0.4329	0.4352
Skewness	-0.1366	-0.1702	0.0871	0.0905	-0.1860	0.0958	-0.6748	-0.2985

Kurtosis	2.3825	1.6297	1.6858	2.1517	1.6852	1.6074	2.1907	2.1461
Jarque-Bera	3.8758	16.9459	14.9376	6.3960	15.8705	16.7969	21.0507	9.2268
Probability	0.1440	0.0002	0.0006	0.0408	0.0004	0.0002	0.0000	0.0099
Sum	1580.6530	911.6551	961.8872	172.3832	2248.1940	945.3464	1779.1120	877.0394
Sum Sq. Dev.	28.9689	3.6864	0.3483	17.8891	115.0286	4.2757	38.0507	38.4449

Table 4.4.1 Source : Compiled using Eviews 10

SHN, CPI, M2, GLD, OI are negatively skewed whereas IIP, IR and EX have a long tail with positive skewness value and the series kurtosis value remains lesser than 3 have a platykurtic distribution.JarqueBera test indicates all the variables of Indian and China are not normally distributed, as p-value is lesser than 0.05.

Country	**Variable**	**Level**		**First Difference**		
		t-statistics	**p-value**	**t-statistics**	**p-value**	**Stationarity**
China	LCHSHN	-1.7379	0.7309	-12.7784	0.0000	I(1)
	LCHCPI	-3.0781	0.1144	-11.2547	0.0000	I(1)
	LCHIIP	-5.0234	0.0003	-15.3128	0.0000	I(1)
	LCHIR	-1.8417	0.6807	-6.7480	0.0000	I(1)
	LCHM2	-1.2743	0.8911	-4.7143	0.0009	I(1)
	LCHEX	-3.8370	0.0165	-10.2232	0.0000	I(1)
	LCHGLD	-1.2667	0.8929	-12.8040	0.0000	I(1)
	LCHOI	-2.1314	0.5248	-11.1873	0.0000	I(1)

Table 4.4.2 : ADF test results

The most frequently demonstrated test amongst all for checking stationarity on a set of data is the ADF test because of its quality of relaxing the postulation of autocorrelation among residuals.By taking first-order differencing for the macroeconomic variables and the stock market index, the null hypothesis of unit root (Time series has unit root) is rejected at 5% significance level lending continuity in the modelling process.Unit root test results show all the modelled variables are integrated of the same order I(1), hence the Johansen and Juselius method technique is applied to explore the long-run relationship among the variables. The initial step in multivariate

cointegration is to determine the appropriate lag selection for the variables. The appropriate lag length is selected using the Akaike Information Criteria (AIC).

The test results of AIC is represented below

Indices & Selected Macroeconomic indicators	AIC	Lag Length
SSE Composite	-37.57799*	2

The following equation was applied to find the long-run relationship between the dependent and independent variables using Johansen Cointegration.

$$Log\ ST = \alpha + \beta_1 Log\ CPI + \beta_2 LogIIP + \beta_3\ LogIR\ + \beta_4\ LogM2\ + \beta_5 LogEX + \beta_6 LogGLD + \beta_7 LogOI + \epsilon_i \quad (4.5)$$

The cointegrating vectors are found using Maximum Eigen Value and Trace Statistics

Indices with Selected Macroeconomic indicators	Number of Cointegrating Relationships	Trace Statistic	Max Eigenvalue Statistic
SSE Composite	None *	219.6802	70.3415
	At most 1 *	149.3387	–
	At most 2*	106.9343	
	At most 3*	73.9098	

Table 4.4.2 : Maximum Eigen Value and Trace Statistics results

The first normalized Cointegration equation are estimated below

LCHSSE = 88.9052 LCHCPI + 93.3637 LCHIIP – 1.5883 LCHIR - 14.5101 LCHM2 +9.5404 LCHEX + 2.5487 LCHGLD - 2.134 LCHOI (4.6)

The short-run dynamics are estimated using the Vector Error Correction Model

Index	Nature of Relationship	Variables	EC term
LCHSSE	Long Run	DLCHIIP	-0.034083
		DLCHOI	
		DLCHM2	-1.628045

	Short Run	DLCHCPI	
		DLCHIR	
		DLCHM2	
		DLCHEX	

Table 4.4.2 : Vector Error Correction Model(VECM) results

Existence of long-run relationship of CPI, IIP, IR,M2,EX,GO,OI with BRICS and developed stock market index is observed. This can support the investors and policy makers to observe the degree of impact and the trend between the variables. The policymakers should watchout for the fluctuations in exchange rate and the oil prices

5.CONCLUSION:

This paper aims to test whether the macro economic variables affect the stock market in China. The analysis was carried out on a monthly data from January 2001 to December 2019. According to basic stock valuation models, stock returns should reflect macroeconomic fundamentals. Augmented Dickey fuller test was carried out to check the stationary and the test results shows all the chosen variables shows stationary at first order differencing I(1). Johansen Co integration test is employed to establish the long run relationship between the stock market and the macroeconomic variables .The study can include the more recent dataset and study the influence of Covid-19 on the stock market index volatility. Topics such as which policies and regulations can affect the stock market are also possible directions for future research.

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