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Impact of Macroeconomic Variables on Stock Market Indices Value: A Cross-Country Indices Study

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Abstract

Complete unpredictability and the contagion effect of stock markets could pose significant challenges for the entire financial markets of the world. Moreover, it is an incontrovertible truth that the variations in stock market indices is an integral part of the dynamics of economic activity and can propel social moods and expectations. In fact, the stock market has predicted 10 out of the last 3 recessions. In this context, this paper examines the present scenario of the stock markets across the under-developed, developing and developed economies of the globe. With the aid of various literature and article reviews, the variables that affect the stock market movement are determined to be inflation, industrial production index, foreign institutional investments, exchange rates, bank rates, unemployment rate, credit rating of various countries and the country's current state of development. As the stock market follows a non linear trend, this paper employs an auto-regression model to arrive at the degree of influence of each variable on the stock market index change. Ultimately the paper aids the policy makers and the investors to focus on the most influencing factor to

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end in better stock picking decisions thereby leading to superior earning capability.

Keywords: Stock market indices, Financial markets, Auto-regression model, Various economies

JEL Classification: G15, E44

Introduction

As the saying goes, the stock market is the barometer of business; the stock market indices reflect the economic status of many countries. It influences the investors' confidence, capital accumulation, international trading, industrial production, liquidity management and henceforth the entire economical development. Most likely, the investment opportunities and the performance of the financial markets in general are impelled by the macro-economic scenario across the globe. Ultimately, it is important to promptly arrive at a decision of which macro-economic variable affects the stock market to a larger degree so as to get a deeper insight on stock picking decisions that aid the end investors, the normal people like us who are the driving forces of any economy.

The paper captures the world's best, moderate and the worst performing stock markets in terms of stock market indices change and the macro-economic variables (inflation, industrial production index, foreign institutional investments, exchange rates, bank rates, credit rating of various countries and the country's current state of development) that affect the stock market indices.

Review of Literature

The Indian stock market index is taken as a function of exchange rates against USD, Index of Industrial Production (IIP), and Wholesale Price Index (WPI) as according to Dharmendra (2009). Chen *et al*. (1986) is of the opinion that changes in stock returns are inclusive of the increase in the industrial production, variation in the risk premium and the yield curve, fluctuations in inflation rates, etc. In order to affirm on the relationship between stock

market indices and the other factors, Dharmendra (2009) carried out unit root test and Granger causality test. This paper takes into account time series data. The results of the correlation matrix show that IIP and SENSEX have a strong correlation. Since causality and correlation are two different entities whose results are not the same; the causality tests show that only IIP influences the SENSEX and that the other two variables are not responsible for causing fluctuations in the stock market index.

Anthony Kyereboah-Coleman and Kwame F. Agyire-Tettey, (2008) in their journal on the movement of Ghana stock exchange indices with respect to various macro-economic variables indicate that the lending rates could primarily contribute to the performance of the stock market. The two models - Neo classical monetary growth model and Keynesian models put forth contradictory remarks on the interest rates' impact on the investment, income and savings thereafter. Rate of inflation, exchange rate, fiscal position, GDP, growth rate etc were other variables that could impact the stock market. The results showed that high lending rates had a negative impact on the business. Inflation also had its share of effect on the stock market indices but not too evident because the present inflation level hardly has an impact on the market. The only disadvantage to this paper was that the effect of macro-economic variables on the stock market index was studied only for one country.

Shiu-Sheng Chen(2003) in his journal on prediction of bear stock market identified the following variables to have an impact on the stock market index : interest rate spreads, inflation rates, aggregate output, unemployment rate, federal fund rates, federal government debts, nominal exchange rates. The aim of his paper was to help policy makers given the predictability of movement in the stock market indices thereby helping them to form market-timing strategies. The paper contributed to 2 types of approaches-parametric and non-parametric. Furthermore, a predictive regression model was made use of to test the hypothesis on the β value.

Tantatape and Komain (2007) through their study on the variations in the stock market indices of Thailand attributed to money supply,

industrial production index, exchange rate and oil prices observed that the money supply had a positive impact on the stock market. This was proved through the Granger's causality test. Furthermore, the impact was seen to a greater extent in the pre-financial crisis than the post-financial crisis in Thailand.

According to Aima, Hira and Zaheer (2011) , the increasing interest rates and exchange rates caused the returns to decline. Whereas inflation showed a positive impact on the stock market. The two major methodologies adopted was co-integration test and vector auto regression which was used to test the long term and short time relationship between the macroeconomic variables and its impact on the stock market indices.

David, Mark and Jesper (2005), in their study, included macroeconomic factors such as interest rates, industrial production, term spread and unemployment rate and money stock. The impact of these on the stock market was tested over 12 industrialised countries and was observed that the interest rates are strong predictors and better reliable to estimate the returns on stock.

Findings from Seyed, Zamri, Yew Wah (2011) show the relationship between the stock market indices and 4 major macroeconomic variables such as crude oil price, money market, inflation and industrial production in China and India. The effect of industrial production and inflation seems to be positive in India whereas the effect of crude oil prices and money supply is negative in India. Unit test and Multi-variate co-integration test were used to determine the relationship between the two variables.

According to T. Sampath (2011), the Auto- Regressive Distributed Lag (ARDL) approach was used to test co-integration. The effect of Wholesale Price Index (WPI), real effective rate and Index of Industrial Production (IIP) seemed to show stronger effect on the stock prices. Exchange rates and Inflation seemed to show a negative relationship to the stock prices.

The following were the possible variables that were obtained from the review of literature - IIP, Money supply, Exchange rate, Interest rate spreads, Inflation rates, Crude Oil Prices, Lending rates, Real

effective exchange rate, Wholesale price index and Index of Industrial Production.

Econometric Model and Sample size estimation:

The econometric model used is linear in nature.

$$Y = f(X1, X2, X3, X4, X5, X6, X7)$$

$$\text{implies } Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + Ui$$

Where,

Y- Stock market index value change (2009-10)
X1- Interest Rate Spread
X2- Internet Users/100
X3- GDP growth (2009-10)
X4- Foreign Direct Investments
X5- Money Supply Growth
X6- Stock Turnover
X7- Real and Effective Exchange rate index

Out of the 214 countries, only 37 of them are listed in the world federation of exchanges and 44 are non-listed. The sample size consists of 24 countries that constitute a combination of developed and developing economies in the ratio 1:2 the data obtained consists of information over the year 2010. This constitutes about 65% of the population (i.e.) 24 out of 37 countries.

Methodology

A linear regression model was run on SPSS over the obtained data to check on the stability and the significance of the independent variables

Data

The data sources available in the IMF website, World Bank website, the websites of the various stock markets all over the world and various other journal articles serve as our database. This paper reflects a set of cross sectional data of the annual stock market indices change and the annual macro-economic variables across 24 countries.

Of the possible variables listed through literature review, the following variables were considered: Interest Rate spread, FDI, GDP Growth, Money Supply Growth, and Real and Effective Exchange Rate index. Apart from these 5 variables were introduced 2 new variables: Internet Users and Stock Turnover.

Table: 1

Country Name	Index	Interest Spread	Internet Use	FDI	GDP	StockTurnover	REER	Money
Australia	AORD	3.067	775.89	6.059	2.257	90.077	115.18	9.376
Bahrain		6.023	55	-1.808	4.5	1.539	89.45	10.509
Bulgaria	SOFIX	7.068	45.98	1.3609	0.4	2.754	121.05	6.303
Chile	IPSA, IGPA	3.004	45	6.3509	6.095	19.712	108.45	10.561
China	SSE	3.06	34.39	1.2511	10.4	164.372	118.66	18.948
Colombia	IGBC	5.72	36.5	3.3808	4.001	13.44	120.32	11.458
C. Republic	PX Index	4.806	68.64	4.9209	2.739	29.417	122.45	1.876
Hungary	BUX	2.669	65.16	3.9109	1.258	94.528	106.12	4.2
Israel	TA-100	2.93	65.39	-2.8009	4.846	66.66	115.39	-11.004
Japan	Nikkei 225	1.098	77.64	-5.9010	4.435	114.488	102.68	1.919
Malaysia	KLSE	2.521	56.3	-4.309	7.194	27.067	108.81	7.348
Mexico	IPC	4.074	31.05	6.6409	5.519	27.306	92.72	12.767
Netherlands	AEX Index	-0.597	90.71	-6.6010	1.69	98.372	99.02	4.028
N. Zealand	NZX 50	1.672	83.01	1.2808	1.9	34.724	94.94	8.359
Nigeria	NSXA	11.064	28.43	5.139	7.824	12.538	117.93	9.31
Pakistan	KSE 100	5.898	16.78	1.9709	4.144	36.181	103.39	15.053
Philippines	PSE Index	4.453	25	6.8208	7.632	22.552	126.8	10.897
Romania	BET-10	6.759	40.02	2.9609	0.948	5.428	104.19	6.817
Russia	RTS Index	4.808	43.31	-9.2009	4.3	85.714	125.93	24.59
Singapore	FTSE Group	5.174	71.14	1.8910	14.763	82.879	111.28	8.611
S. Africa	JSE	3.368	12.33	1.3909	2.89	39.599	101.23	6.934
Switzerland	Swiss Market	2.653	82.17	-4.4010	2.714	75.602	107.5	5.501
Ukraine	PFTS index	5.313	44.59	5.7609	4.1	7.477	99.07	22.691
Zambia		13.516	10.13	6.348	7.61	9.161	125.99	29.859

Tests and Interpretations

Best Fit of the Line: The estimates of the model were obtained from the unstandardised beta co-efficient got through the linear regression model. The error terms were calculated by taking the difference between Y (dependent variable) actual and estimate. The sum of all the error terms obtained was zero. This shows that the model has a best fit line.

The Chow test was also done to show structural stability in the model and hence the model proved *no structural break* in the model.

Table: 2

Country Name	Stock market Indices- (S&P Global Equity % change)		Estimate	Error
	Indices	y	y-	u
Australia	All Ordinaries, S&P/ASX 200	12.49092	-3.35154	15.84245661
Bahrain		9.96791	11.49532	-1.52741197
Bulgaria	SOFIX	-15.1638	3.09932	-18.263168
Chile	IPSA, IGPA	47.24033	43.48376	3.756569958
China	SSE Composite Index	6.914683	8.520687	-1.60600381
Colombia	IGBC, COL20, COLCAP	44.05827	30.211	13.84727059
Czech Republic	PX Index	0.20595	5.489962	-5.28401215
Hungary	BUX	-10.7507	-10.9733	0.222675024
Israel	TA-100 Index (Tel Aviv 100)	7.362251	-0.2376	7.599847542
Japan	Nikkei 225	9.614292	6.388457	3.225835603
Malaysia	KLSE	35.06396	42.90104	-7.83708227
Mexico	IPC Index	26.59595	31.34764	-4.75169543
Netherlands	AEX Index	1.152789	9.977841	-8.82505216
New Zealand	NZX 50 Index	5.230025	10.79224	-5.56221919
Nigeria	NSXA-B index (The All-Share Index)[6]	20.29219	6.980786	13.31140105
Pakistan	KSE 100 Index	15.32022	24.43258	-9.11235466
Philippines	PSE Index	56.66901	55.65219	1.016823516
Romania	BET-10	-6.58282	0.660122	-7.24293902
Russian Federation	RTS Index (RTSI)	21.67312	28.45272	-6.77959643
Singapore	FTSE Group indices	18.43888	27.08247	-8.64358557
South Africa	JSE	32.0867	28.49477	3.591929357
Switzerland	Swiss Market Index	11.03874	4.258032	6.780712541
Ukraine	PFTS index	53.84306	32.49824	21.34481854
Zambia		17.38908	22.49429	-5.10520831

Multicollinearity was used to check if there is any correlation between the independent variables. The factors checked are Tolerance and VIF. Both are inversely related and any VIF rating below 8 is considered to not have problems of multicollinearity.

It was also observed that all the *seven variables* were proved to be *statistically significant* with 90% confidence interval.

Table: 3

Model 1	Coefficients	Standard Error	t-Value	Sig.	VIF
(constant)	3.323	27.888		0.119	
Interest Rate spread	-6.786	1.371	-1.056	-4.949	3.060
Internet Users	-0.366	0.155	-0.444	-2.359	2.381
GDP growth	3.627	0.858	0.616	4.228	1.424
Stock turnover	-0.331	0.083	-0.736	-3.987	2.29
Money supply	0.998	0.367	0.429	2.721	1.665
FDI	-1.643e-10	0.000	-0.285	-1.830	1.627
Exchange Rate	0.479	0.258	0.272	1.857	1.441

Heteroscadasticity : The distribution of the square of the error terms with respect to the y-estimates was found to show *no significant pattern* and hence the distribution was said to be homoscadastic in nature.

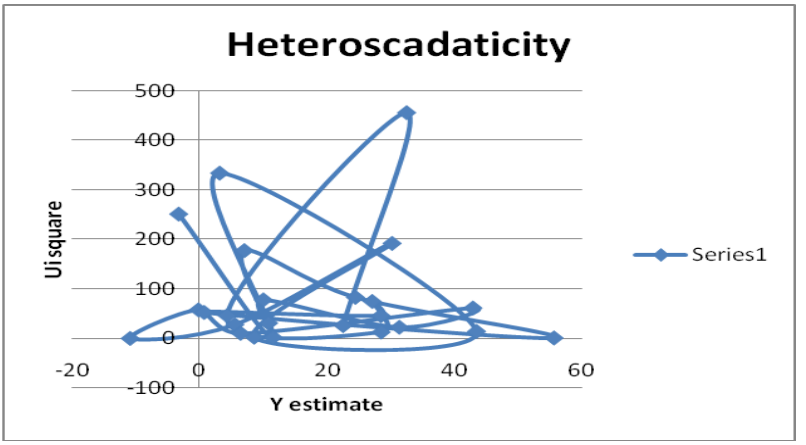

Fig:1

Table: 3

Country name	square	Y estimate
Australia	250.9834	-3.35154
Bahrain	2.332987	11.49532
Bulgaria	333.5433	3.09932
Chile	14.11182	43.48376
China	2.579248	8.520687
Colombia	191.7469	30.211
Czech Republic	27.92078	5.489962
Hungary	0.049584	-10.9733
Israel	57.75768	-0.2376
Japan	10.40602	6.388457
Malaysia	61.41986	42.90104
Mexico	22.57861	31.34764
Netherlands	77.88155	9.977841
New Zealand	30.93828	10.79224
Nigeria	177.1934	6.980786
Pakistan	83.03501	24.43258
Philippines	1.03393	55.65219
Romania	52.46017	0.660122
RussianFederation	45.96293	28.45272
Singapore	74.71157	27.08247
South Africa	12.90196	28.45272
Ukraine	455.6013	32.49824
Zambia	26.06315	22.49429

Auto-correlation - the correlation between the error terms were found not to exist. This was supported by the data on *Durbin Watson co-efficient* which was obtained as *1.976.* **Correlation** between the independent variables were found to be *moderate* in nature (i.e.) between 0.4 and 0.6 majorly.

Table: 4

Coefficient Correlation						
Variables	**REER**	**Stock Turn-Over**	**Money Supply**	**GDP Growth**	**FDI**	**Internet Users**
REER	1.000					
Stock turnover	-0.343	1.000				
Money Supply	0.144	-0.232	1.000			
GDP Growth	-0.021	-0.246	-0.050	1.000		
FDI	-0.043	-0.259	-0.045	-0.294	1.000	
Internet User	0.066	-0.312	0.328	0.005	0.370	1.000

Ranking

The ranking was done by calculating the technical efficiency which is the ratio of y-actual to y- frontier. The S&P rating assumes a different base year (1941-43) as compared to our ranking which is on the basis of just the values obtained during the year 2010.

The ones is yellow signify round about the same ranking whereas those highlighted in green show drastic difference in ranking.

Table: 5

Y*	**Y/Y***			
Y Frontier	**Technical efficiency**	**My Ranking**	**S&P**	
53.84272	1.000006	**1**	**Ukraine**	**1**
51.55548	0.85458	4	Chile	2
76.99667	0.735993	3	Philippines	3
64.82824	0.7287	2	Colombia	4
28.32527	0.716399	5	Nigeria	5
17.99294	0.694212	8	Malaysia	6
49.83925	0.643804	22	Romania	7
64.24552	0.545781	21	Czech Republic	8
52.69213	0.504742	24	Hungary	9
49.7972	0.435228	16	Pakistan	10
25.60251	0.431159	9	Mexico	11
43.83877	0.39666	10	Russian Federation	12
48.42695	0.380757	13	Singapore	13
21.10689	0.348808	7	South Africa	14
27.73294	0.346674	14	Israel	15
45.77706	0.33467	20	Netherland	16
32.8398	0.303531	11	Switzerland	17
29.86517	0.23153	17	Bahrain	18
32.13673	0.162743	19	New Zealand	19
31.32232	0.036804	6	Australia	20
26.83444	0.007675	23	Bulgaria	21
22.0046	-0.29916	15	Japan	22
24.4438	-0.62036	18	China	23
10.37115	-1.03659	12	Zambia	24

Findings and Recommendations

Sl. No	Findings	Recommendations
1	High inverse variation between interest rate spread and Stock market index (-1.1)	Spread must keep varying according to the economy (Lending rate to increase, Deposit rate to decrease)
2	Internet users per 100, FDI are inversely related to the dependent variable	Exchange traded regulations must be tightened, FIIs are important for stocks trading→ Policy implications
3	Developing economies occupy the first five positions	Contagion effect policies can be implemented in such developing countries
4	Ranking differences	S&P's base year is 1941-43 for stock market performance and the inclusive criteria is in higher limits

Summary of tests and Interpretations

Test	**Significance of the test**	**Result**	**Interpretation**	**Is the model stable**
Sum(Ui)	Best fit line	0	Best Fit (BLUE)	Yes
Chow test	Structural Stability	F=0.435	No structural Break	Yes
Histogram	Error termdistribution	Normal curve	Normally distributed Ui	Yes
Multi-collinearity	Correlation among Independent Variables	VIF< 10, No great fluctuation, Tolerance <1, Rsqr	Independent variables are not co	Yes
Heteroscadasticity	Distribution of Uisqr	No pattern between Uisqr and Y estimate	Homoscadastic distribution	Yes
Auto-Co-relation	Correlation between error terms	Durbin Watson Co-efficient=1.976	Co-relation bet Ui, Uj=0	Yes
F-statistic	Sample regression prediciting Population	F=0.001 at 90% confidence	Adequate model	Yes
T-statistic	Ivs significance	All 7 Ivs' t<0.1 at 90%confidence, But insignifican	Significant Ivs	Yes
R sqr	Variation in all Ivs affecting DV	Rsqr= 0.762, Adjusted Rsqr= 0.657	Optimal Variations (No over/under)	Yes
Co-efficient Co-relation	Co-relation among Ivs	All values are moderate <= 0.6, >=-0.4	Not highly Co-related	Yes

Limitations of the study

- Stability in growth cannot be observed
- Non-linear pattern of stock market makes forecasting difficult

Scopes for improvement

- Ranking methodology can be improved
- Extension of model to panel data of the last decade

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