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Impact of the Macroeconomic Variables on the Stock Market Returns: The Case of Germany and the United Kingdom

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Abstract - This paper strives to investigate the long-run relationship and the short-run dynamics among macroeconomic fundamentals and the stock returns of Germany and the United Kingdom. Each case was examined individually, by applying Johansen co-integration, error correction model, variance decomposition and impulse response functions, in a system incorporating the variables such as consumer price index (CPI), interest rates, exchange rates, money supply and industrial productions between the period of February 1999 to January 2011. The Johansen cointegration tests indicate that the UK and German stock returns and chosen five macroeconomic variables are cointegrated. The findings also indicate that there are both short and long run causal relationships between stock prices and macroeconomic variables. The results imply the existence of short-term adjustments and long-term dynamics for both the UK and the German stock markets returns and the certain macroeconomic fundamentals. The results of the study also indicate that the variables employed in the VARs explain some of the variation of the stock market indices, while the intensity and the magnitude of the responses are comparable with regard to the UK and the German stock markets.

Keywords : Macroeconomic variables, Investor, Germany, UK, Returns, Stock markets.

JEL Classification : C22, E44, G15

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I. Introduction

Macroeconomic variables play an important role in the performance of stock market returns. Numerous studies document that there are link between macroeconomic variables and equity returns. It is found that changes in the macroeconomic environment affect the price of share. According to the arbitrage pricing theory the relation between stock returns and certain macroeconomic variables has been established (Ross-1976). In addition, some studies concerning multifactor models frequently incorporate certain macroeconomic variables as explanatory factor of the expected returns (Bilson et. al. 2001). A potential investor and portfolio manager looks at such a stock market where macroeconomic variable are moves sense of direction. It is very interesting to invest stock market but a very risky trench of investment. So, potential investors always try to predict the trends of stock market prices to obtain maximum benefits and minimize the future risks. Being concerned with the relationship between stock market returns and macroeconomic variables, investors might guess how stock market behaved if macroeconomic indicators such as exchange rate, industrial productions, interest rate, consumer price index and money supply fluctuate (Hussainey and Ngoc, 2009). Macroeconomic indicators are compositions of data which frequently used by the policy makers and investors for gathering knowledge of current and upcoming investment priority. The present studies have concentrated on two developed countries' stock markets such as Germany and the United Kingdom and will try to find out the relationship between stock market returns and certain macroeconomic variables in Frankfurt stock exchange and the London stock exchange.

The rest of the study is structured as follows: section two highlights on related literature, section three concentrates on methodology and description of the dataset, section four discusses the empirical results and finally, section five draws a conclusion to the study.

II. Review of the Literature

In globalized economy there are various ways financial market especially the stock market and the macro-economy have been related in the literature. In recent past, longstanding academic studies evidence that macroeconomic indicator affects stock prices. We find plenty of research on how the macroeconomic indicators affect the stock market. In 1981, Fama established a relationship among stock prices and macroeconomic indicators. He found that expected nominal inflation is negatively correlated in real activity and the reality is that the changing inflation has positive relation to returns on the stock market. Later studies support the Fama's (1981) hypothesis. Geske and Roll (1983) emphasized on the importance of policy responses in explaining stock returns. In 1987 Kaul also emphasized the same.

Errunza and Hogan (1998) examined whether the variability of a set of monetary and real macroeconomic factors can explain the variation of the some European stock market volatility. Employing a Vector-auto Regression (VAR), they found evidence to support that monetary instability is a significant factor for

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France and Germany, while for Italy and the Netherlands industrial production is significant. Employing Hodrick-Prescott filter methodology, Brooks et al. (2000) examined the cyclical regularities of financial, macroeconomic and property market aggregates in relation to the property stock price cycle in the UK and indicate that the cycles of consumer expenditure, per capita total consumption, dividend yield and the long-term bond yield are correlated and these variables are mainly coincidental with the property price cycle. The nominal and real T-bill, the interest rates, and other financial variables could provide information to explain stock returns in the United Kingdom. Nasseh and Strauss (2000), using quarterly data during the period of 1962.1 to 1995.4, studied several countries such as Germany, UK, Holland, France, Italy and Switzerland and concluded that CPI, IP exist with large positive coefficients in the said countries' stock markets. On the other hand, they pointed out that in the long-run, interest rates are negatively related. Furthermore, this study argues that the German industrial production and stock prices positively influence the return of other European stock markets like UK, Holland, France, Italy and Switzerland. Considering monthly UK data and employing ARCH and GARCH models, during the period 1967 to 1995, Morelli (2002), tried to determine the relationship between conditional macroeconomic volatility and conditional stock price volatility. This study considers several macroeconomic variables namely, industrial production, money supply, exchange rate, inflation and real retail sales. But the study claims that volatility of chosen macroeconomic indicators does not explain the volatility of stock price in the UK market. Rangvid et al. (2005) examined the predictability of twelve developed economies' stock markets return using macroeconomic variables. This study used macroeconomic variables such as industrial production, money supply, CPI, PPI, exchange rates and interest rates and claimed that interest rates are the reliable and consistent forecaster of equity returns in developed economies.

Inflation influences stock indices. Positive inflation that is: when inflation rate is higher than expected, which is economically bad news implies meaningful impact of stock returns in Spanish stock market (Diaz and Jareno, 2009). Mittal and Pal (2011) drew a similar conclusion regarding the Indian stock return volatility. They employed a VAR model examining Indian stock returns during the period of 1995–2008 (Quarterly data) and demonstrated that inflation rate has notable influences in major stock markets of India. Central bank interest rates or government securities rate has a mixed impact in stock returns. In this regards, Alam and Uddin (2009) studied on fifteen developed and developing countries interest rates during the period spanning from 1988 to 2003. Using both time series and panel regressions they claims that for all fifteen countries share price are negatively related with interest rates. They also found that, changes of interest rates had significant negative relationship with changes of stock price and this happened only in six countries out of 15.

Hussainey and Ngoc (2009) examine the macroeconomic indicator that industrial production and interest rates effects on Vietnamese stock prices. They also studied how Vietnamese stock prices influenced by the US macroeconomic indicators using time series data during the period of January 2001 to April 2008. They found notable relations among stock prices, money market and domestic industrial productions in Vietnam and the United States real production activity has stronger effects on stock prices of Vietnam. Before that, Hamzah et al. (2004) conducted a research on Singapore Stock Exchange to find out the long-term relationship among several macroeconomic indicators and stock price indices and property indices of Singapore. In this regard, they found that stock market indices and property indices creates co-integrating relationship among industrial production, money supply, exchange rate and interest rates. However, Filis (2010) found that there is no causal relationship between Greek stock market and industrial production during the period spanning from January 1996 to June 2008 using multivariate VAR model. He also argued, stock market and oil prices exercise a positive impact on Greek consumer price index in the long-run. Daly and Fayyad (2011) examined, the relationship between Gulf Cooperation Council (GCC) countries, the UK and the US stock market returns and oil price by employing DCV and VAR analysis during the period September 2005 to February 2010 and find that when oil prices increase sharply it predicts the USA, UAE and Kuwait but not the UK, Oman, Bahrain and Qatar.

There are little segmentation observed between emerging and developed market stock returns. The volatility of developed economies' stock returns is less than the volatility of emerging market stock returns. The volatility of emerging market is changed by local macroeconomic variables as well as international macroeconomic variables. Abugri (2008) finds that Chile, Argentina, Brazil and Mexico stock market returns has been changed by individual macroeconomic factor like industrial production, exchange rate, money supply etc as well as the US three month T-bill yields. The global factors are always influenced in explaining stock market return of the above four countries. Approximately identical result was found by Bilson et al. (2001). They claim that emerging stock markets partially identified that these markets are a bit divided from global equity market. In this context, they also argue that global factors are less important than local factors for the stock return variation in the emerging stock markets. Exchange rates do not only influence the developed economies stock markets but also those of developing countries'.

From the above discussion about relevant literature on various macroeconomic variable influences on different stock exchanges, we have seen that different stock market behaved differently. Most of the studies found evidence of influence of certain macroeconomic indicator on stock price indices.

III. Data Description and Empirical Design

In research, the data sources, data description and the methodology need to be specified. The methodology needs to be cautiously designed to obtain realistic results. The methodological design employed in this study consists of unit root tests; Johansen cointegration test, VECM based Granger causality, variance decomposition analysis and impulse response analysis.

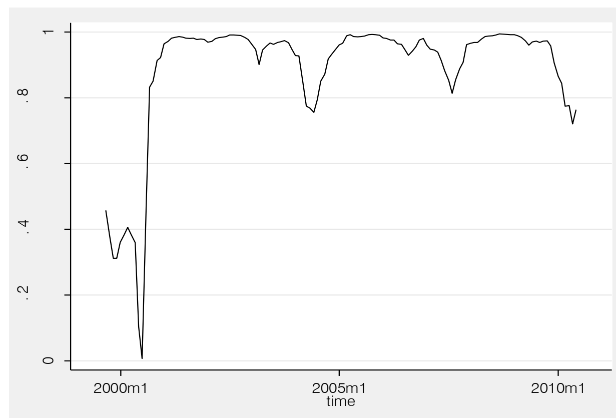
a) Data

The empirical investigation has been carried out in the case of the United Kingdom and German stock market returns and selective macroeconomic variables. The data used under the study are monthly data from February 1999 to January 2011. The UK and German stock prices is the end-of- period closing share price indices.

The stock indices are DAX30 of Frankfurt stock exchange and FTSE100 of London stock exchange. These stock price indices and the chosen macroeconomic variables such as broad money supply (MS), exchange rates, treasury bill rates (Representing interest rate for UK), bond rate (Representing interest rate for Germany) are obtained from the Data Stream. Consumer price index (CPI) representing the rate of inflation and Industrial Production Index (IP) representing the economic activity are sourced from OECD data bank.

The stock market returns of Germany and the UK are shown a high level of time varying correlation. If we have a close look towards German and the UK stock markets return (figure-4.1), we observe that these two developed economies stock market returns are closely correlated in the sample period except late 2000.

Figure 1 : Time Varying Co-relation between Germany and the UK Stock Returns.



The correlations between stock market returns and the macroeconomic variables are different. A positive correlation is evident between the DAX30 and the macro-economic variables with the exception of bond;the correlation (table-1) between the UK price index and the macroeconomic variables are fairly strong with the exception of CPI and MS.

Table 1 : Co-relation between stock markets returns and macroeconomic determinants.

United Kingdom						
	LFTSE100	LCPI	LIP	LEXRATE	LMS	LTBILL
LFTSE100	1					
LCPI	-0.07	1				
LIP	0.30	-0.86	1			
LEXRATE	0.27	-0.75	0.92	1		
LMS	-0.19	0.96	-0.78	-0.63	1	
LTBILL	0.31	-0.74	0.95	0.93	-0.66	1
Germany						
	LDAX30	LCPI	LIP	LEXRATE	LMS	LBOND
LDAX30	1					
LCPI	0.80	1				
LIP	0.87	0.91	1			
LEXRATE	0.086	-0.32	-0.28	1		
LMS	0.38	0.71	0.66	-0.58	1	
LBOND	-0.55	-0.67	-0.73	0.62	-0.48	1

b) Unit Root Test

The first step of the methodological process involves a test for stationarity as the variables to be used in this paper are time series which are usually non-stationary. We employed Augmented Dickey-Fuller(ADF) and Phillips-Perron (PP) tests for unit root. If the variables are stationary in level, they are said to be integrated of order 0 that is I(0). On the other hand, if the said variables become stationary after first differencing are said to beI(1).

c) Johansen Multivariate Co-integration Test:

Co-ingration refers to the situation where the nonstationary time series of the same order exist a long-run relationship. After determing the order of integration of each variables, we perform Johansen co-integration tests whether there is a cointegrating relationship between stock returns and chosen five macroeconomic variables in Germany and the UK. The mathematical form of Johansen cointegration test is given below:

$$z_t = A_1 z_{t-1} + ... + A_p z_{t-p} + Bx_t + \mu_t \quad .... \quad .... \text{(i)}$$

Where z_t = k vector of endogenous variables, x_t=a vector of deterministic variables, μ_t = a vector of innovations. The model (i) may be re-written as a vector auto regression (VAR) following way

$$\Delta z_t = c + \Pi z_{t-1} + \sum_{i=1} \Gamma_i \Delta z_{t-i} + \mu_t \quad .... \quad \text{(ii)}$$

Where $\Pi = \sum_{i=1}^{p} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

In equation (ii) the vector Δz_t and $\Delta z_{t-1}$are I(1) variables. Therefore, the long run relationship among z_t will be determined by the rank of Π, if r= 0 then the equation (ii) reduce to a VAR model of p-th order and in this case the macroeconomic variables in level do not have any co-integrating vector. On the other hand, If the rank 0<r<n then there is a possibility of existing n×r matrices namely α and β and it can be written such that

$$\Pi = \alpha \beta' \quad ... \quad ... \text{(iii)}$$

The Johansen co-integration test estimate the Πmatrix from an unrestrited VAR and also test whether we can reject the restrictions implied by the reduced rank of using either the trace statistic or the maximum eigen value statistic (Wickremasinghe, 2011). The trace statistic and the maximum eigenvalue statistic is determined using the following equations

$$\text{Trace Test} = \lambda_{trace} = -T \sum_{j=r+1}^{k} \ln(1-\hat{\lambda}_j) \quad ..... \quad \text{(iv)}$$

$$\text{Maximum Eigen Value Test} = \lambda_{\max} = -T \ln(1-\hat{\lambda}_{r+1}) \quad ...... \quad \text{(v)}$$

Where T= Number of observations, $\hat{\lambda}_j$ = Estimated values of characteristic roots ranked from largest to smallest and r= 0,1,2,......n-1. It is well known that the co-integration test is Lag sensitive. This study follows the Akaike Information criterion (AIC) and Schwarz Bayesian Criterion (SBC) to select the number of appropriate lags.

d) Error Correction model, Short and Long run Causality

If thre exists a co-integration relationship between the stock returns and macroeconomic variables then there is a possibility of causality among the variables at least one direction (Engle and Geanger, 1987). If we consider x_t (stock market indices) and y_t (macroeconomic variables) as two different time series then the error correction model express as following way:

$$\Delta x_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta x_{t-1} + \sum_{i=1}^{m} \beta_2 \Delta y_{t-1} + \beta_3 ECT_{t-1} + \varepsilon_{1t} \quad ...... \text{(vi)}$$

$$\Delta y_t = \delta_0 + \sum_{i=1}^{n} \delta_1 \Delta y_{t-1} + \sum_{i=1}^{m} \delta_2 \Delta x_{t-1} + \delta_3 ECT_{t-1} + \varepsilon_{2t} \quad ...... \text{(vii)}$$

Where Δ is the difference operator, n and m are the lag lengths of the variables, ECT_{t-1} is the residual from the co-integrating equation. ε_{1t} and ε_{2t} are the disturbance terms. From equation (vi) and (vii) we can examine the statistical significance of the error correction term by separate t-test and the joint significance of the lags of each explanatory variables by χ^2-test.

e) Variance Decomposition and Impulse Response Analysis

The standard Granger causality analysis interpreted within the sample period only. In this regard, variance decomposition analysis could be an important tool to make proper inference regarding the causal relationships beyond the sample period. Actually, Variance Decomposition indicates the percentage of the forecast error variance in one variable that is due to errors in forecasting itself and each of the other variables (Tarik, 2001).

The impulse response function is designed to infer how each variable responds at different time horizon to an earlier shock in that particular variable and to shocks in other macroeconomic variables. Particularly, we investigate the response of the DAX30/ FTSE100 to one standard deviation shocks to the equation for DAX30/FTSE100 and macroeconomic variables and also the response of macroeconomic variables to one standard deviation to the equation for the DAX30/FTSE100.

IV. Empirical Results

a) Stationarity tests

The unit-root test is performed on the UK and German time series to determine whether the time series is stationary. We employed both the ADF and PP unit root tests. The findings of the unit-root test are shown in Table 2. The results indicate that all the variables show unit roots at natural log level and stationary at its first differences. Therefore, the variables are integrated of order one that is I(1). Thus, we are able to investigate the long-run equilibrium relationship among the macroeconomic variables.

Table 2 : Germany and the UK Stock Market- Unit Root Test Results.

	Germany				UK			
	Level		First Difference		Level		First difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
DAX30/ FTSE100	-1.48 (.53)	-1.41 (.57)	-11.08* (.00)	-11.08* (.00)	-1.72 (.42)	-1.70 (.43)	-11.80* (.00)	-11.81* (.00)
Tbill/ bond	-.36 (.91)	-.50 (.89)	-5.44* (.00)	-12.17* (.00)	-.93 (.77)	.097 (.96)	-4.02* (.00)	-5.86* (.00)
CPI	-.22 (.93)	-.32 (.91)	-9.47* (.00)	-17.34* (.00)	2.12 (.99)	1.91 (.99)	-12.59* (.00)	-12.60* (.00)
Exrate	-1.06 (.72)	-1.01 (.74)	-11.33* (.00)	-11.23* (.00)	-.63 (.86)	-.93 (.91)	-9.04* (.00)	-12.59* (.00)
MS	0.74 (.99)	-0.70 (.99)	-4.37* (.00)	-9.76* (.00)	-1.15 (.69)	-.95 (.77)	-8.15* (.00)	-23.68* (.00)
IP	-2.09 (.24)	-1.66 (.45)	-4.19* (.00)	-12.08* (.00)	-.82 (.81)	-.53 (.88)	-4.98* (.00)	-13.65* (.00)

*Notes: *indicates significant at 1% level*

b) Co-integration, Error Correction model, Short and Long-run Causality test results

The Johansen co-integration test results particularly trace statistic and eigenvalue statistic are presented in table-3.

The result represents that both DAX30 and FTSE100 are co-integrated with corresponding macroeconomic variables. Thus, the results implies that there is long run equilibrium relationship between the stock market prices and the five macroeconomic variables in Germany and the UK during the periods under the present study.

Table 3 : Johansen Multivariate Co-integration Test Results for Germany and the United Kingdom.

	Germany				United Kingdom			
	Trace Statistic (λ_{trace})	05% Critical Value	Max Eigen Value Statistic ($\lambda_{\max}$)	05% Critical Value	Trace Statistic (λ_{trace})	05% Critical Value	Max Eigen Value Statistic ($\lambda_{\max}$)	05% Critical Value
r=o	110.66	95.75	38.96	40.07	118.23	95.75	41.33	40.07
r≤1	71.69	69.81	33.89	33.87	76.90	69.81	32.17	33.87
r≤2	37.80	47.85	20.73	27.58	44.72	47.85	20.19	27.58
r≤3	17.07	29.79	11.26	21.13	24.53	29.79	14.08	21.13
r≤4	5.81	15.49	5.31	14.26	10.44	15.49	7.07	14.26
r≤5	0.49	3.84	0.49	3.84	3.36	3.84	3.36	3.84

Global Journal of Management and Business Research Volume XII Issue XVI Version I Year 2012

As we found cointegrating relationship for both the countries,we proceed to investigate the error correction models. The results obtain from Error Correction Mechanism (ECM) specification represented by model (vi) and (vii) is depicts in table-4. According to the results we can see the four sorts of causal relationship such as short-run, long-run, no causality and both short and long run causal relationship. We find there are three short-run, two long-run and one short and long run casual relationships for Germany. The short run causality run from DAX30 to CPI, from money supply (MS) to DAX30 and from industrial production (IP) to DAX30. The long-run causality runs from CPI to DAX30 and from exchange rates to DAX30.

There is only one short and long-run relationship, that from the DAX30 to industrial production. For the United Kingdom , We find there are five short-run, one long-run and two short and long run casual relationships. The short run causality runs from FTSE100 to Tbill, from FTSE100 to MS, from FTSE100 to exchange rate, exchange rate to FTSE100 and FTSE100 to industrial production. The long-run causality runs from CPI to FTSE100 . The short and long-run causal relationship runs from FTSE100 to CPI, from MS to FTSE100 and from IP to FTSE100

Table 4 : Causality test results based on the vector error correction model.

Germany				
Causality		(χ^2 statistic)	ECT_{t-1}	Nature of causality
From	To			
DAX30	CPI	6.96** (0.03)	[-.002] {-.58} (.56)	Short-run
CPI	DAX30	0.41 (0.81)	[-.039*] {-1.71} (.08)	long run
DAX30	Bond	1.61 (0.44)	[-.004] {.21} (.82)	No causality
Bond	DAX30	0.63(0.72)	[-.026] {-1.14} (.25)	No causality
DAX30	MS	0.81 (0.66)	[-.002] {-.50} (.61)	No causality
MS	DAX30	8.86***(0.01)	[-.036] {-1.59} (.11)	Short run
DAX30	Exrate	1.70 (0.42)	[-.011] {-.68} (.49)	No causality
Exrate	DAX30	0.96 (0.61)	[-.041*] {-1.86} (.064)	long run
DAX30	IP	5.74** (0.05)	[-.037*] {-1.80} (.0.07)	Short and long run
IP	DAX30	4.47*(0.10)	[-.036] {-1.37} (.17)	Short-run
United Kingdom				
FTSE100	CPI	12.79*** (0.00)	[-.013***] {-2.87} (.00)	Short and long run
CPI	FTSE100	1.98(0.57)	[-.045*] {-1.86} (0.064)	long run
FTSE100	Tbill	9.64** (.02)	[-.004] {-.499} (.61)	Short-run
Tbill	FTSE100	5.20(0.15)	[-.039] {-1.47} (.14)	No causality
FTSE100	MS	7.93**(0.04)	[-.013] {-1.02} (.30)	Short-run
MS	FTSE100	7.04*(0.07)	[-.042*] {-1.71} (.089)	Short and long run
FTSE100	Exrate	11.70***(.00)	[-.005] {-.33} (.74)	Short-run
Exrate	FTSE100	14.10***(0.00)	[-.038] {-1.55} (.12)	Short-run
FTSE100	IP	6.52*(0.08)	[-.005] {-.33} (.73)	Short-run
IP	FTSE100	6.17*(0.10)	[-.04*] {-1.64} (.10)	Short and long run

*Note: ***, **, * denote significance level at 1%, 5% and 10% respectively. [ ] denote coefficient of the corresponding* ECT_{t-1}*. Numbers in parentheses { } and ( ) are the corresponding t-statistic and P-values*

c) *Variance Decomposition Analysis*

The results of variance decomposition analysis of Germany are presented in table-5 and 6. The table-5 decomposes with the stock market indices of Germany and the macroeconomic variables. The variance decomposition analysis was employed to supplement the Granger causality results to reinvestigate the out of sample impact. The results provided in columns 2-6 of table-5 indicates how much of the DAX30's own shock is explained by movements in its own variance and the chosen macroeconomic variables over the 60 months forecast horizon. According to the results, shown in table-5, the amount of variance of the DAX30 explained by own goes down when the time horizon increased up to 60 months. At horizon one, all variance in the DAX30 is explained by own. At horizon 60, 85% of DAX30 variance is explained by itself. This indicates that at longer horizons, the variance of DAX30 may be caused by variance of other macroeconomic variables especially by money supply and industrial production. At horizon 24, the IP explains 5.93% of the variances of the DAX30. When the time horizon goes up, the actual amount of variance of the DAX30 explained by the IP also goes up. The other variable may cause in the DAX30 is money supply (MS). At horizon 12, 7.25% of the variance in the DAX30 is explained by MS. However, after horizon 12, the actual amount of variance of the DAX30 is goes down. The consumer price index (CPI), bond and exchange rate play little role in explaining the variance of the DAX30.

Table 5 : Variance Decomposition Analysis Results for DAX30.

Month	Dax30	CPI	Bond	MS	Exrate	IP
1	100.00	0.00	0.00	0.00	0.00	0.00
6	90.33	0.55	0.02	6.74	0.05	2.31
12	88.06	0.72	0.01	7.25	0.08	3.88
18	86.98	0.76	0.02	7.05	0.13	5.06
24	86.28	0.78	0.02	6.81	0.19	5.93
36	85.41	0.78	0.02	6.46	0.26	7.06
48	84.91	0.79	0.03	6.25	0.31	7.71
60	84.60	0.79	0.03	6.11	0.34	8.13

The percentage of forecast variance in macroeconomic variables explained by the innovations of DAX30 is presented in table-6. Columns 4 and 5 indicate that the DAX30 explains very little forecast variance of the money supply and exchange rate. The macroeconomic variable whose variance is explained significantly by the DAX30 is IP, bond and CPI. For example, the DAX30 explains 34.61%, 21.52% and 14.38% of the variance in the IP, bond and CPI respectively at the forecast horizon 60.

The result presented in table-4 indicate that, there is a unidirectional causality running from DAX30 to CPI and MS to DAX30, IP to DAX30, CPI to DAX30, exchange rate to DAX30. Based on the above result, we can conclude that the share price of Germany (DAX30) can be predicted from certain macroeconomic variables. Thus, the German stock market index does behave according to the predictions of the efficient market hypothesis (Wickremasinghe, 2011).

Table 6 : Percentage of forecast variance in macroeconomic variables explained by the inovations of DAX30.

Month	CPI	Bond	MS	Exrate	IP
1	0.25	11.02	0.75	0.31	4.20
6	8.92	18.74	2.37	0.09	23.08
12	11.66	20.61	1.27	0.22	27.60
18	12.87	21.13	0.71	0.47	29.73
24	13.47	21.33	0.48	0.74	31.10
36	14.02	21.46	0.32	1.16	32.84
48	14.25	21.50	0.28	1.44	33.90
60	14.38	21.52	0.26	1.63	34.61

The results of variance decomposition analysis of United Kingdom are presented in table-7 and 8. The table-7 decomposes with the stock market indices of United Kingdom and the macroeconomic variables. The results provided in columns 2-6 of table IX indicates how much of the FTSE100's own shock is explained by movements in its own variance and the chosen macroeconomic variables over the 60 months forecast horizon. According to the results shown in table-7, the amount of variance of the FTSE100 explained by own goes down when the time horizon increased up to 60 months. At horizon one all variance in the FTSE100 is explained by own. At horizon 60, 84% of FTSE100 variance is explained by itself. This indicates that at longer horizons, the variance of FTSE100 may be caused by variance of other macroeconomic variables especially by exchange rate and industrial production. At horizon 24, the IP explains 6.35% of the variances of the FTSE100. When the time horizon goes up, the actual amount of variance of the FTSE100 explained by the IP also goes up. The other variable may cause in the FTSE100 is exchange rate. At horizon 48, 5.48% of the variance in the FTSE100 is explained by exchange rate. The consumer price index (CPI), bond and money supply play little role in explaining the variance of the FTSE100.

Global Journal of Management and Business Research Volume XII Issue XVI Version I Year 2012

Table 7 : Variance Decomposition Analysis Results for FTSE100.

Month	FTSE100	CPI	Tbill	MS	Exrate	IP
1	100	0	0	0	0	0
6	89.03	0.50	1.07	3.13	2.09	4.18
12	86.75	0.25	0.58	3.22	3.69	5.51
18	85.72	0.16	0.40	3.17	4.48	6.07
24	85.19	0.12	0.31	3.15	4.87	6.35
36	84.65	0.08	0.22	3.13	5.28	6.64
48	84.37	0.06	0.18	3.12	5.48	6.78
60	84.21	0.05	0.16	3.11	5.61	6.87

The percentage of forecast variance in macroeconomic variables explained by the innovations of FTSE100 is presented in table-8. Table-8 indicates that the FTSE100 explains very little forecast variance of the money supply (MS) and CPI. The percentage of forecast variance in MS by FTSE100 is 3.71% in horizon 12, however when the time horizon increase then percentage of forecast variance in MS by FTSE100 is goes down. The macroeconomic variable whose variance is explained significantly by the FTSE100 is T-bill, IP and exchange rate. For example, the FTSE100 explains 24.85%, 18.15% and 11.24% of the variance in the T-bill, IP and exchange rate respectively at the forecast horizon 6. The result presented in table-4 indicate that, there is a unidirectional causality running from FTSE100 to T-bill, FTSE100 to MS and CPI to FTSE100, MS to FTSE100, IP to FTSE100. Based on the above result, we can conclude that the share price of the UK (FTSE100) can be predicted from certain macroeconomic variables. Thus, the UK stock market index does behave according to the predictions of the efficient market hypothesis (Wickremasinghe, 2011).

Table 8 : Percentage of forecast variance in macroeconomic variables explained by the inovations of FTSE100

Month	CPI	Tbill	MS	Exrate	IP
1	0.16	6.57	4.36	1.09	2.79
6	3.84	24.85	5.04	11.24	18.15
12	3.64	24.14	3.71	9.42	18.98
18	3.48	20.30	2.94	8.66	17.50
24	3.30	17.77	2.46	8.23	16.32
36	3.06	15.81	1.90	7.76	14.91
48	2.91	14.01	1.58	7.52	14.18
60	2.82	13.38	1.37	7.38	13.77

d) Impulse Response Analysis

Figure-2 indicates impulse response of DAX30 to one standard deviation shock in the equations for DAX30 and five macroeconomic variables and also the impulse response of five macroeconomic variables to one standard deviation shock in the equation for DAX30. A standard deviation shock in the equation for the DAX30 increases the DAX30 until horizon six, after which a standard deviation shock to the equation for DAX30 does not produce any volatility in the DAX30. Response of DAX30 to CPI, DAX30 to MS and exchange rate to DAX30 has negative impact. Response of DAX30 to IP, DAX30 to Bond, CPI to DAX30 and IP to DAX30 has positive impact.

Figure 2 : Impulse Response Functions for German stock market (Response to one S.D. Innovations).

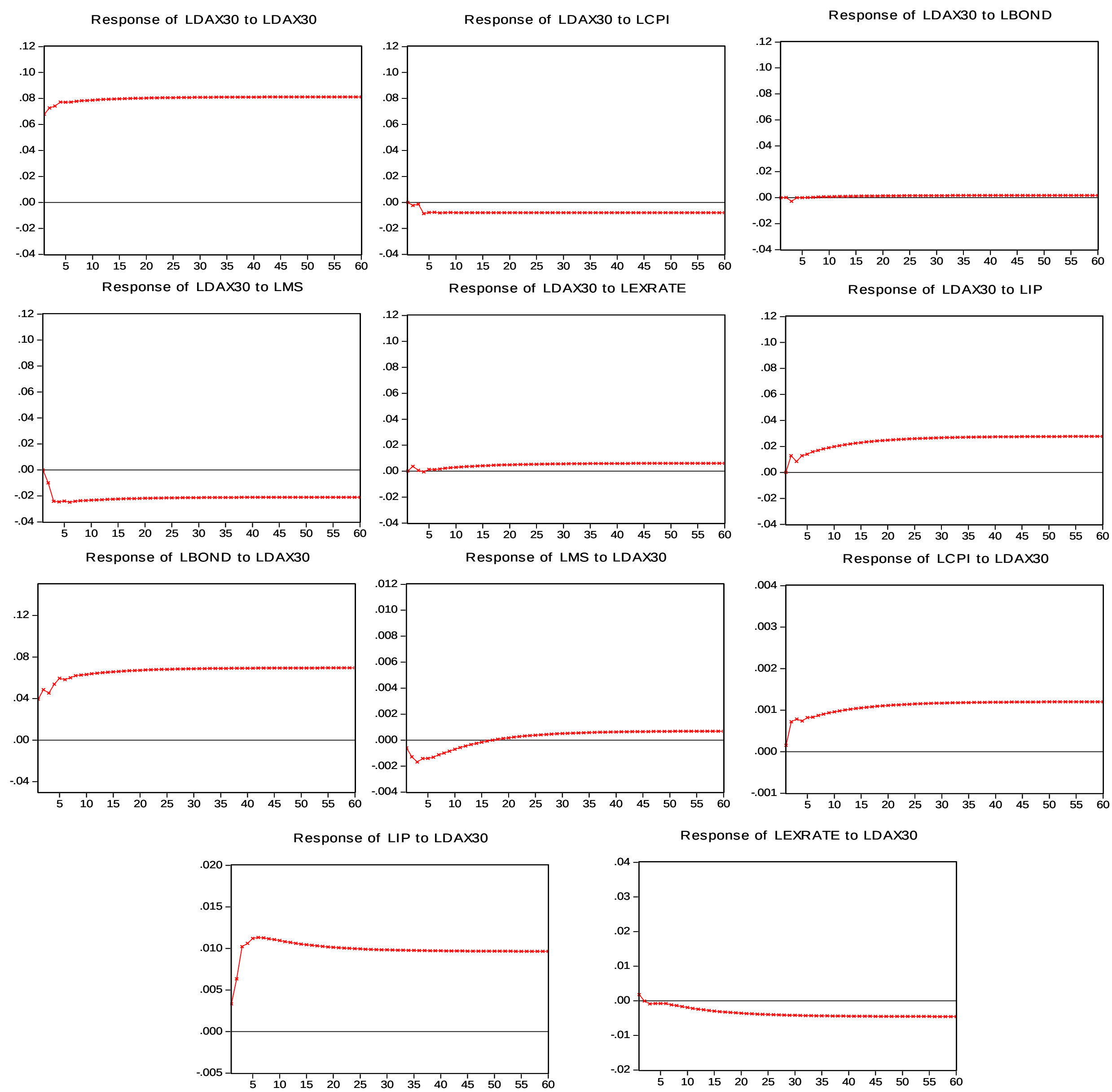
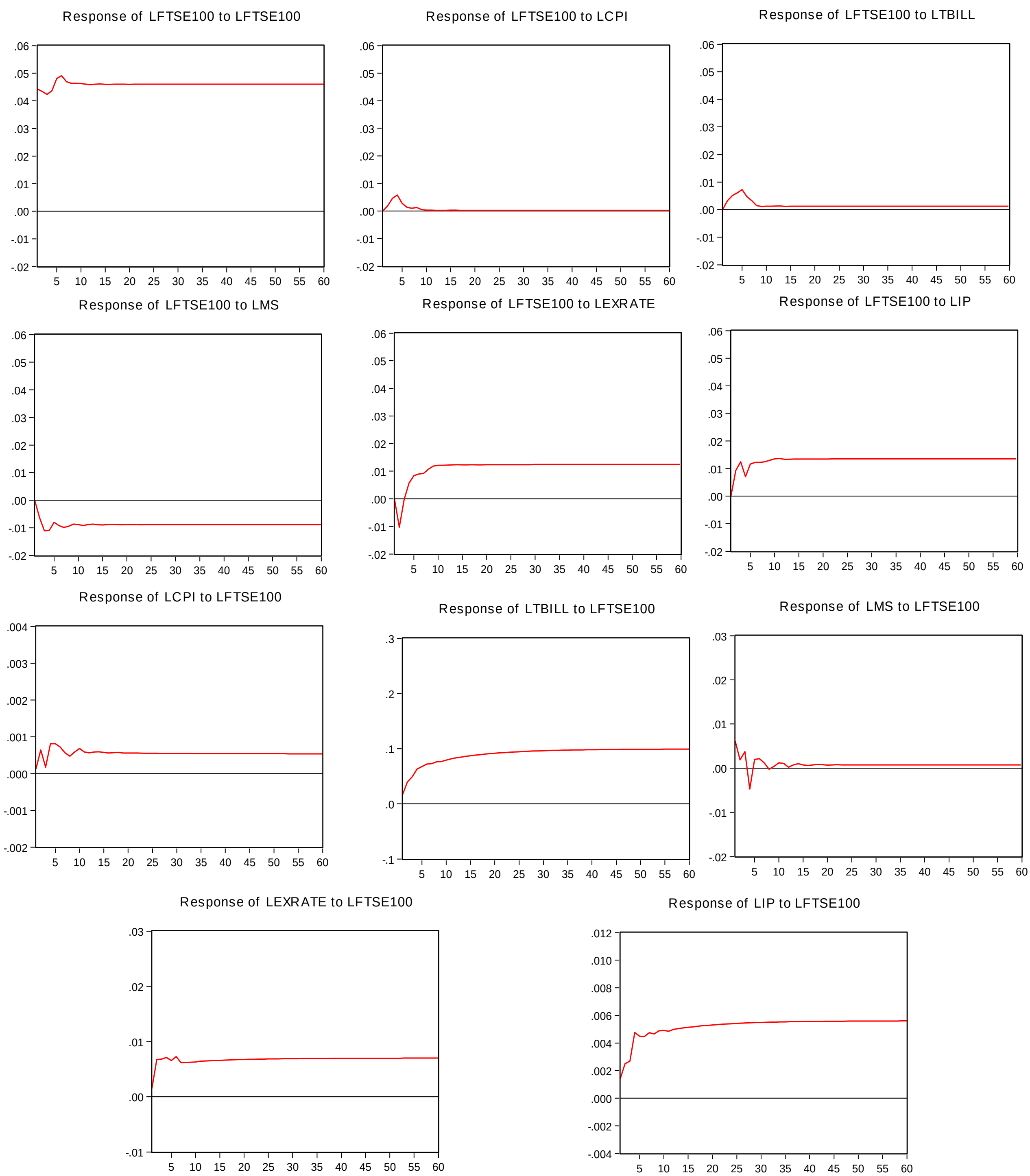


Figure-3 indicates impulse response of FTSE100 to one standard deviation shock in the equations for FTSE100 and five macroeconomic variables and also the impulse response of five macroeconomic variables to one standard deviation shock in the equation for FTSE 100. A standard deviation shock in the equation for the FTSE 100 increases the FTSE 100 until horizon five, after which a standard deviation shock to the equation for FTSE100 does not produce any volatility in the FTSE100. Response of FTSE100 to MS has negative impact. Response of FTSE100 to IP, CPI to FTSE100 and IP to FTSE100, Tbill to FTSE 100, Exrate to FTSE 100 has positive impact. The response of MS to FTSE 100 shows volatiltility up to 18th horizon, after which there is no volatility observed.

Figure 3 : Impulse Response Functions for UK stock market (Response to one S.D. Innovations).



V. Conclusion

This study examined the causal relationship between stock prices and a set of selected macroeconomic variables in Germany and the United Kingdom. We investigated both short and long-term relationship between stock prices and the chosen macroeconomic determinants. We employed both the ADF and PP unit root tests. We carefully selected the deterministic components in the Johansen co-integration test. The results of the Johansen co-integration test indicate that there is co-integrating relationship between the stock prices and macroeconomic determinants in the case of German and the UK markets. After establishing cointegration relationship, we move to estimate the error-correction models to investigate both the short and long-term casual relationships.

The result of the study are consistent with the majority of the relevant literature, implies the existence of short run interactions and long term causal relationship between both Germany and the UK stock markets and the respective fundamentals. We find there are three short-run, two long-run and one short and long run casual relationships for Germany. The short run causality runs from DAX30 to CPI, from money supply (MS) to DAX30 and from industrial production (IP) to DAX30. The lon-run causality runs from CPI to DAX30 and from exchange rate to DAX30. There is only one short and long-run relationship, that is from the DAX30 to industrial production. For the United Kingdom , We find that there are five short-run, one long-run and two short and long run casual relationships. The short run causality run from FTSE100 to Tbill, from FTSE100 to MS, from FTSE100 to exchange rate, exchange rate to FTSE100 and FTSE100 to industrial production. The lon-run causality runs from CPI to FTSE100 . The short and long-run causal relationship runs from FTSE100 to CPI, from MS to FTSE100 and from IP to FTSE100. These results indicate that stock prices in Germany and the UK can be predicted using certain macroeconomic varibles.

The analysis of variance decomposition for Germany found that, at short term horizons most of the forecast horizons of the stock prices are explained by the stock price itself. However, in the long run horizons MS and IP play an important role in explaining the forecast variance in stock prices. When macroeconomic determinants are concerned, the stock prices are able to explain the forecast variance of the IP, Bond and CPI. Furthermore, The analysis of variance decomposition for the United Kingdom market found that, at short term horizons most of the forecast horizons of the stock prices are explained by the stock price itself. However, in the long run horizons Exchange rate and IP play significant roles in explaining the forecast variance in stock prices. When macroeconomic determinants are concerned, the stock prices are able to explain the forecast variance of the IP and T-bill.

The impulse response function of the DAX30 to a standard deviation shock given to the equation for five macroeconomic determinants found that a shock to the macroeconomic variable equations responses from the DAX30 only at the shorter horizons. We also examined whether a stock given to the DAX30 generated any response from macroeconomic determinants. We found that, a standard deviation shock in the equation for the DAX30 increases the DAX30 until horizon six, after which a standard deviation shock to the equation for DAX30 does not produce any volatility in the DAX30. Response of DAX30 to CPI, DAX30 to MS and exchange rate to DAX30 has negative impact. Responses of DAX30 to IP, DAX30 to Bond, CPI to DAX30 and IP to DAX30 has positive impact. Furthermore, The impulse response function of the FTSE100 to a standard deviation shock given to the equation for five macroeconomic determinants found that a shock to the macroeconomic variable equations responses from the FTSE100 only at the shorter horizons. We also examined whether a stock given to the FTSE100 generated any response from macroeconomic determinants. We found that, a standard deviation shock in the equation for the FTSE 100 increases the FTSE 100 until horizon five, after which a standard deviation shock to the equation for FTSE100 does not produce any volatility in the FTSE100. Responses of FTSE100 to MS has negative impact. Responses of FTSE100 to IP, CPI to FTSE100 and IP to FTSE100, Tbill to FTSE 100, Exrate to FTSE 100 has positive impact. The response of MS to FTSE 100 shows volatiltility up to 18th horizon, after which there is no volatility observed. The findings of co-integration, short-run and long-run causal relationship between stock indices and certain macroeconomic variables in our research help policy makers, investors and portfolio manager in efficient investment decision making in both the German and the UK stock markets.

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