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DYNAMIC INTERRELATIONSHIPS BETWEEN MACROECONOMIC INDICATORS, GLOBAL STOCK MARKET, COMMODITIES PRICES, AND JAKARTA COMPOSITE INDEX

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ABSTRACT

This paper aims to analyze interrelationship between Jakarta Composite Index and mcroeconomic indicators, global stock market, and commodities prices. We employ Vector Error Correction Model (VECM) to investigate whether dynamic linkages exist between our research variables. We find that there is co movement between variable in our research. Moreover, Dow Jones, gold price, and oil prices dominantly affect JCI movement in the long-run.

Keywords: cointegration, stock market, commodities, macroeconomy,VECM

JEL Classification: C32, G14, G15

INTRODUCTION

The recent decline in global economic activity due to subprime crisis has again intensified study on the relationship between stock indexes and macroeconomic performance, global market, and commodity prices. The common approach in the dynamic analysis between financial market and macroeonomy used Vector Auto Regressive (VAR) to study the impact of many macroeconomic innovations on the pricing of financial market assets.

The VECM framework has advantages and shortcomings in modelling the interdependence between equity index prices and macroeconomic variables. Wen et al. (2012) argues that this model is effective because they are flexible and are capable to fix the issue of autocorrelation of stock return. Nevertheless, VECM also have some drawback such as the assumption of normal distributions and inability to capture non-linear dependence between variables.

This paper intends to examine the effect of macroeconomic variables and market interdependences, and main commodity prices toward Indonesian stock indices. The evidence from the previous studies for major markets cannot be replicated on Indonesian data, for some reasons as follows: First, Indonesia's economy is very sensitive to world market prices of its natural resources. The structure of its industry, full of company which has limited processing ability of raw materials into end products, amplifies this price dependency. The companies listed in the exchange comprise of a large number of export-dependent industry that rely on international business cycles and, therefore, have high fluctuations in their profitability. Second, a small equity market is also prone with manipulation opportunities that do not exist in more developed markets, and may draw speculators inside, thereby increasing

the possibilities of the market reacting inappropriately to new information.

Furthermore, this study provides several contributions to the literature. First, this study estimates a sets of multivariate n-regime VECM models with ten-variable vectors. Second, this study provide evidence that that the best fit to the data joint density is examined by the VECM model. Lastly, this paper contains new results on the interaction between Stock Indexes and macroeconomic indicators. We show that financial market is not directly impacted by the variables related exchange rate, inflation and interest rate.

LITERATURE REVIEW AND METHOD

It is widely documented that equity returns are significantly influenced by macroeconomic variables. This relationship between both variables is a well-established result, see e.g. Fama (1990), Barro (1990), Schwert (1990), and Ferson and Harvey (1991) who document the correlation between macroeconomic real activity and stock returns in U.S. market. Other paper using international market data also found the same results, for instance Beckers et al. (1992).

The existing model explains the interdependences between asset return and macro variables from the perspective of discounted future cash flows earned by investor of the stock. Stock price is mainly affected by the information that investor use to calculate the estimates of cost of capital and the expected value of dividend. Supply of money may have some impacts on stock market through multiple channels. One way is through the portfolio balance model that works through money supply increase that creates a shift of portfolio from cash to equities. In addition to that, the dynamics of money supply influence equity market because of their impact toward expected inflation. The higher the uncertainty of inflation, the lower the stock price becomes. Moreover, inflation reduce corporate profits and share price because of their adverse impact toward corporate income and expenses.

The exchange rate has indirect impact to stock prices. According to Gan et al. (2006), under pressure domestic currency may cause export price to fall, and thus increase export volumes, assuming elastic demand of the product. Ajayi and Mougoue (1996) also showed that stock price have short-term negative effect toward domestic currency, but the currency depreciation may affect stock prices adversely in short-term and long-term.

The relationship between stock market and oil prices appears to be natural. Mussa (2000) argues that oil price volatility influence real activity, corporate income, and monetary measures. Thus, oil prices significantly affect asset prices and capital markets. For Japanese market, Brown and Otsuki (1990) also support the findings that oil price is crucial in the pricing process of equities. Using 18 national equity markets data, Ferson and Harvey (1993) document that changes in oil prices in the U.S. market contributes to volatility of global economy.

In contrast with above, Huang et al. (1996) shows that crude oil price may not have large impact on economy. However, Ciner (2001) contests the argument of Huang et al. and shows that international evidences support the importance of oil prices. In addition to that, Malliaris and Urrutia (1995) presents results which shows the impact of Gulf crisis to stock prices. So far, many papers has examine the impact of an oil price factor in the stock market (i.e. Kaneko and Lee, 1995; Faff and Brailsford, 2000).

Beside macroeconomic variables effects, the corelation among the global equity markets with domestic stock prices has long been examined. Jeon and Chiang (1991) using univariate and multivariate approaches showed that a common trend existed in the network of equity prices in major stock exchanges in New York, London, and Tokyo. Furthermore, empirical studies among advanced equity markets and the Asian markets are well documented by Cheung and Mak (1992), who examined daily co-movement of the stock market in U.S. and Asia.

The data used in this study is monthly series data during the period of January 2000 to December 2012, obtained from Bloomberg, CEIC, Bank Indonesia and BPS. To answer the research questions, we use these following data as follows:

Table 1
Research Variables

No.	Variable	Description	Source
1	LJCI	Jakarta Composite Index	Bloomberg
2	LGDP	Real Gross Domestic Product	Badan Pusat Statistik
3	LCPI	Consumer Price Index	Bank Indonesia
4	IR	Policy Rate (SBI/BI Rate)	Bank Indonesia
5	LDJI	Dow Jones Index	Bloomberg
6	LNKY	Nikkei 225 Index	Bloomberg
7	LHSI	Han Seng Index	Bloomberg
8	LCOAL	Coal prices at the New South Wales	Bloomberg
9	LCPO	Coal prices at Malaysia	Bloomberg
10	LGOLD	Gold Price	Bloomberg
11	LOIL	Crude Oil (West Texas Intermediate) Price	Bloomberg
12	LREER	Real Effective Exchange Rate Index	CEIC

The Jakarta Composite Index (JCI) is a cap-weighted index of all stocks listed on the Indonesia Stock Exchange. The index has a base index value of 100 as of August 10, 1982. Currently, it includes more than 400 companies listed in the sto ck exchange.

From the figure above, it shows that, by December 2012 Jakarta Composite Index (JCI) grows by approximately eight times of its original level in January 2000. JCI grows up to 19% in the past 12 months to a historically high 4978 points level. This is the most significant increase compare to other major stock indexes such as Dow Jones Index (DJI), Nikkei 225 Index (NKY), and Hangseng Index (HIS) which recorded less impressive increase with only about less than twice during the same time.

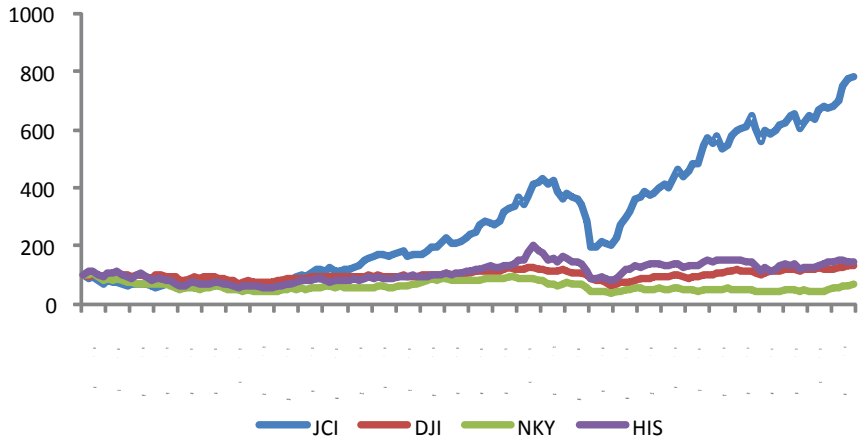

Figure 1
Jakarta Composite Index (JCI) vs. Foreign Stock Market
(January 2000=100)

We take monthly observations on the movements of JCI along with Global Commodities (Oil, CPO, Gold and Coal) in figure 2, and find that these indexes are moving along together very closely, for period spanning January 2000 to December 2012, with JCI and Gold as the ones that seems to have the highest correlation, especially after the period of global sub-prime mortgage crises. JCI and Oil also seems to have a very significant relationship due to the fact that Indonesia is oil-producing countries and former members of OPEC. Indonesia, a resource-based economy (the main producer of CPO and Coal), is highly influenced by the fluctuation of CPO and Coal prices in both short-run and long-run.

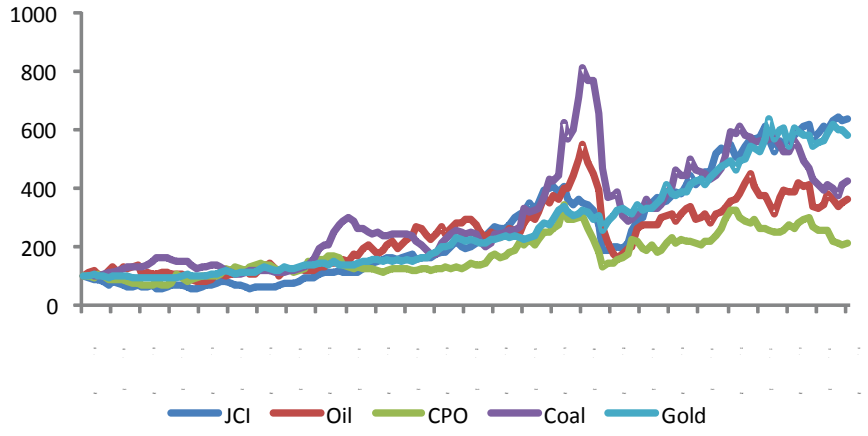

Figure 2
Jakarta Composite Index (JCI) vs. Global Commodities
(December 1999=100)

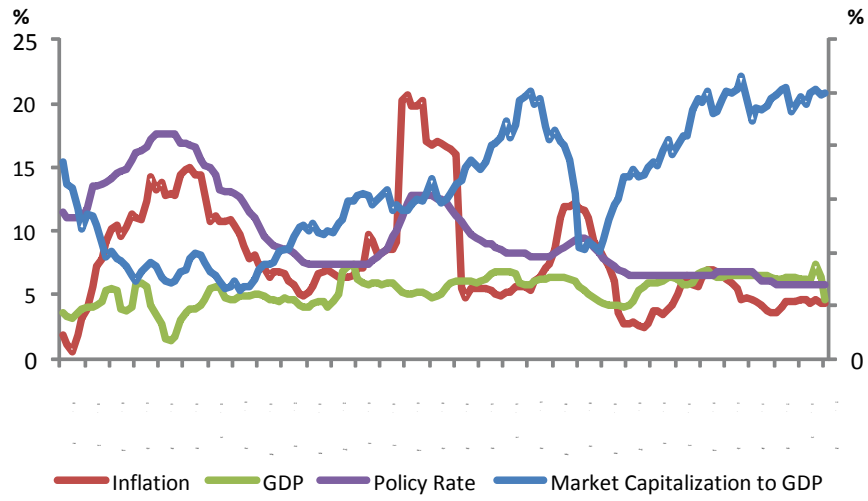

Figure 3
Jakarta Composite Index (JCI) vs. Macro Economy

The data from figure 3 shows that Indonesia market capitalization to GDP is still below 50%, and therefore indicates that Indonesia stock market is undervalued. It is worth noting that Indonesia GDP growth averages around 5.3 % between January 2000 and December 2012 and are benefiting from the low level of inflation. As shown in the figure, over the period of last decade, the central bank has consistently adjust the policy rate to smooth business cycles and shield the economy from external shocks from global markets.

This study use Vector Autoregression (VAR) model to capture the linear interdependencies among multiple time series variables we describe in section 2. VAR was introduced by Sims (1980) as an n-equation, n-variable linear model in which each variable is in turn influenced by its past values, as well as current and pas values of other n-1 variables.

The standard VAR methodology begins with the analysis of Granger-causality tests, followed by impulse responses and decompositions of forecast error variance. In our study the computation of this statistics are done using Eviews software. To identify the best VAR model, we followed standard identification procedures in figure 5. We identify the problem in our study, create relevant hypothesis, and collect data. Then, we check the stationarity of our data and perform cointegration to select between VAR or VECM models.

Johansen's cointegration test is based on the VAR(p) model of non-stationary variables. For simpler Johansen test procedure, VAR(1) model will be used. In Johansen's cointegration test, analysis of variables is not only focused on the result of VAR equation system (Impulse Response Function and Variance Decomposition are the most commonly used, as previously discussed), but also considered a stepping stone for the next cointegration test.

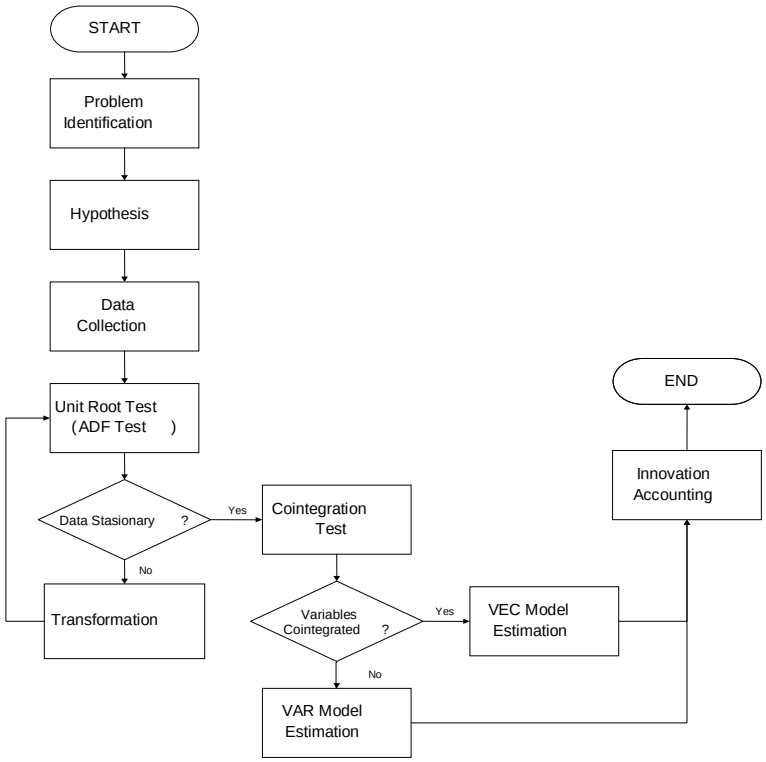

Figure 4
VAR Identification

RESULTS AND ANALYSIS

From Table 2, our study do not reject the null hypothesis that all variables have a unit at the 5-percent significance, showing that the natural logarithm of all variables in are I (1).

In this section, the AIC and SIC criterion are used in determining the optimal lag length in a VAR model. Determination of optimal lag used by the researcher in order to estimate a short run equation is based on Akaike Information Criterion (AIC). The criterion of optimal lag information can be seen in Table 3 below. According to Table 3, it can be seen that the optimal lag based on AIC is lag 8.

Table 2
Unit Root Test (Augmented Dickey Fuller)

Unit Root Test (P Value)							
No.	Variable	Level			First Difference		
		Intercept	Trend + Intercept	None	Intercept	Trend + Intercept	None
1	LJCI	0.9299	0.1096	0.9813	0.0000	0.0000	0.0000
2	LGDP	0.9991	0.5699	1.0000	0.0000	0.0001	0.2535
3	LCPI	0.8700	0.4867	1.0000	0.0000	0.0000	0.3183
4	IR	0.5817	0.1839	0.3282	0.0000	0.0000	0.0000
5	LDJI	0.4360	0.4811	0.7717	0.0000	0.0000	0.0000
6	LNKY	0.1154	0.4242	0.3223	0.0000	0.0000	0.0000
7	LHSI	0.6971	0.4392	0.8040	0.0000	0.0000	0.0000
8	LCOAL	0.4347	0.0519	0.8759	0.0000	0.0000	0.0000
9	LCPO	0.6555	0.3861	0.8710	0.0000	0.0000	0.0000
10	LGOLD	0.9762	0.0111	0.9998	0.0000	0.0000	0.0000
11	LOIL	0.6194	0.1575	0.8526	0.0000	0.0000	0.0000
12	LREER	0.5001	0.1159	0.8239	0.0000	0.0000	0.0000

Table 3
Comparison Between Several Model Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1008.081	NA	2.11E-21	-13.55212	-13.308	-13.45293
1	3160.526	3924.186	2.88E-33	-40.8779	-37.70438*	-39.58847*
2	3335.899	291.0955	1.95e-33*	-41.30475	-35.20183	-38.82507
3	3458.218	183.0617	2.87E-33	-41.00976	-31.97744	-37.33983
4	3595.17	182.6028	3.80E-33	-40.91387	-28.95214	-36.05369
5	3774.307	209.6032	3.25E-33	-41.39194	-26.5008	-35.34151
6	3950.164	177.0525*	3.53E-33	-41.82535	-24.00482	-34.58468
7	4108.841	133.8503	6.45E-33	-42.02505	-21.27511	-33.59412
8	4329.397	150.0385	7.76E-33	-43.06663*	-19.38729	-33.44546

The Johansen Cointegration Test of variables indicates the existence of eleven cointegration equations. Not all variables are stationary in level; therefore, there is a cointegration among variables. Thus, estimation model by VECM can generate stationary estimation and errors. Cointegration test result indicates that research variable has long-term relation. It can be concluded that the next step of analyzing short-run analysis between research variable in long-term can be executed. In the long-run (with the use of cointegrating vectors interpretation), the following model in Table 5 can be constructed.

Table 4
VECM Long-Run Model

	LJCI(-1)	LGDP(-1)
C	-23.50514	9.333342
LCPI(-1)	2.176738	0.36857
	[-7.35268]	[-22.1046]
RATE(-1)	0.026761	-0.003352
	[-3.00123]	[6.67464]
LDOW(-1)	2.05255	0.066329
	[-10.5567]	[-6.05705]
LNIKKEI(-1)	-1.494602	-0.024195
	[7.82668]	[2.24962]
LHANG(-1)	1.241069	0.014093
	[-8.39391]	[-1.69234]
LCOAL(-1)	0.262134	-0.05237
	[-4.26436]	[15.1263]
LCPO(-1)	-0.347209	-0.004659
	[2.84199]	[0.67711]
LGOLD(-1)	-1.037357	0.208215
	[6.20749]	[-22.1220]
LOIL(-1)	0.362622	-0.035947
	[-5.08136]	[8.94347]
LXRATE(-1)	2.215124	-0.107565

Table 5
Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
LJCI does not Granger Cause LCOAL	6.17784*	0.00264
LCOAL does not Granger Cause LJCI	1.9668	0.14347
LJCI does not Granger Cause LCPI	1.2577	0.28725
LCPI does not Granger Cause LJCI	4.79021*	0.00961

LJCI does not Granger Cause LCPO	6.21205*	0.00255
LCPO does not Granger Cause LJCI	0.35961	0.69854
LJCI does not Granger Cause LDOW	1.79171	0.17018
LDOW does not Granger Cause LJCI	5.19344*	0.00658
LJCI does not Granger Cause LGDP	2.81233***	0.06319
LGDP does not Granger Cause LJCI	2.79443***	0.06429
LJCI does not Granger Cause LGOLD	2.17988	0.11658
LGOLD does not Granger Cause LJCI	2.02644	0.13535
LJCI does not Granger Cause LHANG	4.29829**	0.01528
LHANG does not Granger Cause LJCI	7.27706*	0.00096
LNIKKEI does not Granger Cause LJCI	5.22579*	0.00641
LJCI does not Granger Cause LNIKKEI	0.37928	0.68501
LOIL does not Granger Cause LJCI	1.67439	0.19086
LJCI does not Granger Cause LOIL	8.73634*	0.00026
LXRATE does not Granger Cause LJCI	1.4445	0.23908
LJCI does not Granger Cause LXRATE	9.17528*	0.00017
RATE does not Granger Cause LJCI	1.41234	0.24675

* Null hypothesis rejected at 1% significance level
**Null hypothesis rejected at 5% significance level
*** Null hypothesis rejected at 10% significance level

The results of the Granger-causality are reported in Table 5. Macroeconomic variables, namely, LCPI and LGDP are found to be the most essential variables which affect the JCI performance when they were considered together with the JCI using the Granger causality test. The results shows that movement of global stock markets such as Dow Jones, Nikkei and Hang-Seng significantly determine the fluctuations of JCI.

As can be seen from figure 5, the impulse response of the JCI to a GDP implies that JCI responds most strongly to GDP on month 10 and 20 when the GDP shocks occurs. This may reflect a low degree of economic and financial integration and the free information between the real and capital sectors. To some extent, JCI also reacts to GDP without lag. Because the two variables operate with a lag, this result is as expected. Furthermore, JCI responds positively to Dow Jones and Gold while JCI responds negatively to Hang Seng, CPO, oil, inflation and gold. Although the responses are somewhat sluggish between 10-20 months, but JCI continue to react noticeably to these variable shocks afterward. In addition to that, the increase in global commodities prices is responded negatively by JCI. Any global commodities (coal, oil and CPO) price increase will have negative effect on stock markets. Finally, oil price increase will increase production costs, as oil is one of main production factors. However, the elevation of gold price is positively responded by JCI.

The decomposition results in Table 6 show that even in the long-run (i.e the 100-month forecast horizon), GDP, CPI and Interest Rate contribute a relatively small share to the variation of JCI. On the other hand, Dow Jones and Oil Prices are the shocks that produce the highest variation in the JCI. In the short run (e.g., 1-month forecast horizon), JCI, Dow Jones, and Oil Prices produces 47%, 17%, and 20% of the variation of JCI, respectively. Extending the focus to the long-run (e.g. 100-month forecast horizon), JCI, Dow Jones, and Oil Prices generates 19%, 22%, and 18% of the variation of JCI.

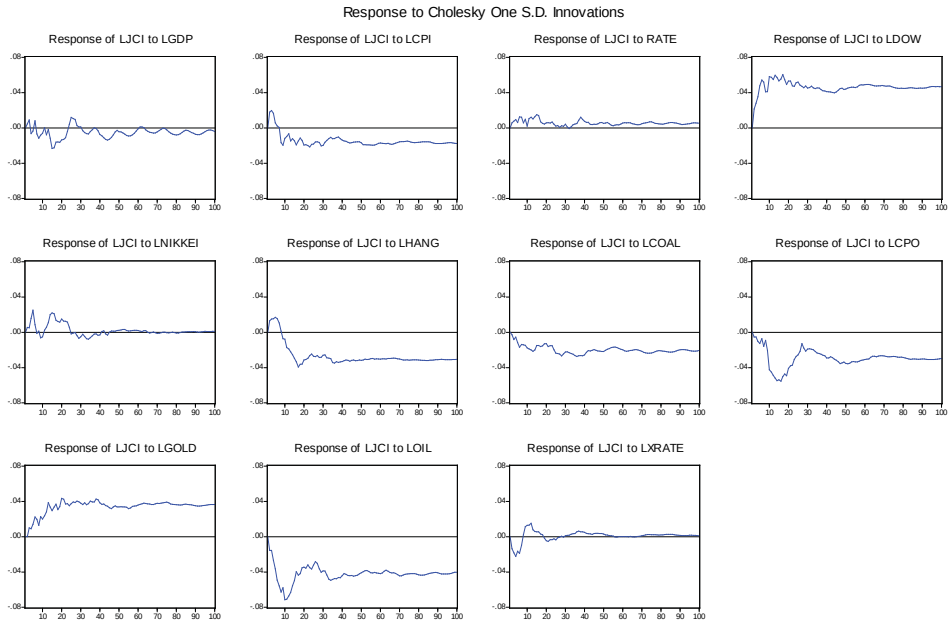

Figure 5
Impulse Response Function

Table 6
Variance Decomposition of JCI Results

Variance Decomposition of LJCI													
Period	S.E.	LJCI	LGDP	LCPI	RATE	LDOW	LNIKKEI	LHANG	LCOAL	LCPO	LGOLD	LOIL	LXRATE
1	0.057498	100	0	0	0	0	0	0	0	0	0	0	0
10	0.314242	47.64515	0.513954	1.839772	0.654542	17.29243	1.093415	1.403209	1.472174	2.975325	2.364827	20.67135	2.073856
20	0.467923	24.47046	1.244744	1.749375	0.78008	21.88771	1.484399	4.707006	1.990508	12.71649	6.220921	21.54127	1.207038
30	0.555578	22.23035	1.104927	2.36721	0.606162	23.15616	1.238418	5.807456	2.920233	11.27196	9.224622	19.19241	0.880095
40	0.642017	22.1596	0.879658	2.158402	0.557428	22.07771	0.981704	6.803283	3.74383	9.791117	10.61332	19.52865	0.705308
50	0.711627	21.40592	0.904091	2.267227	0.504681	21.48422	0.805204	7.542622	3.927772	10.00375	10.98064	19.57661	0.597263
60	0.773286	20.44291	0.840934	2.515449	0.459055	21.88907	0.691096	7.936066	3.892025	10.31064	11.2194	19.29573	0.507622
70	0.832069	20.00832	0.749535	2.616523	0.431385	22.25287	0.598555	8.137075	3.978485	10.02061	11.68167	19.08629	0.438696
80	0.888204	19.77102	0.688664	2.615718	0.418611	22.20385	0.525672	8.380089	4.132412	9.776762	12.05015	19.04646	0.390591
90	0.939974	19.53733	0.647792	2.642559	0.405079	22.12486	0.469777	8.607507	4.214345	9.761342	12.22933	19.0056	0.35448
100	0.988719	19.29798	0.61232	2.693428	0.390742	22.19357	0.425268	8.755345	4.239661	9.77212	12.35202	18.94532	0.322225
Cholesky Ordering: LJCI LGDP LCPI RATE LDOW LNIKKEI LHANG LCOAL LCPO LGOLD LOIL LXRATE													

CONCLUSIONS

This paper provides the latest examination of the effect of macroeconomic variables, global index, and commodity prices on JCI. Using the VECM methodology, this study computes ten different structural shocks to JCI. The results show that the impact of Dow Jones, and Oil price factor shocks have an important role in explaining the dynamics in JCI. Furthermore, the Granger causality tests shows a significant role for idiosyncratic CPI, Dow, GDP, Hang Seng and Nikkei shocks leading to JCI, whereas the Coal, Interest Rate,

Exchange Rate shocks do not lead the JCI.
Future research efforts could also investigate the effect of shocks on JCI across different sector for a panel of countries. The empirical findings will be useful to investors who need to calculate the exact impact of macroeconomic variable, global stock market, and commodities prices changes on JCI across industries.

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