



## Exchange Rates, Stock Prices, and Commodity Prices: Are There Any Relationships?

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### ABSTRACT

Since the 2008 financial crisis, commodity (e.g., gold) transactions have received much attention, along with the rising prices, instead of currencies such as the US dollar. On the other hand, the relationship between stock prices and exchange rates has been analyzed in the past; however, the findings seem ambiguous and no consensus about the relationship has been obtained yet. The relationship varies depending on the time, currency, kinds of stocks, and so on. One reason is the omission of commodity prices. This study shows that the relationship between stock prices and the exchange rate is weak. In Japan, the exchange rate has a significant impact on commodity prices. There is a possibility that commodity prices can be related to the relationship between stock prices and exchange rates. However, the relationship cannot be found for the Euro area. The relationship between exchange rate and commodity prices and also the relationship between commodity prices and stock prices should be taken into account when analyzing the relationship between exchange rate and stock prices.

**Keywords:** commodity price; exchange rate; Euro area; Japan; stock price

### INTRODUCTION

The relationship between stock prices and exchange rates has received much attention since the introduction of floating exchange rate system in developed countries in the 1970s. Since then, liberalization and deregulation of international financial markets and rapid volume growth of transactions in international trade and financial assets have been ongoing. The growth of international financial transactions should be noted especially.

After the financial crisis occurred in 2008, commodity transactions have increased greatly, instead of US dollar and stocks. Typical commodity prices, namely, gold prices, for example, have risen enormously. The relationship between exchange rates and stock prices has been analyzed not only in business but also in academic fields in the past; however, findings seem ambiguous about the relationship and a definite consensus has not been reached. The relationship varies depending on the time, span, currency (exchange rate), kinds of stocks, and so on. One reason may be the omission of something. Commodity price is one possibility when analyzing the relationship between exchange rates and stock prices. There is some possibility that the relationship between exchange rates and commodity prices and also the relationship between commodity prices and stock prices should be taken into account when analyzing the relationship between exchange rates and stock prices. Despite the importance of this issue, it has not been discussed a lot in spite of the fact that some studies have examined the relationship between exchange rates and stock prices [1-15].

However, because of the recent large fluctuations in stock prices, exchange rates, and commodity prices, the relationship between exchange rates and stock prices has recently received more focus than ever and should be analyzed more.

In Japan, huge numbers of international financial transactions and international trade have been ongoing, and the volume of commodity transactions has been increasing. Also, in the Euro area, the new currency, the euro, has started to circulate. For both Japan and the Euro area, the exchange rate against the US dollar is one of the important factors that affects stock prices or commodity prices. Especially since the Lehman shock, commodities, the Japanese yen, and the euro, instead of the US dollar, have attracted interest for use in transactions and speculations because of the rising prices from market participation. This article empirically examines the relationship between exchange rates and stock prices while considering commodity prices. For commodity prices, gold price is employed as a typical financial commodity for estimation. VAR/VEC analyses are used for estimation.

This article is structured as follows. Section 2 reviews existing studies related to exchange rates, commodity prices, and stock prices. In section 3, data for empirical analyses are presented. For empirical analyses, VAR/VEC is used for estimation. Finally, this article ends with a brief summary. Section 4 performs empirical analyses and analyzes the results.

### **RELATED STUDIES**

Exchange rate theories have improved greatly since the introduction of the floating exchange rate system in the 1970s. For the theory of exchange rate determination relative to incorporation of asset (stock) transactions, the so-called monetary approach is related to stock prices. This approach to the determination of the exchange rate seeks to find the point at which the available amount of money is equal to the demand to hold the money. According to the theory, there is usually a positive relationship between stock prices and exchange rates. Empirically, [16] showed a positive cointegration relationship between these variables.

Another important exchange rate theory is the *portfolio approach* as per [17,18]. This approach determines the exchange rate as with asset prices of, for example, stocks, bonds, and other financial money market instruments. Against the theory of monetary approach, there is a negative relationship between stock prices and exchange rates. However, empirical studies on the relationship between stock prices and exchange rates are inconclusive [19]. Using US data, [20-22] provided different results. Neither theories has provided conclusive results on the relationship between exchange rates and stock prices depending on the time, span, currency (exchange rate), kinds of stocks, and so on.

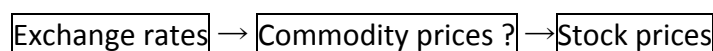
Commodity prices have been discussed recently from many aspects. [23-25] showed the relationship between commodity prices, inflation, and monetary policy. [26] showed that stock price changes cause significant changes in exchange rate. [27] showed the relationship among wheat prices, production, domestic food prices, GDP, and exchange rates. [28] suggested that oil prices do not change unemployment, but exchange rate influences unemployment.

The relationship between commodity and currency started to be analyzed in early in the 2000s. [29-34] showed that commodity prices allow exchange rates to move. A rise in commodity prices increases the supply of commodities, and the demand for the currency of the commodity-supplying country with the result that the currency appreciates (i.e., the exchange rate falls). So there is a negative relationship between commodity prices and the exchange rate.

These studies support the view that there is a significant relationship between commodity price and exchange rate. However, [35] did not accept this view.

It is difficult to obtain a consensus; however, some possibility exists that there are some common elements between exchange rates and stock prices. One possibility is a commodity (Figure 1). In the following sections, the relationship between exchange rates and stock prices is examined empirically with consideration of commodity prices. Section 3 defines the data. Section 4 conducts empirical analyses and analyzes the results. Finally, this article ends with a brief summary.

**Figure 1. Relationship among exchange rates, commodity prices, and stock prices**



### THE DATA

This article uses three variables: stock price, exchange rate, and commodity price for the case of Japan and the Euro area. The data for the Japanese stock price is the Nikkei Average 225, namely most famous Japanese stock price index. The exchange rate is the Japanese yen against the US dollar (period average), and commodity price is gold price (million ounces). For the Euro area, Germany's DAX is used for stock prices (period average). Exchange rate is the euro against the US dollar (period average), and the commodity price is gold price. All of the data are monthly averages. Monthly data are employed for estimation. The data are from International Financial Statistics (IMF). The sample period is from 2001 to 2013 for Japan and from 2002 to 2013 for the Euro area. The euro started in 1999; however, the first three years are omitted to avoid the period of unstable currency values.

### EMPIRICAL ANALYSES

To perform the empirical analyses, preliminary statistics are calculated for estimations. The stationarity of the data is determined using the standard test for a unit root, and the augmented Dickey-Fuller test is conducted. Table 1 shows the results. EXC denotes exchange rates, STOCK denotes stock prices, and GOLD denotes gold prices representing commodity prices. The figures in the table are probability.

**Table 1. ADF unit root tests**

	Japan	Euro Area
EXC	0.2255	0.6620
$\Delta$ EXC	0.0000	0.0000
STOCK	0.2030	0.9988
$\Delta$ STOCK	0.0000	0.0000
GOLD	0.9124	0.8112
$\Delta$ GOLD	0.0007	0.0000

It is clear that all three variables are non-stationary in the levels but stationary in their first difference.

### Empirical Results

All of the variables are all I(1). While considering this fact, VAR and VER models are estimated. The results are shown in Table 2, Figures 2a and 2b, Table 3, Figures 3a, and 3b.

**Table 2. VAR model**

	Japan			Euro Area		
	EXC	STOCK	GOLD	EXC	STOCK	GOLD
EXC(-1)	1.277 (26.714)	0.0005 (0.0008)	-13.892 (-2.286)	1.203 (16.605)	30.964 (0.784)	-20333.77 (-0.315)
EXC(-2)	-0.288 (-6.045)	-0.007 (-0.120)	11.805 (2.095)	-0.244 (-3.406)	-43.289 (-1.106)	12067.96 (0.188)
STOCK(-1)	0.018 (0.476)	1.301 (27.552)	-9.477 (-1.085)	-0.0002 (-1.685)	1.092 (14.276)	150.378 (1.202)
STOCK(-2)	-0.022 (-0.572)	-0.321 (-6.803)	7.967 (0.912)	0.0001 (1.406)	-0.098 (-1.283)	-138.277 (-1.105)
GOLD(-1)	-0.0001 (-0.641)	-0.0005 (-2.048)	0.824 (16.685)	-9.24E-08 (-1.066)	2.19E-06 (0.046)	0.799 (10.375)
GOLD(-2)	0.0001 (0.587)	0.0005 (1.917)	0.170 (3.456)	1.83E-07 (2.058)	1.39E-05 (0.287)	0.152 (1.934)
C	1.792 (1.186)	3.338 (1.808)	555.035 (1.626)	0.066 (3.028)	22.842 (1.015)	2527.402 (0.129)
Adj.R2	0.993	0.984	0.994	0.979	0.999	0.987
F-statistic	9839.494	4168.179	11321.67	1400.595	59186.02	2277.358
Akaike AIC	5.664	6.064	16.504	-4.879	7.719	22.517

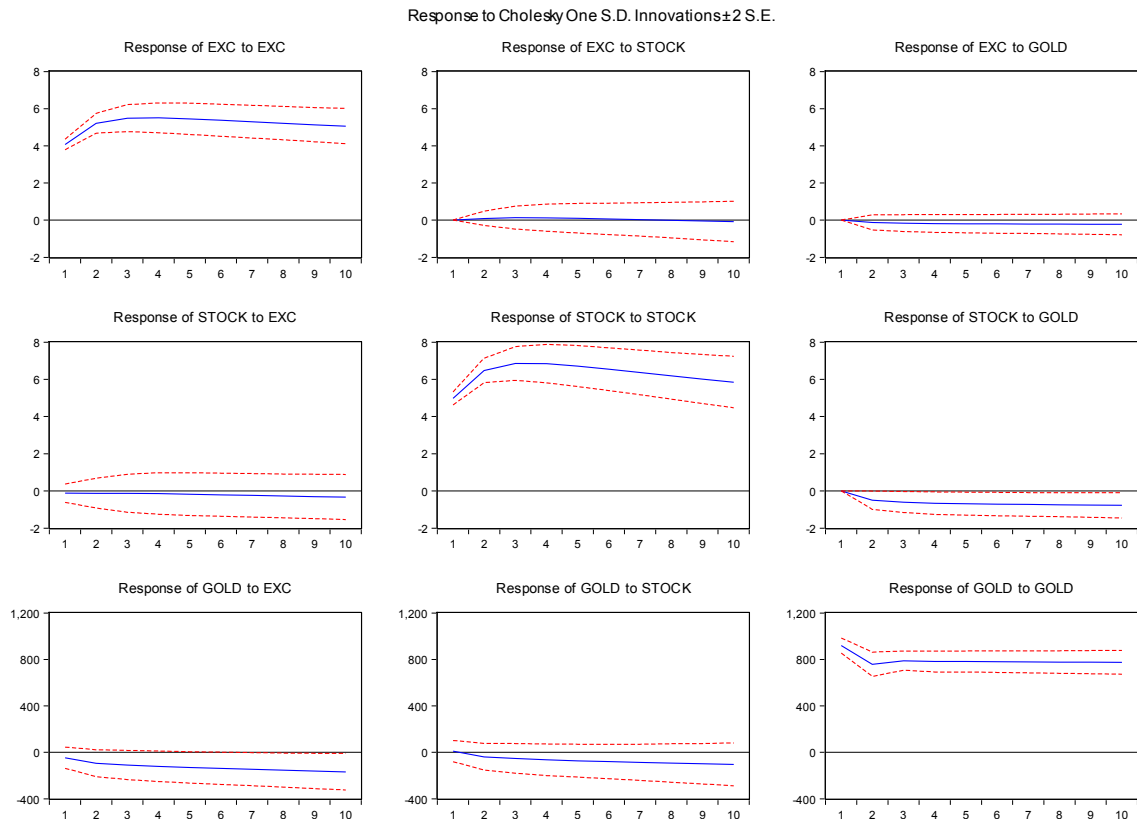
*Note. Figures in parentheses are t-statistics.*

**Table 3. VER model**

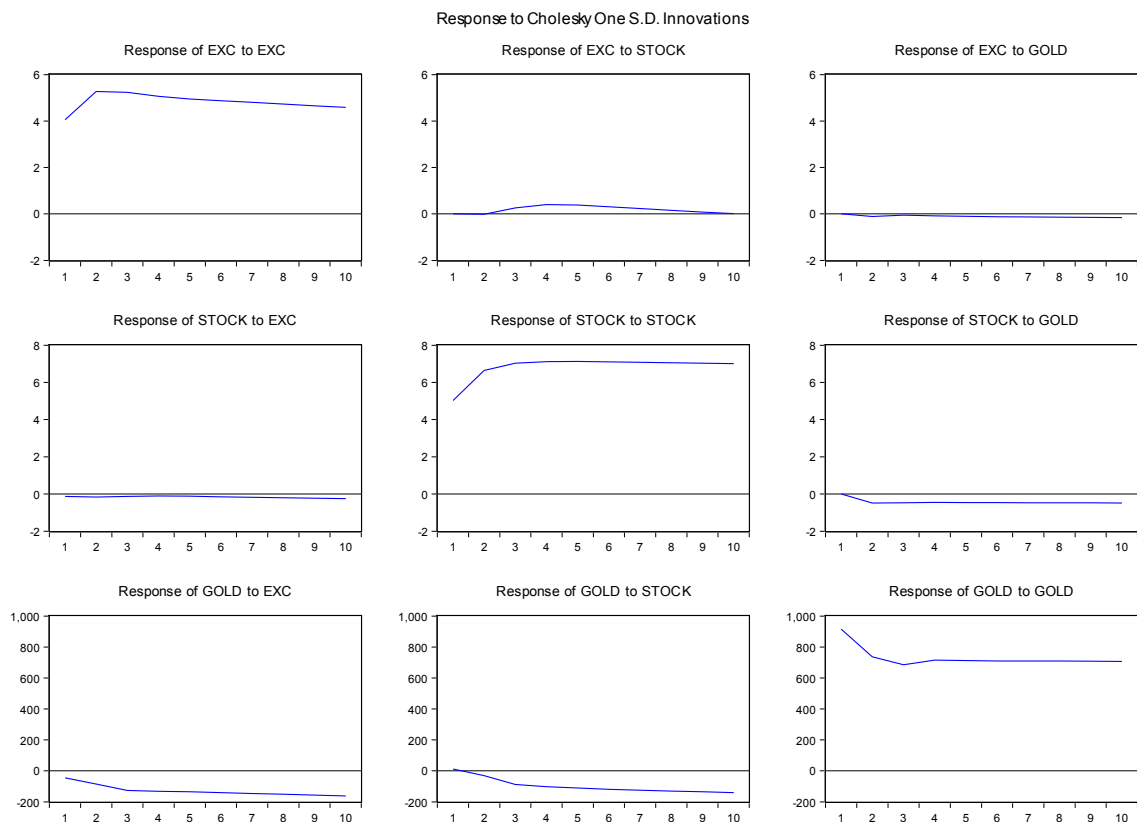
	Japan			Euro Area		
	D(EXC)	D(STOCK)	D(GOLD)	D(EXC)	D(STOCK)	D(GOLD)
cointEq	-0.012 (-2.256)	-0.004 (-0.628)	-1.934 (-1.559)	-0.037 (-2.734)	-9.610 (-1.289)	3370.018 (0.280)
D(EXC(-1))	0.310 (6.261)	-0.0004 (-0.007)	-10.565 (-0.942)	0.271 (3.612)	51.275 (1.247)	-15640.72 (-0.230)
D(EXC(-2))	-0.083 (-1.684)	0.011 (0.181)	-7.749 (-0.691)	-0.075 (-1.019)	5.108 (0.126)	-27351.82 (-0.421)
D(STOCK(-1))	0.005 (0.128)	0.325 (6.489)	-6.588 (-0.719)	-0.0002 (-1.448)	0.101 (1.316)	113.282 (0.917)
D(STOCK(-2))	0.063 (1.569)	-0.027 (-0.552)	-0.255 (-1.008)	0.0001 (0.872)	0.030 (0.396)	343.412 (2.768)
D(GOLD(-1))	-0.0001 (-0.457)	-0.0005 (-1.910)	-0.193 (-3.861)	-1.69E-07 (-1.867)	-5.48E-06 (-0.110)	-0.202 (-2.533)
D(GOLD(-2))	9.01E-05 (0.403)	8.92E-05 (0.322)	-0.096 (-1.915)	2.83E-08 (0.312)	5.83E-05 (1.178)	-0.118 (-1.485)
C	-0.286 (-1.402)	0.146 (0.580)	87.861 (1.904)	9.33E-05 (0.040)	7.929 (6.237)	-1946.531 (-0.951)
Adj.R2	0.091	0.092	0.035	0.104	0.049	0.047
F-statistic	6.787	6.854	3.104	3.930	1.123	2.245
Akaike AIC	5.657	6.085	16.498	-4.730	7.874	22.642

*Note. Parentheses are t-statistics.*

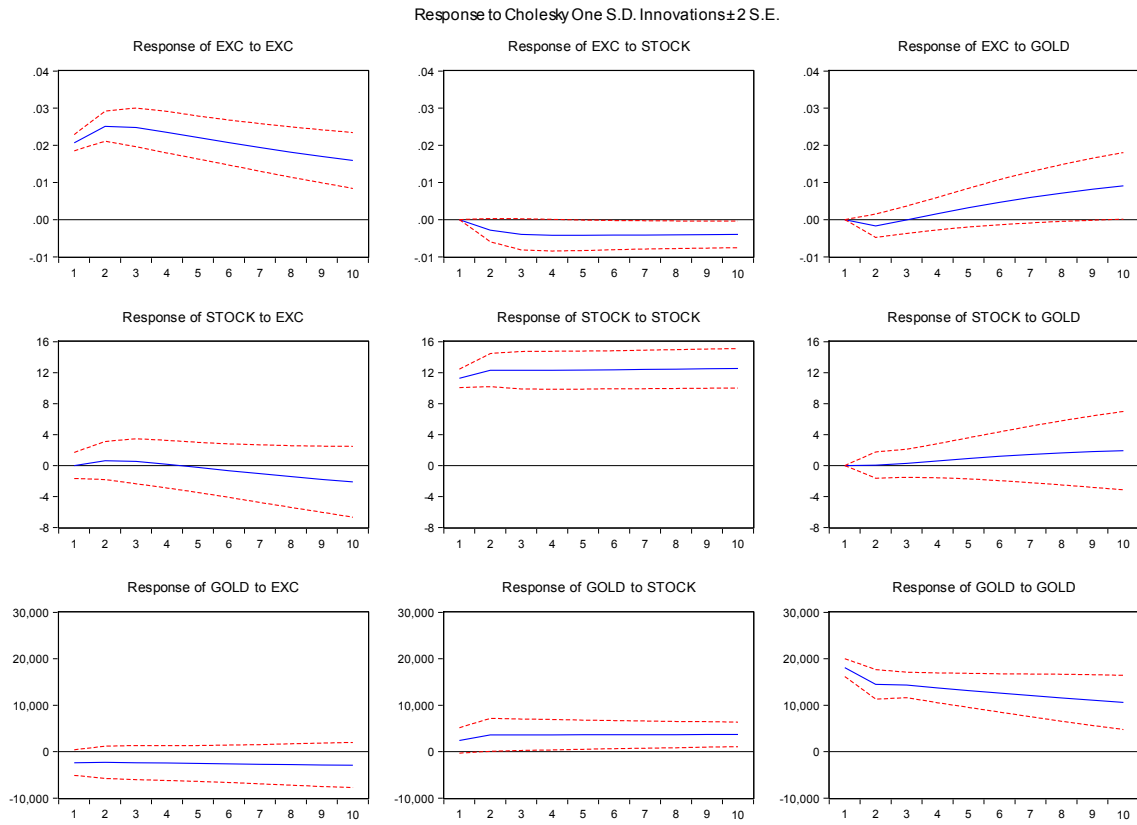
**Figure 2a. VAR impulse response (Japan)**



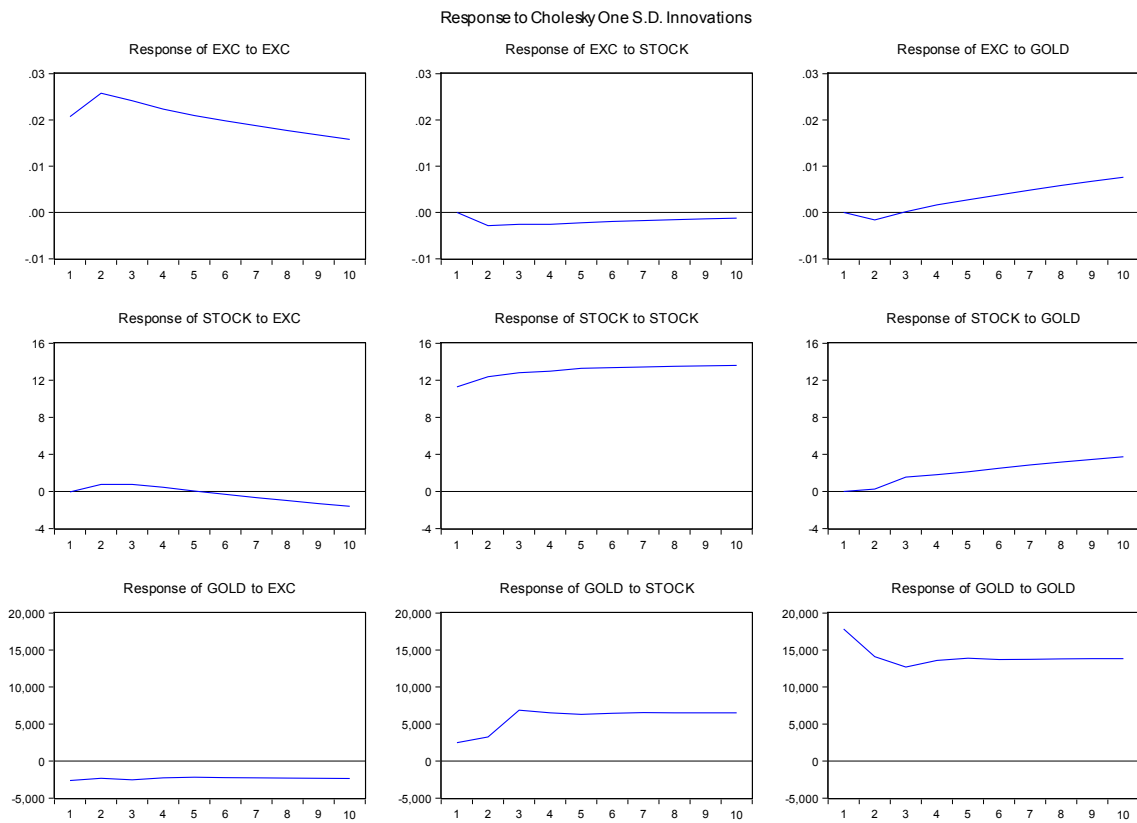
**Figure 1b. VER impulse response (Japan)**



**Figure 3a. VAR impulse response (Euro area)**



**Figure 3b. VER impulse response (Euro area)**



Appropriateness of the use of the VAR or VER is examined using the cointegration test. The relationship between exchange rates and stock prices are examined. The results of the cointegration tests are shown in Table 4. The test outcomes determine not only whether a VAR or VER model is appropriate but also provide information on whether a stable long-run relationship exists between the variables being used.

**Table 4. Tests for cointegration**

	Japan	Euro Area
Trace	0.524	0.693
Eigenvalue	0.687	0.705

*Note.* The figures are  $p$ -values for the test of no cointegration.

It is clear that there are no cointegration among these variables, so the VER model is appropriate for estimation. The relationship between stock prices and exchange rate has no cointegration, so there is no long-run relationship between these two variables. This case may be the result of the omission of variable(s). The author of this article expected that there is a commodity price influence between exchange rates and stock prices as shown in Figure 1.

To check the relationship among the three variables (i.e., exchange rates, gold prices, and stock prices), a causality test is performed. The results are shown in Table 5. The results indicate that there is no causality between stock prices and exchange rates. Also there is no evidence of causation of the exchange rate as would be predicted by a commodity price. However, there is evidence that the exchange causes commodity price changes in Japan.

**Table 5a. Pairwise Granger Causality Tests (Japan)**

	F-statistic	Prob.
STOCK does not Granger cause EXC	1.888	0.171
EXC does not Granger cause STOCK	1.402	0.238
GOLD does not Granger cause EXC	0.269	0.604
EXC does not Granger cause GOLD	3.952	0.048
GOLD does not Granger cause STOCK	0.252	0.616
STOCK does not Granger cause GOLD	1.448	0.230

*Note.* Figures are  $p$ -values for the tests of no causality.

**Table 5b. Pairwise Granger Causality Tests (Euro area)**

	F-statistic	Prob.
STOCK does not Granger cause EXC	0.070	0.790
EXC does not Granger cause STOCK	0.175	0.675
GOLD does not Granger cause EXC	0.014	0.903
EXC does not Granger cause GOLD	1.962	0.092
GOLD does not Granger cause STOCK	0.778	0.378
STOCK does not Granger cause GOLD	0.045	0.830

*Note.* Figures are  $p$ -values for the tests of no causality.

## CONCLUSIONS

This article examines the inclusive points regarding the existence of a relationship between exchange rates and stock prices. The study showed that the relationship between stock prices and the exchange rate is weak. In Japan, the exchange rate has a significant impact on commodity prices. There is a possibility that the commodity prices could be related to the relationship between stock prices and exchange rates. However, the relationship could not be found for the case of Euro area (however, it was significant at the 10% level). Also, there was

no evidence that commodity prices impact stock prices both for the case of Japan and the Euro area. Sample period, currency, kinds of stocks may produce different results. There is much room and need for further study.

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