Exchange Rate Effects on Equity Prices: The Recent Case from Japan

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Abstract

This paper investigates recent effects between the yen-US dollar exchange rate and Japanese stock prices. Applying bivariate Bayesian Vector Autoregressive (VAR) models, we obtain several clear findings. First, (1) our analyses using Bayesian VAR models find that, in our recent sample period, the first lags of the yen-dollar exchange rate are statistically significant in explaining four stock index prices of the Tokyo Stock Price Index (TOPIX), Tokyo Stock Exchange (TSE) Second Section stock index, TOPIX Large 70 stock index, and TOPIX Small stock index in Japan. Second, (2) our impulse response analyses find that, in our recent sample period, the above four stock index prices clearly respond to the shock in the yen-dollar exchange rate whilst the exchange rate little responds to the shock in these stock prices. Therefore, our results suggest that, in the recent years, past yen-dollar exchange rate series much more strongly affect Japanese stock prices whilst past Japanese stock price series have little effect on the yen-dollar exchange rate movements. Moreover, (3) our analyses of the time-varying correlation coefficients between the exchange rate changes and Japanese stock returns reveal that the contemporaneous correlations between them become much higher in the recent years.

Keywords: Bayesian VAR model, Yen-dollar exchange rate, Japanese stock price, Time-varying correlation

1. Introduction

In the recent years, as often reported in the media, Japanese stock prices are generally higher than before whilst the yen is depreciated than before. Then how are the time-series comovements of Japanese stock prices and the yen-US dollar exchange rate changes recently? Has the relationship between them changed in the recent years? Further, recently, do stock prices affect the exchange rate or does the exchange rate have an effect on stock prices? In order to derive the answers to these questions, by using the actual data, this paper tests the recent relationships between the yen-US dollar exchange rate and Japanese stock index prices. In empirical analyses, we employ Bayesian Vector Autoregressive (VAR) models in this paper.

This study provides the following interesting and clear findings. First, (1) our research using Bayesian VAR models clarifies that recently, the first lags of the yen-dollar exchange rate statistically significantly explain the movements of four Japanese stock index prices; namely, the Tokyo Stock Price Index (TOPIX), Tokyo Stock Exchange (TSE) Second Section stock index, TOPIX Large 70 stock index, and TOPIX Small stock index in Japan. Next, (2) our impulse response analyses further reveal that, recently, the above four Japanese stock index prices clearly react to the shock to the yen-dollar exchange rate, however, the exchange rate little reacts to the shock to the stock prices. Thus these results indicate that, in the recent years, the past yen-dollar exchange rate much more strongly influences Japanese stock prices; while past Japanese stock prices have little influence on the yen-dollar exchange rate. Further, (3) our analyses of the time-varying correlation coefficients of the exchange rate and Japanese stock returns find that, in the recent years, much higher contemporaneous correlations between them are observed. After this introduction, we review existing studies in Section 2; our data are explained in Section 3; our methodology is described in Section 4; our results are explained in Section 5; and in Section 6, our conclusions are presented.

2. Literature Review

Focusing on the recent studies, this section conducts related literature review. First, Liang, Lin, and Hsu (2013) revisited the relations between stock markets and currency markets of the Association of South-East Asian Nations (ASEAN) countries with the panel Granger causality methodologies. They concluded that their results were supportive for the ‘stock-oriented’ hypothesis of exchange rates by Branson (1983) and Frankel (1983), which

suggested that exchange rates affect stock prices negatively through capital mobility. Ciner, Gurdgiev, and Lucey (2013) examined the return relationships between major asset classes using the US and UK data. They derived the evidence that both in the US and UK, we can regard gold as a safe haven against exchange rates. In addition, Vithessonthi and Tongurai (2013) investigated the effects of the imposition of Thailand's unremunerated reserve requirement on capital inflows in 2006–2007 on exchange rate volatility. They showed that during the period of the imposition of the unremunerated reserve requirement in Thailand, the exchange rate volatility of the Thai baht against the US dollar, the euro, the British pound, and the Japanese yen seemed to be larger.

Further, Moore and Wang (2014) investigated the determinants of the time-varying correlations between real exchange rates and stock returns for four developed markets and six Asian emerging markets. Andrieș, Ihnatov, and Tiwari (2014) attempted to identify the comovement patterns of stock price, exchange rate, and interest rate in India from July 1997 to December 2010 by applying some cross-wavelet methodologies. Moreover, a very recent study by Ho and Huang (2015) investigated the nonlinear connections between stock price indices and exchange rates of China, India, Russia, and Brazil. Abouwafia and Chambers (2015) explored the linkages among monetary policy, stock prices, and exchange rates in the Middle East region. Gelman et al. (2015) examined the associations between capital flows and real exchange rates. Furthermore, Ca'Zorzi, Kocięcki, and Rubaszek (2015) implemented a Bayesian forecasting of real exchange rates with a Dornbusch prior. Petrevski et al. (2015) examined the transmission of various foreign shocks to South Eastern European economies by using a Bayesian VAR approach. As the above review of recent studies shows, we understand that the time-series linkage of the yen-dollar exchange rate changes and Japanese stock price evolution in the recent period has been little analyzed in existing literature.

3. Data

In this study, we use four Japanese equity index and one exchange rate data. Specifically, EXLR means the percentage log changes as to the yen-US dollar exchange rate, TXLR denotes the percentage log return of the TOPIX, TSE2LR denotes the percentage log return of the TSE Second Section stock index, TL70LR means that of the TOPIX Large 70 stock index, and TSMLR denotes that of the TOPIX Small stock index in Japan.

We further use the level variables related to the above five variables. Namely, EX represents the level variable of the yen-dollar exchange rate; TX denotes the level variable of the TOPIX; TSE2 represents the level variable of the TSE Second Section stock index; TL70 means that of the TOPIX Large 70 stock index; and TSM denotes that of the TOPIX Small stock index in Japan. In addition, this paper analyzes two sample periods: the first is (1) the period from April 1, 2010 to November 13, 2012 and the second is (2) that from December 26, 2012 to August 18, 2015. This study uses data from the QUICK Corp.

Table 1 shows the descriptive statistics as to the above five log return (change) variables. This table indicates the following characteristics of the return data. First, (1) the mean values of the five variables are all negative for our first sample period from April 1, 2010 to November 13, 2012 while they are all positive for our second sample period from December 26, 2012 to August 18, 2015. Further, (2) the kurtosis values of the five variables are clearly higher for our first period than those for our second period. Third, (3) for our first and second sample periods, the skewness values of the five variables are all slightly negative except for the exchange rate change variable, EXLR.

4. Methodology

This paper employs the following analyzing methodology and models. For examining the dynamic relations of the above four kinds of Japanese stock index prices and the yen-dollar exchange rate, (1) we first calculate the time-varying correlation coefficients by taking 20-days windows and compare them in our two sample periods explained above. (2) Second, we estimate four sorts of bivariate Bayesian VAR models by using the above level variables and investigate the impulse response functions derived from those models. More concretely, the econometric models we estimate in this study are the bivariate Bayesian VAR(4) models of (1) EX and TX; (2) EX and TSE2; (3) EX and TL70; and (4) EX and TSM. As the following equations (1) and (2), all our VAR(4) models can be summarized as two equations:

$$ex_t = \tau_1 + \sum_{h=1}^{p} \zeta_{1,h} ex_{t-h} + \sum_{j=1}^{q} \psi_{1,j} sp_{t-j} + \kappa_{1,t}, \quad (1)$$

$$sp_t = \tau_2 + \sum_{r=1}^{p} \zeta_{2,r} ex_{t-r} + \sum_{s=1}^{q} \psi_{2,s} sp_{t-s} + \kappa_{2,t}. \quad (2)$$

In the above VARs, we always specify the lag orders as $p = 4$ and $q = 4$ to conduct consistent tests in our study. In the above models, *ex* means the yen-dollar exchange rate level and *sp* is one of the four Japanese equity index prices: the TOPIX, TSE Second Section stock index, TOPIX Large 70 stock index, or TOPIX Small stock index in Japan.

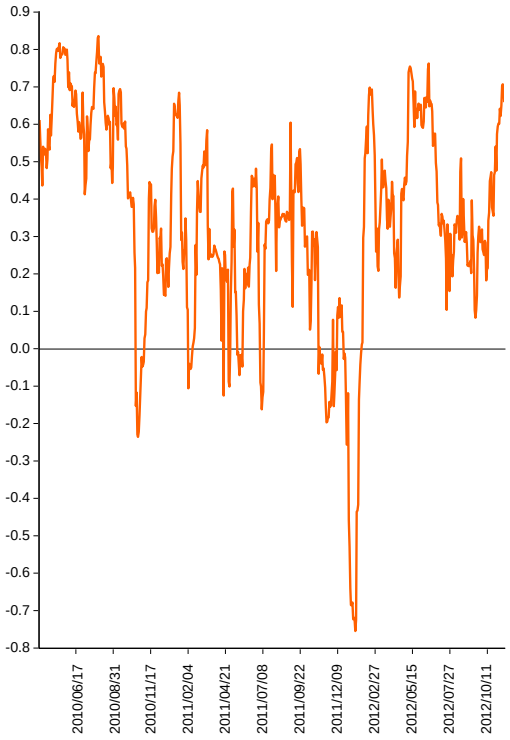
Table 1. Descriptive statistics of the Japanese stock index returns and the yen-dollar exchange rate changes: For the period from April 1, 2010 to November 13, 2012 and December 26, 2012 to August 18, 2015

Panel A. Statistics for the period from April 1, 2010 to November 13, 2012			
	EXLR	TXLR	TSE2LR
Mean	−0.0251	−0.0469	−0.0010
Median	−0.0297	−0.0320	0.0600
Maximum	3.8351	6.4275	5.7307
Minimum	−2.1419	−9.9519	−11.5827
Standard deviation	0.5693	1.2168	0.9002
Skewness	1.1281	−0.9851	−4.6266
Kurtosis	9.9756	12.4999	72.1236
Observations	647	647	647
	TL70LR	TSMLR	
Mean	−0.0508	−0.0182	
Median	−0.0465	0.0431	
Maximum	7.3691	7.1139	
Minimum	−9.6662	−13.1830	
Standard deviation	1.3363	1.2727	
Skewness	−0.5960	−2.1904	
Kurtosis	9.4533	27.7828	
Observations	647	647	
Panel B. Statistics for the period from December 26, 2012 to August 18, 2015			
	EXLR	TXLR	TSE2LR
Mean	0.0590	0.1068	0.1123
Median	0.0554	0.1320	0.1570
Maximum	3.1691	5.0746	4.0984
Minimum	−2.7370	−7.1196	−4.4570
Standard deviation	0.6142	1.2621	0.8547
Skewness	0.2390	−0.4870	−0.8902
Kurtosis	6.5219	5.7782	7.2138
Observations	647	647	647
	TL70LR	TSMLR	
Mean	0.1109	0.1023	
Median	0.1397	0.1870	
Maximum	4.4878	5.7778	
Minimum	−7.6730	−7.0532	
Standard deviation	1.3066	1.1978	
Skewness	−0.5802	−0.6440	
Kurtosis	5.9119	7.1629	
Observations	647	647	

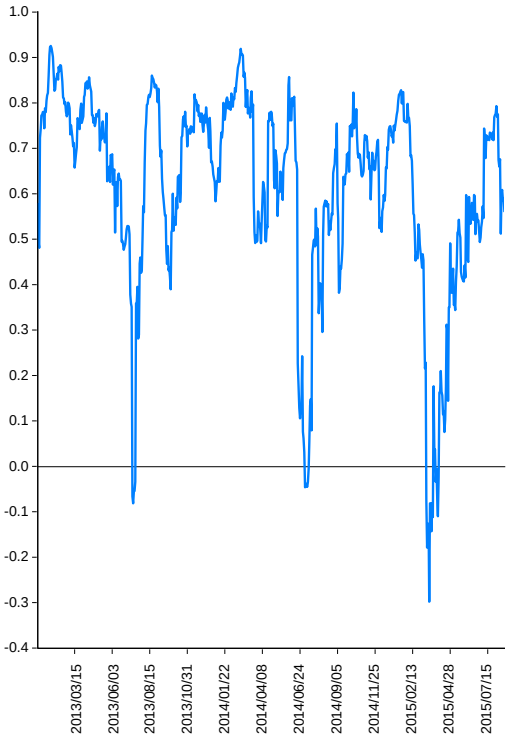
Notes: Descriptive statistics for the analyzed stock return and exchange rate change variables are shown in this table. The statistics are shown for two sample periods. Further, EXLR means the percentage log changes of the yen-dollar exchange rate series, TXLR denotes the percentage log return of the TOPIX, TSE2LR denotes the percentage log return of the TSE Second Section stock index, TL70LR means that of the TOPIX Large 70 stock index, and TSMLR denotes that of the TOPIX Small stock index in Japan.

Panel A. EXLR and TXLR

April 1, 2010 to November 13, 2012

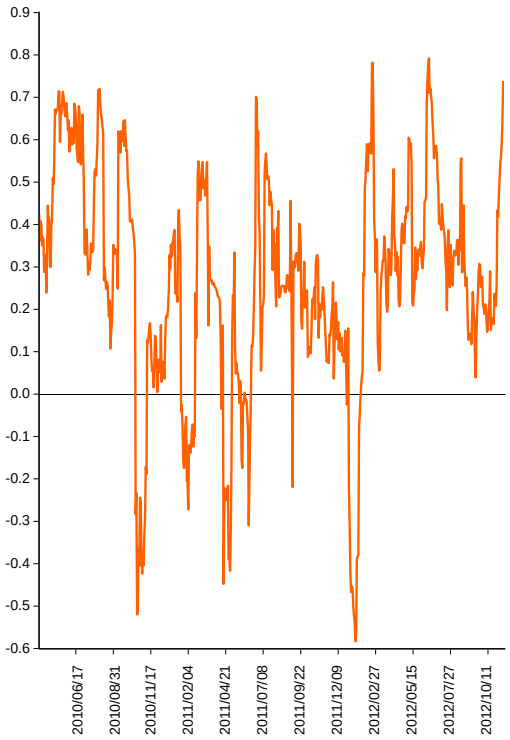


December 26, 2012 to August 18, 2015

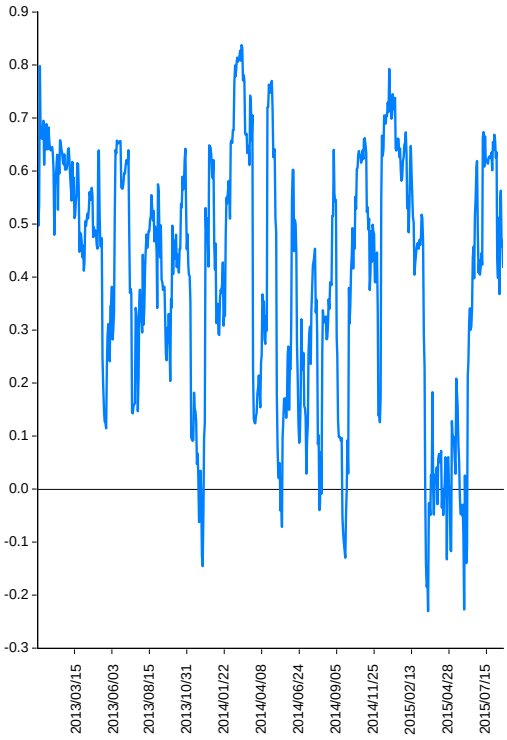


Panel B. EXLR and TSE2LR

April 1, 2010 to November 13, 2012

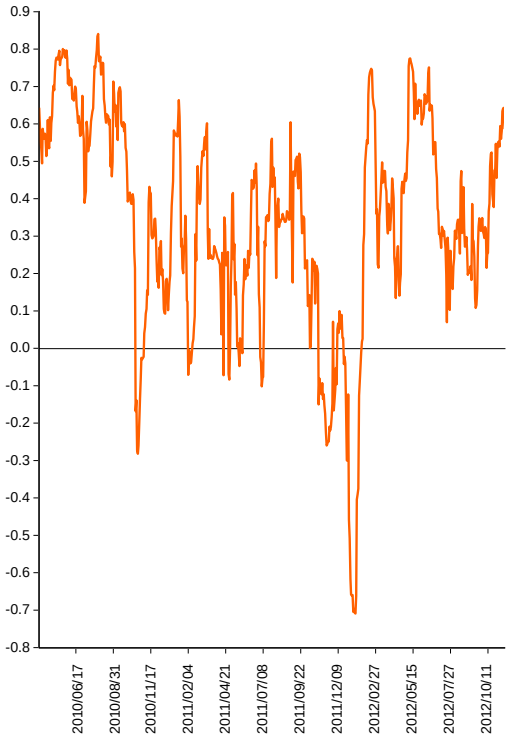


December 26, 2012 to August 18, 2015

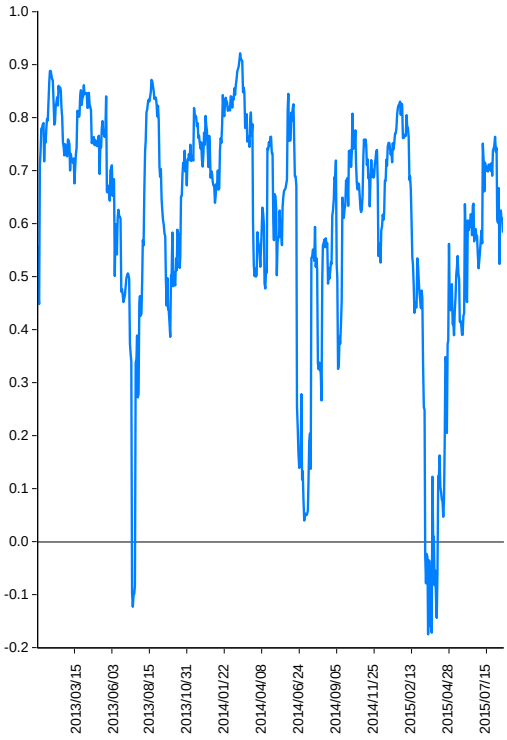


Panel C. EXLR and TL70LR

April 1, 2010 to November 13, 2012

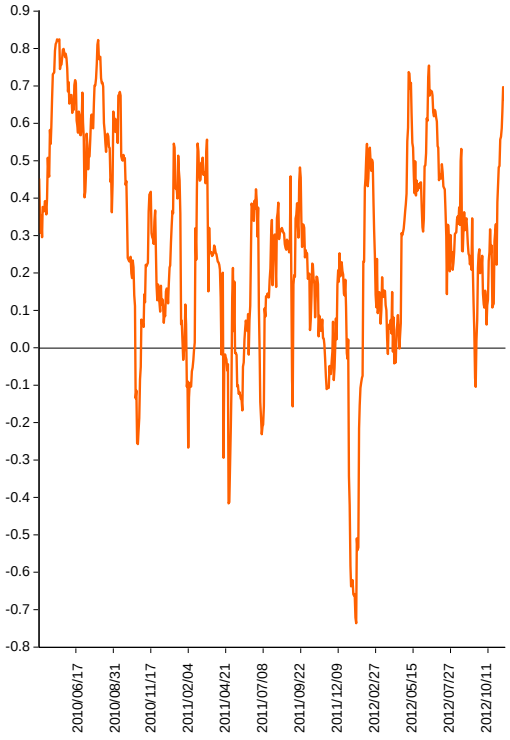


December 26, 2012 to August 18, 2015



Panel D. EXLR and TSMLR

April 1, 2010 to November 13, 2012



December 26, 2012 to August 18, 2015

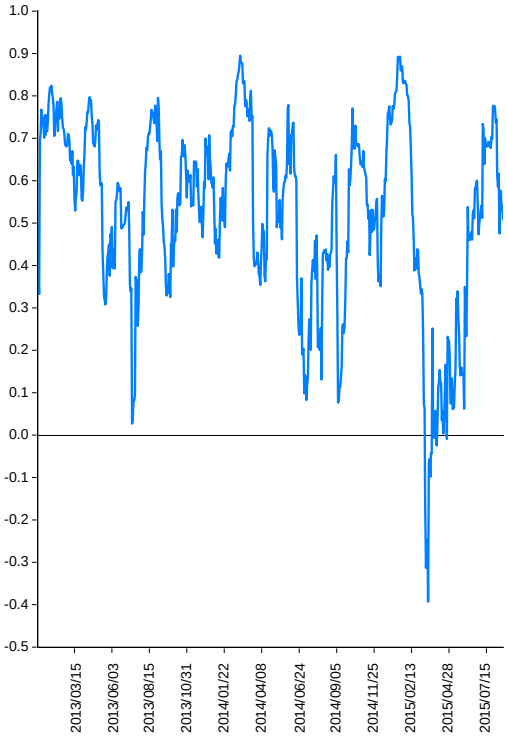


Figure 1. Time-series evolution of the time-varying correlations between four kinds of Japanese stock index returns and the yen-dollar exchange rate changes

Table 2. Estimation results of the bivariate Bayesian VAR models: For the period from April 1, 2010 to November 13, 2012 and from December 26, 2012 to August 18, 2015

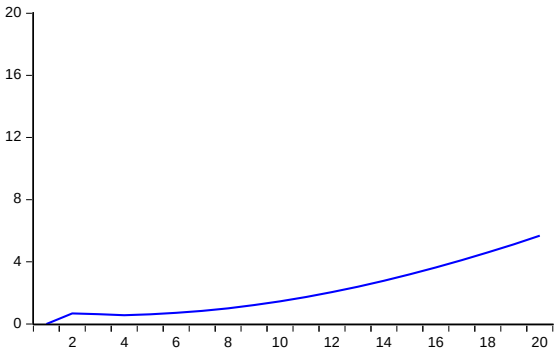
Panel A. Estimation results for April 1, 2010 to November 13, 2012					
Model 1			Model 2		
	EX	TX		EX	TSE2
EX(−1)	0.7918***	0.6728	EX(−1)	0.7985***	0.5128
t-value	24.1340	0.9592	*t*-value	24.8054	0.4054
p-value	0.0000	0.3378	*p*-value	0.0000	0.6853
EX(−2)	0.1285***	−1.1969*	EX(−2)	0.1298***	−1.6333
t-value	3.8360	−1.6753	*t*-value	3.8991	−1.2521
p-value	0.0001	0.0944	*p*-value	0.0001	0.2110
EX(−3)	0.0484*	0.3830	EX(−3)	0.0470*	0.4967
t-value	1.8866	0.7014	*t*-value	1.8457	0.4978
p-value	0.0597	0.4833	*p*-value	0.0654	0.6188
EX(−4)	0.0118	0.2004	EX(−4)	0.0107	0.5419
t-value	0.5996	0.4762	*t*-value	0.5437	0.7033
p-value	0.5490	0.6341	*p*-value	0.5869	0.4821
TX(−1)	0.0020	0.9203***	TSE2(−1)	0.0008	1.1010***
t-value	1.3550	28.8704	*t*-value	1.0346	37.5052
p-value	0.1759	0.0000	*p*-value	0.3012	0.0000
TX(−2)	0.0017	0.0524	TSE2(−2)	0.0012	−0.0896**
t-value	1.0807	1.5183	*t*-value	1.3255	−2.5526
p-value	0.2803	0.1294	*p*-value	0.1855	0.0109
TX(−3)	−0.0016	0.0182	TSE2(−3)	−0.0012*	−0.0228
t-value	−1.3273	0.7098	*t*-value	−1.8630	−0.8941
p-value	0.1849	0.4781	*p*-value	0.0629	0.3716
TX(−4)	−0.0017*	−0.0091	TSE2(−4)	−0.0008	−0.0111
t-value	−1.8620	−0.4702	*t*-value	−1.6303	−0.6037
p-value	0.0631	0.6384	*p*-value	0.1035	0.5462
Constant term	1.1738***	9.6197	Constant term	1.1392**	56.5466***
t-value	3.2761	1.2516	*t*-value	2.3528	2.9621
p-value	0.0011	0.2112	*p*-value	0.0189	0.0032
$Adj.R^2$	0.9882	0.9800	$Adj.R^2$	0.9883	0.9713
Model 3			Model 4		
	EX	TL70		EX	TSM
EX(−1)	0.7947***	0.7182	EX(−1)	0.7978***	0.3118
t-value	24.2799	0.9672	*t*-value	24.6362	0.4113
p-value	0.0000	0.3338	*p*-value	0.0000	0.6810
EX(−2)	0.1282***	−1.3119*	EX(−2)	0.1289***	−1.0251
t-value	3.8285	−1.7308	*t*-value	3.8633	−1.3151
p-value	0.0001	0.0840	*p*-value	0.0001	0.1890
EX(−3)	0.0478*	0.4173	EX(−3)	0.0473*	0.4251
t-value	1.8652	0.7203	*t*-value	1.8544	0.7138
p-value	0.0626	0.4716	*p*-value	0.0641	0.4756
EX(−4)	0.0115	0.1868	EX(−4)	0.0111	0.3168
t-value	0.5820	0.4183	*t*-value	0.5614	0.6896
p-value	0.5608	0.6759	*p*-value	0.5747	0.4907

TL70(−1)	0.0016	0.9083***	TSM(−1)	0.0014	0.9791***
t-value	1.1734	28.4603	*t*-value	1.0381	31.5763
p-value	0.2411	0.0000	*p*-value	0.2996	0.0000
TL70(−2)	0.0017	0.0611*	TSM(−2)	0.0020	−0.0034
t-value	1.1533	1.7771	*t*-value	1.3666	−0.0988
p-value	0.2492	0.0760	*p*-value	0.1722	0.9213
TL70(−3)	−0.0015	0.0251	TSM(−3)	−0.0016	−0.0108
t-value	−1.3157	0.9794	*t*-value	−1.5049	−0.4235
p-value	0.1887	0.3278	*p*-value	0.1328	0.6721
TL70(−4)	−0.0016*	−0.0082	TSM(−4)	−0.0015*	−0.0042
t-value	−1.8469	−0.4186	*t*-value	−1.8310	−0.2190
p-value	0.0652	0.6756	*p*-value	0.0676	0.8267
Constant term	1.1665***	9.4807	Constant term	0.9402**	32.6558***
t-value	3.2525	1.1612	*t*-value	2.2622	3.3447
p-value	0.0012	0.2460	*p*-value	0.0240	0.0009
$Adj.R^2$	0.9882	0.9814	$Adj.R^2$	0.9882	0.9460
Panel B. Estimation results for December 26, 2012 to August 18, 2015					
Model 1			Model 2		
	EX	TX		EX	TSE2
EX(−1)	0.8543***	2.4049***	EX(−1)	0.8721***	3.1354**
t-value	24.6626	2.8675	*t*-value	26.6532	2.0054
p-value	0.0000	0.0043	*p*-value	0.0000	0.0453
EX(−2)	0.0951***	−1.5124*	EX(−2)	0.0859**	−1.6423
t-value	2.7198	−1.7908	*t*-value	2.5013	−1.0036
p-value	0.0067	0.0738	*p*-value	0.0126	0.3160
EX(−3)	0.0289	−0.1125	EX(−3)	0.0151	−0.5541
t-value	1.1024	−0.1777	*t*-value	0.5865	−0.4511
p-value	0.2707	0.8590	*p*-value	0.5577	0.6521
EX(−4)	0.0171	−0.2584	EX(−4)	0.0072	−0.1063
t-value	0.8582	−0.5363	*t*-value	0.3666	−0.1135
p-value	0.3911	0.5919	*p*-value	0.7141	0.9097
TX(−1)	0.0034**	0.8718***	TSE2(−1)	0.0011	0.9900***
t-value	2.4006	25.1666	*t*-value	1.6315	31.2542
p-value	0.0167	0.0000	*p*-value	0.1033	0.0000
TX(−2)	−0.0014	0.0936***	TSE2(−2)	−0.0007	−0.0067
t-value	−0.9374	2.6510	*t*-value	−1.0029	−0.1909
p-value	0.3489	0.0082	*p*-value	0.3163	0.8487
TX(−3)	−0.0018	−0.0070	TSE2(−3)	−0.0004	0.0013
t-value	−1.6368	−0.2654	*t*-value	−0.6865	0.0509
p-value	0.1022	0.7908	*p*-value	0.4926	0.9594
TX(−4)	−0.0002	0.0122	TSE2(−4)	0.0003	0.0020
t-value	−0.2440	0.6136	*t*-value	0.7302	0.1026
p-value	0.8073	0.5397	*p*-value	0.4655	0.9183
Constant term	0.4013	−16.4774*	Constant term	1.1506**	−33.8077
t-value	0.9847	−1.6644	*t*-value	2.2470	−1.3771
p-value	0.3251	0.0965	*p*-value	0.0250	0.1690
$Adj.R^2$	0.9960	0.9938	$Adj.R^2$	0.9960	0.9979

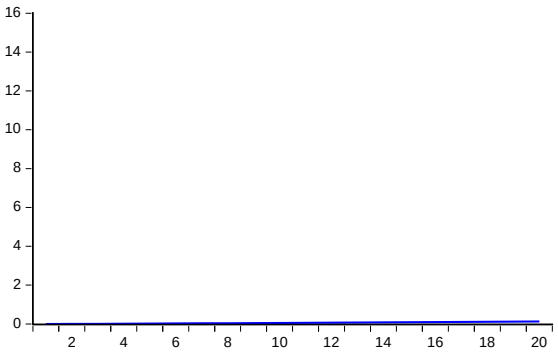
Model 3			Model 4		
	EX	TL70		EX	TSM
EX(−1)	0.8510***	2.3291***	EX(−1)	0.8647***	2.1588**
t-value	24.4914	2.8356	*t*-value	25.7645	2.4463
p-value	0.0000	0.0047	*p*-value	0.0000	0.0147
EX(−2)	0.0947***	−1.4402*	EX(−2)	0.0900***	−1.4257
t-value	2.7070	−1.7458	*t*-value	2.5989	−1.5697
p-value	0.0070	0.0813	*p*-value	0.0096	0.1170
EX(−3)	0.0289	−0.0557	EX(−3)	0.0233	−0.1264
t-value	1.1019	−0.0901	*t*-value	0.8947	−0.1856
p-value	0.2709	0.9283	*p*-value	0.3713	0.8528
EX(−4)	0.0172	−0.2562	EX(−4)	0.0136	−0.1102
t-value	0.8626	−0.5446	*t*-value	0.6903	−0.2129
p-value	0.3887	0.5863	*p*-value	0.4903	0.8315
TL70(−1)	0.0037**	0.8758***	TSM(−1)	0.0026**	0.8826***
t-value	2.5389	25.2488	*t*-value	2.0621	26.2611
p-value	0.0114	0.0000	*p*-value	0.0396	0.0000
TL70(−2)	−0.0014	0.0929***	TSM(−2)	−0.0010	0.0764**
t-value	−0.9260	2.6274	*t*-value	−0.7598	2.1870
p-value	0.3548	0.0088	*p*-value	0.4477	0.0291
TL70(−3)	−0.0018	−0.0079	TSM(−3)	−0.0013	0.0051
t-value	−1.6209	−0.2993	*t*-value	−1.3247	0.1968
p-value	0.1055	0.7648	*p*-value	0.1858	0.8441
TL70(−4)	−0.0003	0.0087	TSM(−4)	−3.1E−05	0.0100
t-value	−0.3166	0.4369	*t*-value	−0.0413	0.5052
p-value	0.7516	0.6623	*p*-value	0.9671	0.6136
Constant term	0.5823	−23.2006**	Constant term	0.5182	−13.1442
t-value	1.1712	−1.9676	*t*-value	1.4124	−1.3580
p-value	0.2419	0.0495	*p*-value	0.1583	0.1749
$Adj.R^2$	0.9960	0.9945	$Adj.R^2$	0.9960	0.9937

Notes: This table displays the estimation results of our four VAR(4) models for the yen-dollar exchange rate and four kinds of stock index prices in Japan. In this table, EX means the level variable of the yen-dollar exchange rate, TX denotes the level variable of the TOPIX, TSE2 denotes the level variable of the TSE Second Section stock index, TL70 means that of the TOPIX Large 70 stock index, and TSM denotes that of the TOPIX Small stock index in Japan. Moreover, $Adj.R^2$ means the adjusted-*R* squared value and ***, **, and * indicate the statistical significance of the coefficients at the 1, 5, and 10% levels, respectively.

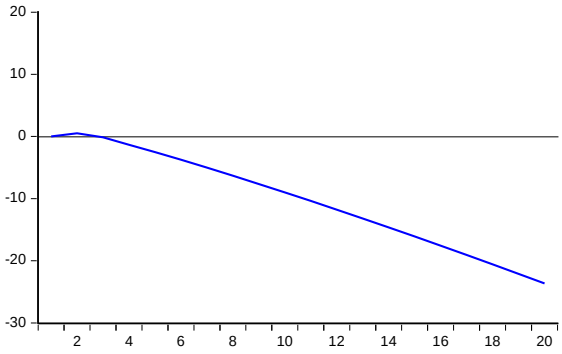
Panel A. Accumulated Response of TX to EX



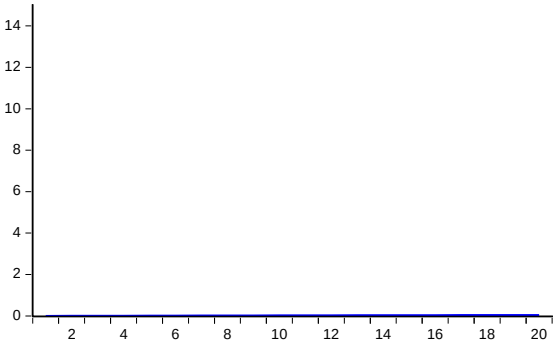
Panel B. Accumulated Response of EX to TX



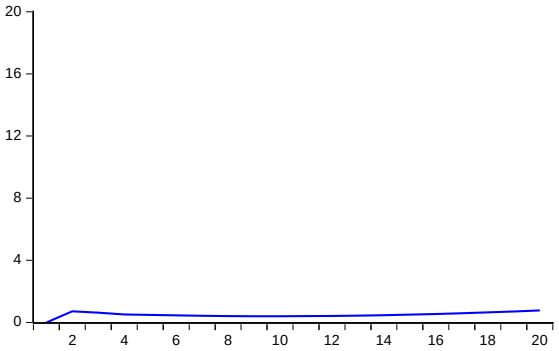
Panel C. Accumulated Response of TSE2 to EX



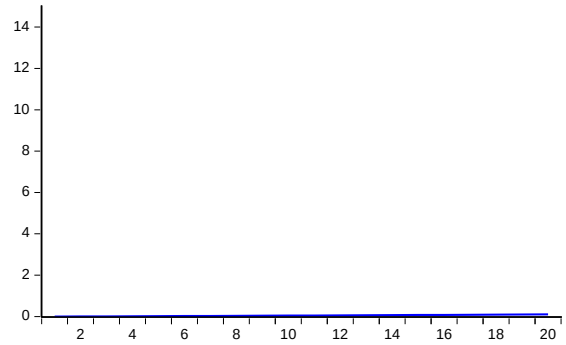
Panel D. Accumulated Response of EX to TSE2



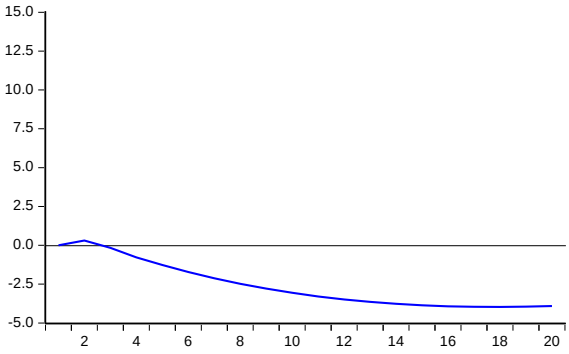
Panel E. Accumulated Response of TL70 to EX



Panel F. Accumulated Response of EX to TL70



Panel G. Accumulated Response of TSM to EX



Panel H. Accumulated Response of EX to TSM

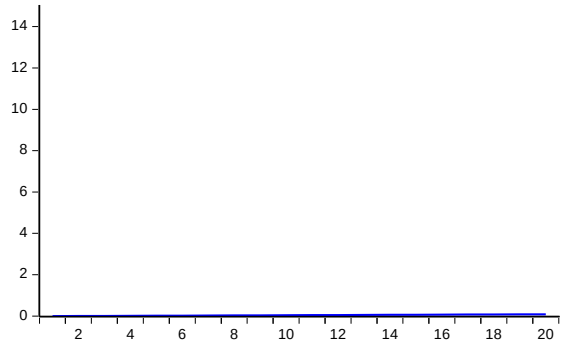
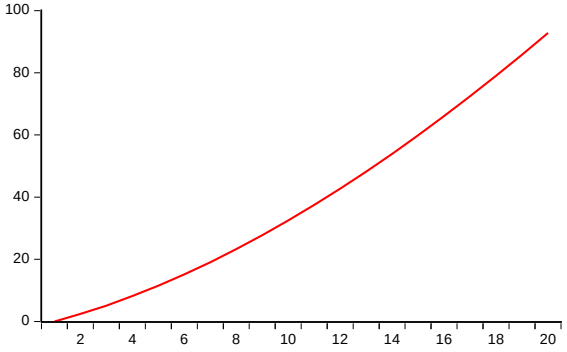
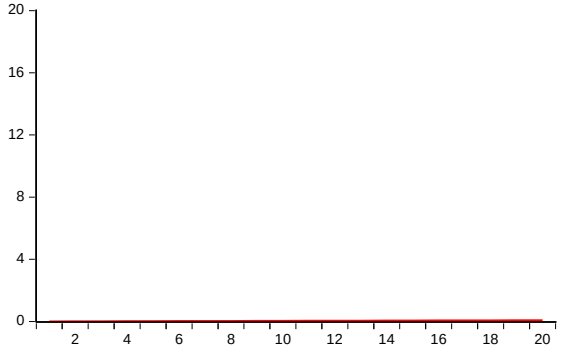


Figure 2. Impulse responses for the period from April 1, 2010 to November 13, 2012

Panel A. Accumulated Response of TX to EX



Panel B. Accumulated Response of EX to TX



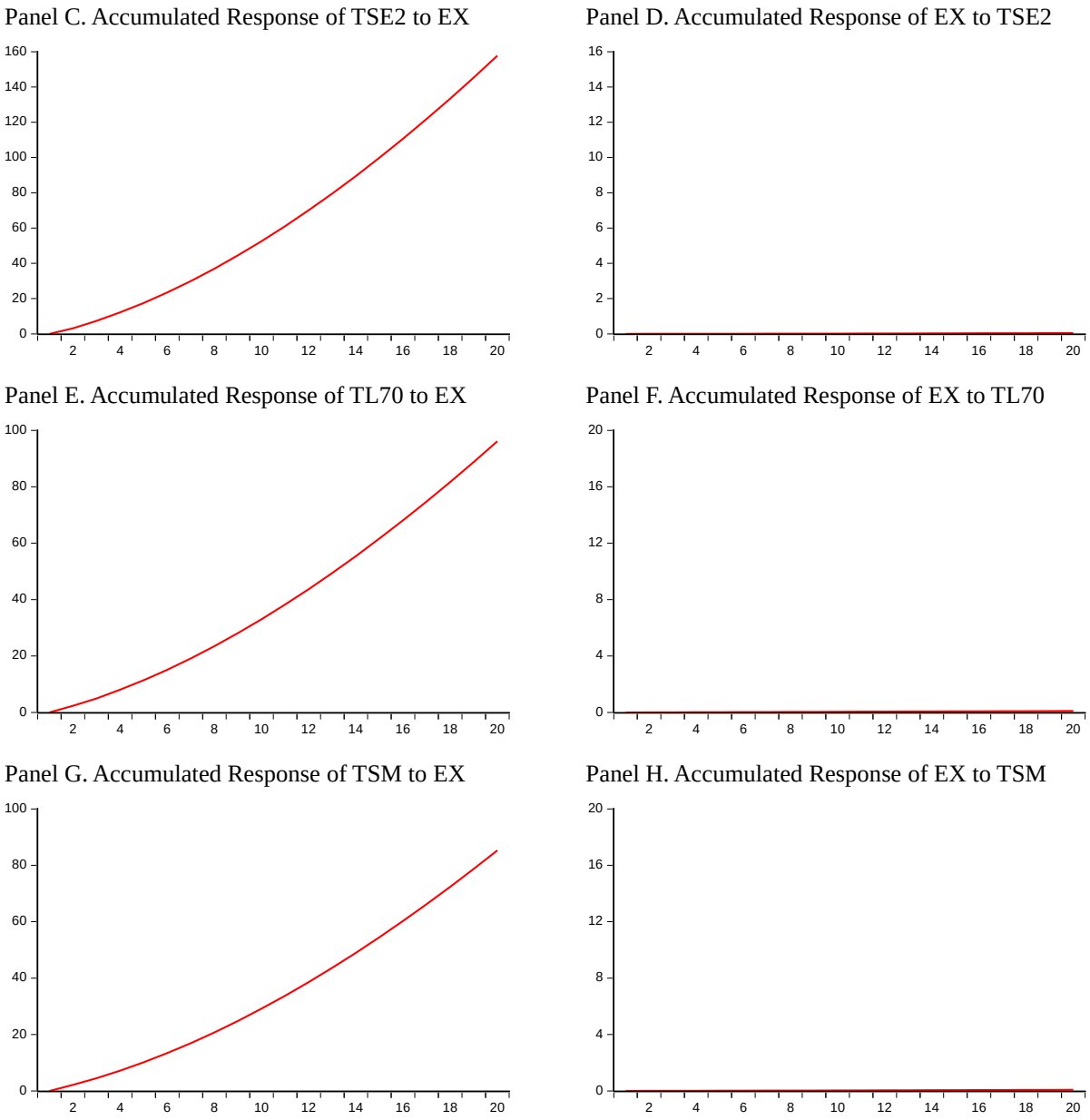


Figure 3. Impulse responses for the period from December 26, 2012 to August 18, 2015

5. Empirical Results

Regarding our empirical results, first, Figure 1 displays the time-varying correlation coefficients between the yen-US dollar exchange rate changes and stock returns, which are computed by taking 20-days windows. In all panels of Figure 1, the correlations for our first sample period are on the left side while the correlations for our second sample period are on the right side. In Figure 1, all panels indicate that, in the recent years, all our four Japanese stock return variables, TXLR, TSE2LR, TL70LR, and TSMLR exhibit much higher contemporaneous correlations with the changes in the yen-dollar exchange rate.

Next, Table 2 shows the estimation results as to our four kinds of bivariate Bayesian VAR models. In Table 2, Panel A displays the results for our first sample period and Panel B shows the results for our second sample period. In Panel B of this table, it is shown that in our second sample period, the first lag variables of EX are statistically significant in explaining the four Japanese stock index prices, TX, TSE2, TL70, and TSM. In addition, Panel B of Table 2 also shows that the first lag variables of TX, TL70, and TSM are statistically significant in explaining the

movements of the exchange rate although all coefficients of the stock price lag variables are very small. Contrary to this, the estimation results of our VAR models displayed in Panel A of Table 2 indicate that there is little mutual effect between the yen-dollar exchange rate and the four kinds of Japanese stock index prices in our first sample period.

Based on the above results, for examining the degrees of the effects between stock prices and the exchange rate in our two sample periods, the mutual impulse response functions of EX, TX, TSE2, TL70, and TSM are depicted in Figures 2 and 3. Figure 2 exhibits their mutual responses for our first sample period and Figure 3 shows those for our second sample period, respectively. Figure 2 suggests that in our first sample period, EX shows little response to the shock in stock prices and stock prices do not exhibit clear response to the shock in EX. On the other hand, Figure 3 demonstrates that, in our second sample period, EX again shows almost no response to the shock in equity prices; however, all four Japanese stock index prices of TX, TSE2, TL70, and TSM exhibit much strong positive responses to the shock in EX. Therefore, our results of impulse response analyses suggest that, in the recent years, the past yen-dollar exchange rate series much more strongly affect Japanese stock prices whilst past Japanese stock prices do not affect the yen-dollar exchange rate changes.

6. Conclusions

This paper investigated the recent effects between the yen-dollar exchange rate changes and Japanese stock prices. Applying bivariate Bayesian VAR models, we obtained several interesting findings. First, (1) our analyses using Bayesian VAR models found that, in our recent sample period, the first lag variables of the yen-dollar exchange rate were statistically significant in explaining the four stock index prices: the TOPIX, TSE Second Section stock index, TOPIX Large 70 stock index, and TOPIX Small stock index in Japan.

Second, (2) the results of our impulse response analyses indicated that the yen-dollar exchange rate little responded to the shock in the equity prices in Japan; however, all stock prices of the TOPIX, TSE Second Section stock index, TOPIX Large 70 stock index, and TOPIX Small stock index positively responded to the shock in the exchange rate rather strongly in our recent sample period. Thus, our results of impulse response analyses clearly suggested that, in the recent years, the past yen-dollar exchange rate evolution much more strongly affected Japanese stock prices. Moreover, (3) our analyses of the time-varying correlation coefficients between the yen-dollar exchange rate and Japanese stock index returns revealed that, recently, contemporaneous correlations between the exchange rate and stock returns in Japan much increased.

Although it is not sure whether these strong contemporaneous linkages between them continue long in the future; however, under these recent economic and financial circumstances, it is considered that, for example, the clear exit announcements and decisive actions related to the current US monetary policy shall further affect the yen-dollar exchange rate and Japanese stock prices simultaneously. Trends of the Chinese economy and financial markets may also strongly influence the Japanese financial markets. Thus when there are such events or shocks to the economy, the volatile financial markets in Japan shall be expected and in such cases, behaviors of foreign investors, which much increasingly affect the Japanese financial markets in the recent years, may also play further important role in determining the movements of the Japanese financial markets.

Furthermore, we note that the evidence derived from our empirical examinations in this paper is rather clear and hence further investigations by employing other methodology and incorporating other contexts, for instance, are our future tasks.

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