How Did Japanese Investments Influence International Art Prices?

Takato Hiraki[a]
Akitoshi Ito[b]
Darius Alexander Spieth[c]
Naoya Takezawa[d]

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a. School of Business Administration, Kwansei Gakuin University
b. Faculty of Administration, University of Regina
c. School of Art, Louisiana State University
d. Graduate School of International Management, International University of Japan

Correspondence to:
Takato Hiraki
Professor of Finance
School of Business Administration
Kwansei Gakuin University
Uegahara 1-1-155, Nishinomiya-shi
662-8501 Japan
Email: thiraki@kwansei.ac.jp Phone: (+81) 798-54-6973 Fax: (+81) 798-51-0903

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Key words: Art prices, VAR, Japan, real estates

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Abstract

This study examines dynamics among the art, Japanese land, Japanese and U.S. stock market prices during the sample period from 1976 to 1998. We find that the Japanese land prices caused both art and Japanese stock prices to co-move during the sample period. We interpret this finding as suggesting that the accelerated appreciation of land prices in Japan stimulated Japanese investor demands for both international arts and Japanese stocks, especially, in the late 1980s. We further show that the Japanese land index as well as own art index returns are dominant factors in generating fluctuations of returns in most art indexes. We also find that an influence of the Japanese land prices on art prices was preserved and even increased in the 1990s after the burst of bubbles. We interpret this as suggesting that in the 1990s the decreasing land prices in Japan urged some Japanese investors to sell their holdings of arts at a considerable bargain.

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How Did Japanese Investments Influence International Art Prices?

The late 1980s correspond to the so-called "bubble period" in Japan, which is characterized by rapidly increasing stock and land prices in the domestic markets. During the bubble period, it was recognized that massive Japanese investments went to the international art market, bidding up prices of paintings, especially, in the very expensive class. For example, by the end of 1990 all three of the world's most highly paid art paintings were bought by Japanese investors.[1] In addition, Japanese investments in paintings were often made by large Japanese corporations or wealthy individuals directly or indirectly backed by corporate assets. On March 30, 1987, Yasuda Fire & Marine Insurance Co. bought Vincent Van Gogh's *Sunflowers* (1989, III.1) for U.S. $39.4 millions at Christie's London, one of the largest auction houses in the world. This was the highest price paid up to that date for a single work in the art market. Another spectacular example of Japanese involvements in the international art market is the case of Ryoei Saito, then Honorary Chairman of Daishowa Paper Manufacturing Co., a family-controlled firm listed on the first-section of the Tokyo Stock Exchange: A total of $160 millions was spent on Van Gogh's *Portrait of Dr. Gachet* (1990, III.3) and Renoir's *Moulin de la Galette* (1876, III.4) during sales held on successive evenings at Sotheby's and Christie's New York in mid-May 1990.[2]

Given the accelerated Japanese investments in the international art market during the late 1980s, this paper investigates the dynamic relationship between the art prices and the prices of other asset classes including Japanese and U.S. stock market indices and Japanese lands. Past literature shows that investors with common characteristics tend to hold similar assets and may affect prices of those assets systematically. For example, past studies reveal that closed-end funds and small stocks tend to be held by small individual investors and that the discount on the closed-end funds is negatively correlated with the returns on small stocks (Lee, Shleifer and Thaler (1991)). Other studies (for example, Gompers and Metrik (2001) and Falkenstein (1996)) show that institutional investors prefer large capitalization stocks in their portfolios. Gompers and Metrik (2001) argue that dominance of institutional investors in the U.S. stock market in the 1980s and 1990s has contributed to disappearance of the small firm effect by

[1] This information is obtained from *The Top Ten of Everything, London* (1987) and Troster (1996).
[2] Saltzman (1998) discusses in detail the transactions that led up to Saito's purchase of he masterpiece paintings from the business side as well as the subsequent efforts to liquidate the painting at a steep discount as demonstrated in statistic terms in this paper.

bidding up the relative prices of large firm stocks against small firm stocks.[3] Thus, we conjecture that the Japanese investor group with its nationality being a common characteristic may have contributed to the formation of unique dynamics among art, Japanese stock, and Japanese land prices, especially in the late 1980s and the early 1990s. This has led to a main motivation of this study.

Several past studies (Goetzmann (1993), Pesando (1993), and Mei and Moses (2002)) attempt to construct the art price index by using the repeated-sales regression technique with the detailed data of art sales in major auction houses around the world. Those studies also examine the risk and return characteristics of the estimated art price index by making comparison with those of traditional asset classes such as common stocks and bonds. In this study, we examine the dynamic pricing relationships among arts and other major asset classes with a special focus on the influence of Japanese investments on international art prices. The long-run effect of Japanese investments on the international art prices would typically be conjectured to have high influences from traditional asset classes (stocks and bonds) considering the fact that wealth in the domestic market would be generated through these marketable assets. However, after the liberalization of the Japanese capital markets and real estate booms in the early 1980's, we argue that these environmental changes in investments may have systematically affected the pricing dynamics of the domestic and international assets. These new dynamics may have led to the 'bubble economy' domestically and to a new and accelerated linkage between domestic land and international art prices. This view is indeed supported subsequently. We provide evidence that there exits a structural breakpoint in 1981 using the Nikkei 225 stock index, SP500 index, Japanese land prices. The importance of the land price change significantly reduces when tested against a VAR system from 1951-2003. The very significant pricing dynamics involving the land prices during the 1976-1998 represents an internationally a unique phenomenon during the bubble formation and bubble bursts in Japan. For this, it is very important in this study to include the land price index in Japan as one of the major asset classes.[4] During the bubble period in the late 1980s, investments in lands were known as an accelerator of speculative investments in land-related assets, including country-club memberships, equities and arts by individual and corporate investors (popularly called *zai-tech* in Japanese). In short, investments in lands started a bubble cycle by further

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[3] Kang and Stulz (1998) and Dahlquist and Robertson (2001) provide evidence that foreign investors bias their portfolio holdings toward large capitalization stocks.

[4] Ziemba (1991) examines the bilateral relationship between land and stock prices in a Japanese domestic context. The study does not cover the period corresponding to bubble bursts in Japan.

stimulating speculative investments in other domestic and international asset classes.

Our findings are as follows. First, during the sample period from 1976 to 1998, an increase (decrease) in the Japanese land price rate of changes caused both international art and Japanese stock prices to increase (decrease). Interestingly, the Japanese land prices become a stationary series after differencing twice while both art and Japanese stock prices do after differencing once. We interpret this as suggesting that accelerated land price appreciation toward the peak of bubbles in Japan stimulated Japanese investor demand for international arts and Japanese stocks. We further show that the rates of changes in Japanese land index returns as well as own art index returns are dominant factors in generating fluctuations of returns in most art indices. We also find that a contemporaneous influence of the Japanese land price changes on art prices is preserved and even increased in the 1990s after the burst of bubbles. We interpret this finding as suggesting that in the 1990s the accelerated decrease in land prices urged some Japanese investors to sell their holdings of arts at a considerable bargain.

This paper is structured as follows. Section II explains the data and provides the basic statistics of variables. Section III shows the results from the VAR (vector auto-regression) analysis. Section IV shows that our 1976-1998 sample is unique in the long-run in that the influence of accelerated land prices is unusually strong. Section V concludes the paper.

I. Data and Basic Statistics

We use the return on Nikkei 225 Index as a proxy for the entire Japanese stock market. We also use the average land price in the six major cities in Japan compiled by the Japan Real Estate Institute. In our subsequent analysis we use its second-order differences, which are related to the first-order differences, i.e., the rates of return, of the prices of the other asset classes. A unit root problem is only eliminated after differencing twice for the land price variable. As for Nikkei 225 and Japanese land price, we report the results using yen-denominated returns because the U.S. dollar conversion of returns for these two indices does not change our main results and conclusion very much. As a U.S. stock market index, we use S&P 500.

As for the art prices, we use six different art price indices provided by Art Market

Research (AMR).[5] AMR collects the sales data for individual artists that are revealed at some 800 auctions-houses located all over the world. For each artist, the index is constructed roughly as the average prices of his or her paintings on a monthly basis, and after some seasonality adjustment, the index corresponding to a portfolio of particular artists is calculated. The base year of all indices is January 1975 at which the value of indices is set to 1000. Among the six art indices we use in this study, the first index is the Art 100 index, which represents the art market as a whole. The remaining 5 indices are a subset of the Art 100 Index and correspond to portfolios of artists grouped by national/geographical origin and/or time period or individual artist name. They include the French Impressionist index, Pierre-Auguste Renoir index, Edgar Degas index, Dutch Old Master index, and American Art 100 index. S&P 500 index and art index returns are all originally U.S. dollar-denominated.

Our sample period covers 1976-1998, and the frequency of the data is semi-annual. We use semi-annual data frequency because the Japanese land price index is only available on a semi-annual basis, which represents the highest frequency out of a few alternative sources available in Japan. As we reveal later, the Japanese land price plays a very important role in the analysis of dynamics among art, stock and land prices. All art index returns are calculated as a first-order difference of the log of the index price level. Table 1 shows basic statistics of returns for various indices. The art indices show relatively high volatility. The standard deviation of all art indices is higher than that of the S&P 500 index and approximately comparable to that of Nikkei 225. In spite of this higher volatility, all art indices, except for French Impressionist Index, cannot earn as high returns as the S&P 500 index. The average return on the land index is lowest and the land index's standard deviation is also lowest among the indices in this table. The Japanese land index and various art indices exhibit decaying, but relatively high autocorrelations.

Panel B of Table 1 shows correlations among indices. First, the S&P 500 index is only marginally correlated with various art indices. Although the American 100 index is most highly correlated with the S&P 500 index among the art indices, the correlation is still about 10 percent. Second, Nikkei 225 and the Japanese land index second-order differences exhibit high positive and negative correlations, respectively, with most of the art indices during the period from 1976 to 1998 (For Nikkei 225, the correlation

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[5] Please see http://www.artmarketresearch.com/amr_fr.html for details of the art indices provided by AMR.

with the Art 100 index is 0.313; and for the Japanese land index it is 0.158.) Third, the land index has much higher correlations with art indices than Nikkei 225. Figure 1 depicts movements of Nikkei 225, Japanese land index (in second-order differences) and Art 100 index returns. It seems that Nikkei 225 and Art 100 index move together with the Art 100 index slightly lagging Nikkei 225. The graph shows that all of the three indices experience a large negative return between 1990 and 1991.

II. VAR Analysis

In order to examine the dynamics among various indices, we apply the VAR (vector auto-regression) methodology to the data. The use of VAR has several merits. First, we can test whether a particular variable with various lags jointly affect another variable (i.e., Granger-causality test). If we could detect evidence that a particular variable Granger-causes other variables, such information would be of value in order to understand an economic linkage between indices. Second, by employing an impulse response analysis, we can examine how the system reacts to a random shock to a particular variable. This analysis will enhance our understanding of price dynamics among indices. Finally, the decomposition of forecast error variance provides useful information about the relative importance of variables in generating the fluctuations of each variable.

Specifically, for each art index we estimate the following VAR system:

$$y_t = A + \sum_{s=1}^{L} B_s y_{t-s} + u_t, \quad E(u_t u_t^{'}) = \Sigma, \qquad (1)$$

where y_t is a 4 x 1 vector of returns on Nikkei 225, land, S&P 500 index, and a chosen art index at time t, and A and Bs are 4 x 1 and 4 x 4 matrices of parameters. L is the lag length for the VAR system and u_t is a 4 x 1 vector of errors with the variance-covariance matrix of Σ. Using the AIC (Akaike Information Criterion), we determine the number of lags required for the VAR system. We find that for most of the art indices, the lag length of one is sufficient to describe linear dependencies. In each equation of the VAR system, Granger-causality tests are performed to see whether all coefficients of lagged returns of a particular variable are jointly equal to zero or not.

An impulse response analysis is performed by transforming the VAR system expressed by (1) to a moving average representation. That is,

$$y_t = \bar{y} + \sum_{s=0}^{\infty} C_s u_{t-s} \qquad (2)$$

where $\bar{y}$ is a mean vector of y_t and C_s are 4 x 4 matrices of coefficients. Since different elements of vector u_t are contemporaneously correlated, we cannot observe the distinct response patterns of the VAR system. However, the Choleski factorization achieves this. In other words, we use

$$y_t = \bar{y} + \sum_{s=0}^{\infty} C_s u_{t-s} = \bar{y} + \sum_{s=0}^{\infty} C_s F e_{t-s} = \bar{y} + \sum_{s=0}^{\infty} D_s e_{t-s} \qquad (3)$$

where $\sum = FF'$ and $u=Fe$ so that e_t has a covariance matrix which is equal to an identity matrix. Now the (i,j)th element of D_s represents the impulse response of the ith variable in s periods to a one-standard-deviation shock in the jth variable. In this paper, we graphically present impulse responses of each variable together with two standard error bands based on the Monte Carlo method. Finally, this orthogonalization of errors is used to calculate the forecast error variance of a particular variable which is explained by innovations in own and other variables. We report the percentage of forecast error variance for each variable up to 4 and 8 periods (2 and 4 years) ahead.

Table 2 shows the results of VAR analysis for the six different art indices introduced in the previous section. Panel A presents parameter estimates for each VAR system. Surprisingly, the Art 100 and other art index returns are influenced by lagged land index returns. One-period lagged land index returns are all positive and statistically significant at a conventional level. The results of Granger-causality tests in Panel B confirm this: F statistics associated with lagged land index returns are statistically significant at the 1 percent level for all art indices except for DUTCHOLD (Dutch Old Master index) and DEGA (Dega Index) the F statistic for DUTCHOLD is significant at the 5 percent level and that for DEGA is not significant at any conventional level. Notice that Nikkei returns are also influenced by lagged land index returns in a similar fashion: one-period lagged land index returns are all positive and statistically significant. The associated F statistics show that land index returns Granger-cause Nikkei returns.

We interpret this finding as indicating that the accelerated appreciation of land prices, measured in the second-order differences, in Japan stimulated Japanese investor demands for both international arts and Japanese stocks in our sample period. In other words, this finding indicates a (likely) positive wealth momentum effect consistent with the causal direction from Japanese land prices to Japanese stock and international art prices. It is understandable to find that accelerated land prices caused changes in other asset class prices because in Japan the lending practice between banks and corporate or individual borrowers are based on the value of land provided as a collateral. The credit system of the entire economy during the sample period of this study was built on the collateral value of lands. Goetzmann (1993) finds that the London stock market prices Granger-caused art prices over the period from 1900 to 1986, interpreting this as a manifestation of the wealth effect. Our finding suggests that depending on the sample period, the wealth effect transmitted from Japanese investors become important in determining art prices internationally.

Among the six art indices, only the DUTCHOLD (Dutch Old Master index) was significantly and positively influenced by lagged S&P 500 index returns as is indicated by the result of Granger-causality tests. We interpret this as the wealth effect transmitted from U.S. investors, which was also important in determining international art prices in our sample period.

Variance decomposition in panel C, Table 2 provides information about the relative importance of variables in explaining forecast error variance of each variable. The overall picture is as follows: First, for most of the estimated VAR systems, the land price index explains about 20 percent of the forecast error variance of Nikkei index returns while about 75 percent explained by Nikkei itself. S&P 500 and art indices little contribute to forecast error variance of Nikkei returns. This suggests a relative importance of the land index in fluctuations of Nikkei returns.

Second, for all art indices except for DEGA and DUTCHOLD (Dutch Old Master index), both own art and land indices dominantly explain forecast error variance. In the case of the Art 100 index, even 33 percent of forecast error variance is attributed to the land index. This result also confirms a relative importance of Japanese land prices in generating fluctuations of international art prices. While the Granger causality tests indicate that S&P 500 returns Granger-cause DUTCHOLD (Dutch Old Master Index), the results of variance decomposition suggest that for these two art indices, an influence of the S&P 500 index is not as large as that of the land index. Exceptional is DUTCHOLD (Dutch Old Master index). The S&P 500 index explains more than 20 percent of forecast error variance of DUTCHOLD and dominates the land index. It has been well known that paintings consisting of DUTCHOLD (Dutch Old Master index) were not in the center of interest among Japanese buyers in the 1980s and 1990s because they much strongly preferred, as also well known, the style of French Impressionist and Post-Impressionist paintings. Thus, the finding that the Dutch Old Mater Index behaves atypical in the statistical analysis compared with the other art indices shows further evidence for the influence of Japanese investors on the formation of prices in international art markets with their unique preference.

Figure 2 graphs impulse responses of each variable to one-standard-deviation shocks to own and other variables. Two standard error bands are also drawn in each graph. In a horizontal line, "1" corresponds to a contemporaneous response to the current shock.[6] A positive influence of the land index return on the Nikkei and art index return is confirmed again. That is, a positive shock to the land index leads to a significant increase of Nikkei returns in the next period. For all systems estimated, the lower band lies above zero at the one-period ahead response. After period 1, however, this effect decays to zero quickly. The current positive shock to the land index return also leads to a significant increase in the Art 100 index return at the next period because the lower band lies above zero at the one-period ahead response. After period 1, this effect decays to zero relatively quickly. FRIMPR (French Impressionist index), and AMER100 (American Art 100 index) also exhibit a response pattern similar to that of the Art 100 index. However, RENOIR (Renoir index), DEGAS (Degas index) and DUTCHOLD (Dutch Old Master index) indicate a different and complicated response pattern.

We have checked a sensitivity of the results to the alternative use of U.S. dollar returns for Nikkei and Japanese land indices. The results using dollar-converted returns do not yield qualitatively different conclusions. For an illustrative purpose, Table 3 shows the results of the VAR analysis for the Art 100 index with all returns denominated in terms of U.S. dollars. For this system, the AIC led to the lag of one. Table 3 indicates that one-period lagged land index returns still significantly positively affect future Nikkei and Art 100 index returns. The variance decomposition shows that the land index is still important in explaining forecast error variance of Nikkei and Art 100 returns,

[6] We tried various ordering of variables and obtained similar response patterns.

although the relative importance of the land index somewhat declines.[7]

We have also checked a sensitivity of our results to the use of alternative art index. Mei and Moses (2002) have developed their own art index by using the detailed sales data at major auction houses and applying the repeated-sales regression technique. Therefore, we use their index (the MEI-MOSES index hereafter) in this sensitivity experiment.[8] Unfortunately, the frequency of the MEI-MOSES index is annual as opposed to the semi-annual data used in this study. Thus, the semi-annual return for the MEI-MOSES index was obtained by first interpolating the raw index data using a cubic spline method and then taking the log returns of the interpolated data. This provided us with a semi-annual frequency data series of the MEI-MOSES index on which the VAR analysis was conducted. We find that the VAR results using the MEI-MOSES index do not significantly differ from the results of the other art indices as indicated in the Appendix B of this paper. In other words, the lagged land index returns exhibit a significant influence on the MEI-MOSES and Nikkei index returns. The impulse response analysis (not reported) also produces similar results to those of the other art indices from AMR.

III. Long-run and Short-run Structural Breaks

Goetzmann and Spiegel have been preparing the long-run art index and provided us their annual series, Goetzmann-Spiegel Art Index, from 1951 to 2003.[9] The missing observations in earlier years are linearly interpolated in their series, but this is only the long-run art index data available for more than five decades. Using annual Nikkei 225, SP500, Japanese land prices and Goetzmann-Spiegel index series, we conducted again the analysis of the VAR whose results are shown in Table 4. Notice that the second-order difference is taken for the land prices while only the first-order difference for the rest of the price variables in the VAR. While the art index is marginally but significantly affected by the Nikkei, it is not significantly influenced by the art index in the long-run. This long-run results show strong contrast with the previously document results in Table 2 for the shorter sample covering early 80's and early 90's, i.e. the bubble formation and bubble burst periods.

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[7] When the lag order of the VAR is one, Granger causality tests are equivalent to t tests of single coefficients.

[8] We thank Jianping Mei and Michael Moses for their suggestion to use their art index.

[9] We thank William Goetzmann and Matthew Spiegel providing us this important data.

We next ran the Chow test on Nikkei 225, Japanese land index (in second order differences), SP500 and Goetzmann-Spiegel Art index returns over the 1951-2003 period. To save space we only qualitatively report the result. Testing for the breakpoint of 1981 has a F-statistic of 2.104 which implies a p-value of 0.0987. Though marginal, the result is significant at the ten percent level. So, there exists a structural breakpoint in 1981. Our sample using quarterly data series approximately corresponds to the second sub-period identified through the Chow test of long-run breakpoints. All an all, the unique and interesting result documented earlier (in Table 2) captures the phenomenon uniquely associated with asset bubbles in Japan. The land plays an important role in determining fluctuations in the international asset prices only in this unique period.

Lastly we also examined how contemporaneous correlation structure among Nikkei land index (in second-order differences), S&P500 and art index returns changes over time, especially, before and after the burst of bubbles in Japan. To save space, we only qualitatively report the results. As we expected, the Nikkei returns have relatively high positive correlations with art indices in the first sub-period of 1976-1989, reflecting massive Japanese investments in international arts in the 1980s. In the second sub-period, however, Nikkei's correlations with most art indices become weak and the absolute size of the correlations is much smaller than in the first sub-period. Surprisingly the Japanese land price returns are *more positively* correlated with all art indices in the second sub-period (i.e., during the 1990s) than in the first sub-period. Given the fact that land prices in Japan almost completely reversed at the end of the first sub-period and its declines were much accelerated in the early 1990s, this result is extremely interesting. We interpret this result as evidence that after the bubble burst, the accelerated declines in land prices urged some of Japanese investors to sell their holdings of arts in international markets at a considerable bargain.

IV. Conclusions

In this study, we examine dynamics among art, Japanese stock market, Japanese land, and U.S. stock market returns. The general observation that massive Japanese investments went to the international art market in the late 1980s has motivated this study. In other words, we make the flow-driven conjecture that Japanese investors with its nationality being a common characteristic may have contributed to the formation of unique price dynamics among international arts, Japanese and U.S. stock, and Japanese land, especially, in the late 1980s.

The results of the VAR analysis indicate that during the sample period from 1976 to 1998, an increase (decrease) of the Japanese land prices caused an increase (decrease) of both art and Japanese stock prices. We interpret this finding as suggesting that the accelerated appreciation of land prices in Japan stimulated Japanese investor demands for both international arts and Japanese stocks in our sample period, especially, in the late 1980s. Such a "wealth effect" is understandable because during our sample period the Japanese lending practice between banks and borrowers is based on the collateral value of the land which had never declined until the point of bubble burst. We also show that the Japanese land index as well as own art index returns are dominant factors in generating fluctuations of most art index returns. In addition, the finding that the Dutch Old Mater Index behaves atypical in the statistical analysis compared with the other art indices is interpreted as further convincing evidence for the influence of Japanese investors on international art prices with their unique preference.

Appendix A Mei-Moses semiannual VAR estimates

Panel A: Parameter Estimates of the VAR System

	MEI-MOSES							
	NIKKEI(Yen)		LAND(Yen)		SP500($)		ART INDEX	
NIKKEI(-1)	-0.084		0.013		-0.200		0.176	
LAND(-1)	2.000	**	0.053		0.932		0.389	
SP500(-1)	-0.160		0.005		0.043		-0.099	
ART INDEX(-1)	0.175		0.037		0.100		0.544	**
C	0.027		-0.004		0.051	**	0.027	
Adj. R^2	0.155		-0.067		0.041		0.412	

Panel B: Granger Causality Tests (F-statistics)

NIKKEI			0.468		1.400		0.264	
LAND	10.463	**			3.065		26.796	**
SP500	0.619		0.038				0.112	
ART INDEX	1.093		1.097		0.530			

Panel C: Variance decomposition by variable of N-period ahead forecasts

	# of Periods				
NIKKEI	4	77.80	19.14	1.32	1.74
	8	0.00	0.00	0.00	0.00
LAND	4	2.87	95.67	0.07	1.39
	8	0.00	0.00	0.00	0.00
SP500	4	6.17	8.82	84.17	0.85
	8	0.00	0.00	0.00	0.00
ART INDEX	4	21.76	3.98	2.83	71.42
	8	0.00	0.00	0.00	0.00

NIKKEI = Nikkei 225; LAND = Japanese land index(2nd Diff.)
SP500 = S&P 500; MEI-MOSES = Mei and Moses Art index

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Table 1. Basic statistics of semi-annual returns on various indices: 1976 - 1998

Panel A: Descriptive Statistics

	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART100($)	FRIMPR($)	RENOIR($)	DEGAS($)	DUTCHOLD($)	AMER100($)
Obs	46	45	46	46	46	46	46	46	46
Mean	0.0229	-0.0013	0.0502	0.0385	0.0516	0.0409	0.0358	0.0334	0.0360
Std. Dev.	0.1337	0.0301	0.0957	0.1324	0.1881	0.1233	0.1580	0.1336	0.1237
Skewness	-1.2263	-1.5802	0.0583	-0.3390	-0.2519	0.5106	0.6378	-0.2605	-0.1218
Kurtosis	5.6945	6.0036	3.0907	4.2789	5.0023	2.6951	3.4155	4.2483	4.4031
Jarque-Bera	25.445	35.644	0.042	4.016	8.171	2.177	3.449	3.507	3.887
Prob.for J-B stat	0.000	0.000	0.979	0.134	0.017	0.337	0.178	0.173	0.143
Auto-correlation									
AC(1)	-0.004	0.084	0.028	0.571	0.511	0.572	0.361	0.232	0.517
AC(2)	0.148	0.169	-0.237	0.261	0.051	0.406	-0.017	-0.154	0.193
AC(3)	0.102	0.004	-0.047	0.082	-0.084	0.259	-0.184	0.016	0.054
AC(4)	0.219	-0.267	0.075	-0.004	-0.119	0.044	-0.140	-0.010	-0.018
Q(4)	4.158	5.414	3.262	19.793	14.052	27.864	9.170	3.850	15.142
Prob. for Q(4)	0.385	0.247	0.515	0.001	0.007	0.000	0.057	0.427	0.004

Panel B: Correlations

	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART100($)	FRIMPR($)	RENOIR($)	DEGAS($)	DUTCHOLD($)	AMER100($)
NIKKEI(Yen)	1.000								
LAND(Yen)	0.158	1.000							
SP500($)	0.283	0.028	1.000						
ART100($)	0.313	-0.136	0.075	1.000					
FRIMPR($)	0.359	-0.026	0.037	0.907	1.000				
RENOIR($)	0.049	-0.453	0.018	0.689	0.561	1.000			
DEGAS($)	0.225	-0.377	-0.020	0.578	0.535	0.532	1.000		
DUTCHOLD($)	0.140	-0.302	-0.084	0.544	0.418	0.391	0.291	1.000	
AMER100($)	0.311	-0.138	0.102	0.867	0.755	0.563	0.556	0.385	1.000

NIKKEI = Nikkei 225; LAND = Japanese land index(2nd Diff.); SP500 = S6P 500; ART100 = Art 100 index; FRIMPR = French Impressionist index; RENOIR = Pierre-Auguste Renoir index; DEGAS = Edgar Degas index; DUTCHOLD = Dutch Old Master index; AMERI100 = American Art 100

Table 2. VAR statistics

Panel A: Parameter Estimates of the VAR System

	ART100				FRIMPR				RENOIR			
	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($)	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($)	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($
NIKKEI(-1)	-0.138	0.043	-0.166	-0.043	-0.135	0.042	-0.176	-0.104	-0.068	0.034	-0.168	0.253 *
LAND(-1)	2.302 **	0.019	0.951	2.224 **	2.153 **	0.047	0.968	2.889 **	2.642 **	-0.099	0.918	1.668 **
SP500(-1)	-0.174	0.001	0.035	0.033	-0.151	-0.003	0.036	0.127	-0.173	0.001	0.035	-0.151
ART INDEX(-1)	0.287	-0.052	-0.013	0.620 **	0.180	-0.032	0.009	0.542 **	0.302	-0.084 *	-0.023	0.749 **
C	0.027	0.000	0.057 **	0.024	0.028	0.000	0.056 **	0.029	0.025	0.001	0.057 **	0.014
Adj. R^2	0.211	-0.033	0.030	0.549	0.198	-0.044	0.030	0.424	0.203	0.021	0.031	0.524

Panel B: Granger Causality Tests (F-statistics)

	ART100				FRIMPR				RENOIR			
NIKKEI		0.468	1.400	0.264		0.468	1.400	0.050		0.468	1.400	7.192 *
LAND	10.463 **		3.065	26.796 **	10.463 **		3.065	15.986 **	10.463 **		3.065	13.844 **
SP500	0.619	0.038		0.112	0.619	0.038		0.259	0.619	0.038		0.057
ART INDEX	1.093	1.097	0.530		1.742	0.775	0.205		0.003	3.816	1.308	

Panel C: Variance decomposition by variable of N-period ahead forecasts (%)

	# of Periods	ART100				FRIMPR				RENOIR			
NIKKEI	4	73.34	22.22	1.51	2.93	73.94	21.31	1.58	3.17	74.71	22.07	0.74	2.48
	8	73.33	22.23	1.51	2.92	73.94	21.31	1.58	3.17	74.70	22.07	0.75	2.48
LAND	4	7.68	89.87	0.07	2.38	6.51	91.07	0.07	2.34	9.44	84.77	0.16	5.63
	8	7.70	89.84	0.07	2.39	6.52	91.06	0.07	2.34	9.78	84.06	0.20	5.96
SP500	4	5.66	8.91	84.58	0.85	5.56	8.94	84.83	0.68	5.74	8.42	84.55	1.29
	8	5.66	9.06	84.40	0.89	5.56	9.01	84.75	0.69	5.84	8.66	84.01	1.49
ATR INDEX	4	3.28	33.96	0.11	62.66	2.60	27.52	1.04	68.83	14.64	19.71	2.08	63.57
	8	3.44	34.30	0.11	62.15	2.66	27.65	1.04	68.65	15.87	20.89	2.17	61.07

NIKKEI = Nikkei 225; LAND = Japanese ladn index; SP500 = S6P 500; ART100 = Art 100 index; FRIMPR = French Impressionist index; RENOIR = Pierre-Auguste Renoir index; DEGAS = Edgar Degas index; DUTCHOLD = Dutch Old Master index; AMERI100 = American Art 100

Table 2 (Cont'd)

Panel A: Parameter Estimates of the VAR System

	DEGAS				DUTCHOLD				AMER100			
	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($)	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($)	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX($
NIKKEI(-1)	-0.030	0.043	-0.194	0.220	-0.056	0.024	-0.117	-0.080	-0.096	0.043	-0.153	-0.034
LAND(-1)	2.031 **	-0.041	1.097 *	1.076	2.189 **	0.068	0.631	1.466 *	2.206 **	0.018	0.918	1.938 **
SP500(-1)	-0.177	-0.006	0.044	-0.116	-0.160	0.002	-0.002	0.573 **	-0.182	0.004	0.037	-0.100
ART INDEX(-1)	-0.010	-0.047	0.060	0.343 *	0.089	0.002	-0.217	0.383 *	0.188	-0.057	-0.055	0.549 **
C	0.036	0.000	0.054 **	0.036	0.033	-0.002	0.063 **	-0.006	0.031	0.000	0.058 **	0.034 *
Adj. R^2	0.137	-0.033	0.038	0.122	0.144	-0.083	0.117	0.223	0.165	-0.031	0.035	0.458

Panel B: Granger Causality Tests (F-statistics)

NIKKEI		0.468	1.400	0.264		0.468	1.400	0.050		0.468	1.400	7.192
LAND	10.463 **		3.065	26.796	10.463 **		3.065	15.986 *	10.463 **		3.065	13.844 **
SP500	0.619	0.038		0.112	0.619	0.038		0.259 **	0.619	0.038		0.057
ART INDEX	1.093	1.097	0.530		1.742	0.775	0.205 **		0.003	3.816	1.308	

Panel C: Variance decomposition by variable of N-period ahead forecasts (%)

	# of Periods												
NIKKEI	4	78.81	19.04	1.31	0.84	77.88	20.14	1.23	0.74	76.85	20.53	1.41	1.21
	8	78.77	19.07	1.31	0.85	77.87	20.14	1.24	0.75	76.85	20.53	1.41	1.21
LAND	4	3.62	93.00	0.02	3.36	3.22	96.75	0.01	0.02	6.03	91.21	0.02	2.73
	8	3.64	92.98	0.02	3.35	3.22	96.75	0.01	0.02	6.05	91.18	0.02	2.74
SP500	4	6.19	9.17	84.06	0.57	6.16	10.63	76.90	6.31	5.71	8.94	84.23	1.12
	8	6.20	9.19	84.04	0.57	6.15	10.67	76.86	6.32	5.72	9.04	84.10	1.14
ATR INDEX	4	14.92	20.09	2.36	62.63	1.30	19.17	13.66	65.88	4.08	27.48	0.82	67.62
	8	14.92	20.10	2.36	62.62	1.30	19.16	13.68	65.86	4.18	27.62	0.83	67.37

NIKKEI = Nikkei 225; LAND = Japanese land index; SP500 = S6P 500; ART100 = Art 100 index; FRIMPR = French Impressionist index; RENOIR = Pierre-Auguste Renoir index; DEGAS = Edgar Degas index; DUTCHOLD = Dutch Old Master index; AMERI100 = American Art 100

Table 3. VAR statistics using U.S. dollar returns

Panel A: Parameter Estimates of the VAR System		ART100			
		NIKKEI	LAND	SP500	ART INDEX
NIKKEI(-1)		-0.405	-0.150	-0.177	-0.215
LAND(-1)		0.783 *	0.464	0.203	0.543 *
SP500(-1)		0.024	0.069	0.067	0.166
ART INDEX(-1)		0.017	0.158	-0.092	0.477 **
C		0.034	0.017	0.052 **	0.006
Adj. R^2		0.032	0.076	-0.040	0.390
Panel B: Variance decomposition by variable of N-period ahead forecasts (%)					
NIKKEI	4	88.29	49.81	3.14	3.45
	8	88.09	49.46	3.14	3.71
LAND	4	11.01	46.22	9.02	14.65
	8	11.07	46.15	9.05	15.48
SP500	4	0.16	0.88	86.89	5.60
	8	0.19	0.97	86.84	5.79
ATR INDEX	4	0.54	3.09	0.95	76.31
	8	0.65	3.42	0.97	75.02

Table 4. Long-run VAR Analysis

VAR statistics

Panel A : Parameter Estimates of the VAR System

	NIKKEI(Yen)	LAND(Yen)	SP500($)	Goetzamnn-Spiegel ART INDEX
NIKKEI(-1)	0.133	0.005	0.101	0.287 *
LAND(-1)	0.000	0.026	-1.132 *	-0.486
SP500(-1)	0.372	0.107 *	-0.047	0.043
ART INDEX(-1)	0.347	0.067	0.087	-0.114
C	0.004	-0.018	0.057	0.048
Adj. R^2	0.096	0.095	0.017	0.014

Panel B: Granger Causality Tests (F-statistics)

	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX
NIKKEI		0.072	0.003	2.108
LAND	0.240		3.697	0.043
SP500	4.631 *	5.876 *		0.132
ART INDEX	2.981	2.551	0.269	

Panel C: Variance decomposition by variable of N-period ahead forecasts

	# of Periods	NIKKEI(Yen)	LAND(Yen)	SP500($)	ART INDEX
NIKKEI	4	85.32	2.39	6.17	6.12
	8	0.00	0.00	0.00	0.00
LAND	4	13.09	73.71	9.22	3.98
	8	0.00	0.00	0.00	0.00
SP500	4	3.01	10.32	85.71	0.96
	8	0.00	0.00	0.00	0.00
ART INDEX	4	9.03	9.55	0.41	81.01
	8	0.00	0.00	0.00	0.00

NIKKEI = Nikkei 225; LAND = Japanese land index (2nd order diff.)
SP500 = S&P 500; Goetzamnn-Spiegel = Goetzamnn-Spiegel Art index

Figure 1. Returns on Nikkei 225, Japanese land index, and Art 100 index

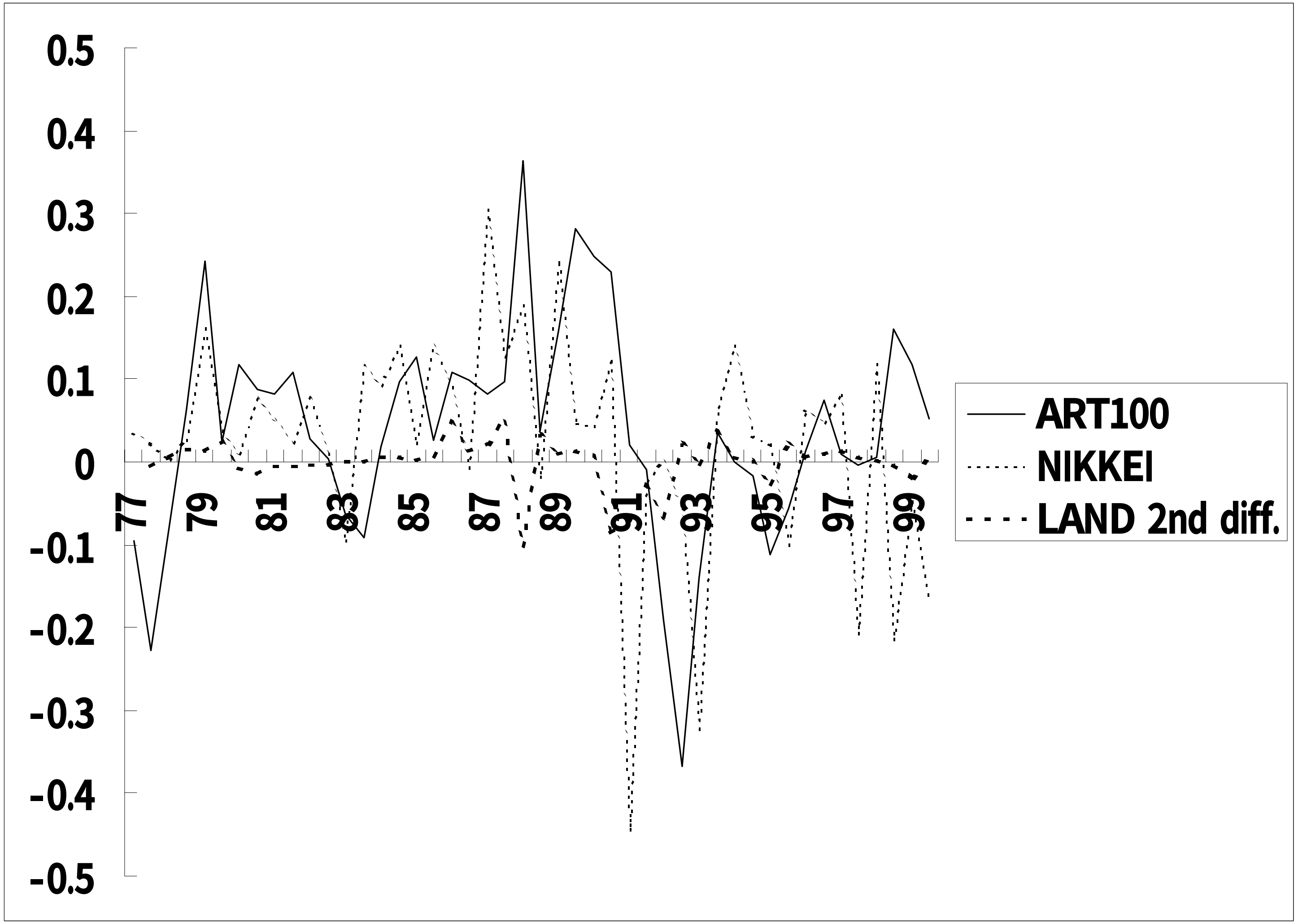
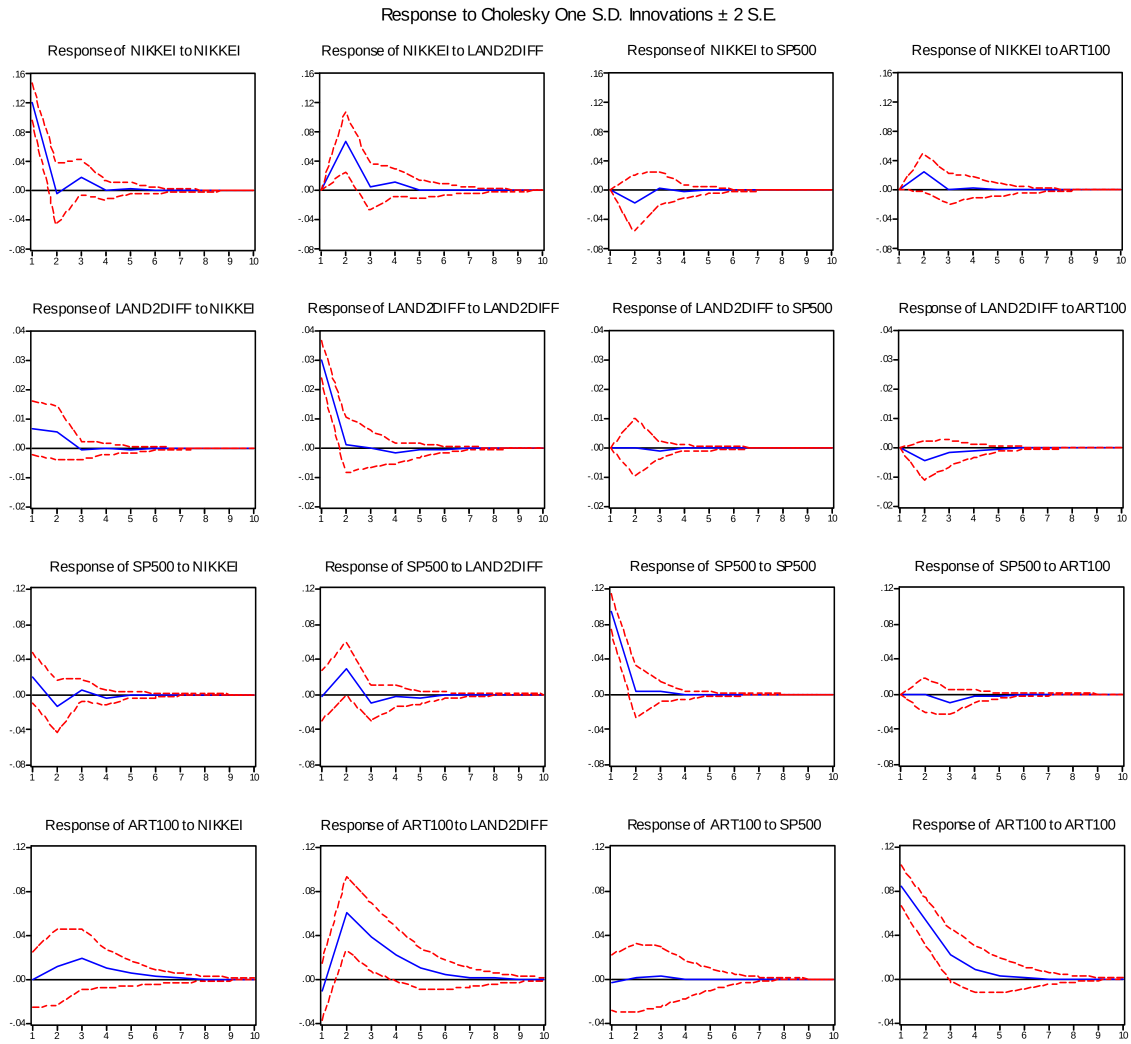


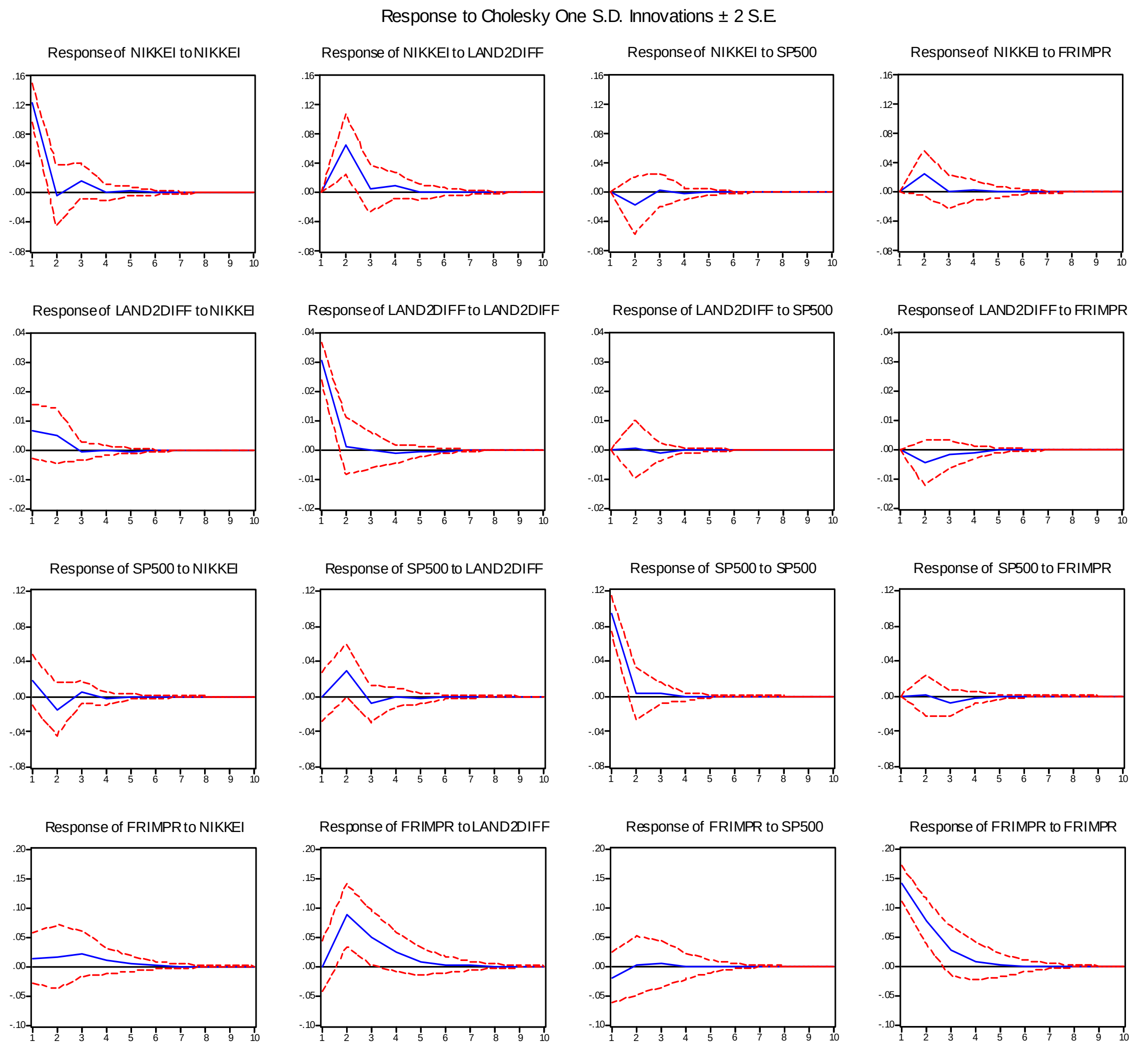
Figure 2.

VAR impulse response analysis of Nikkei 225, Land index, S&P 500 index and art index returns

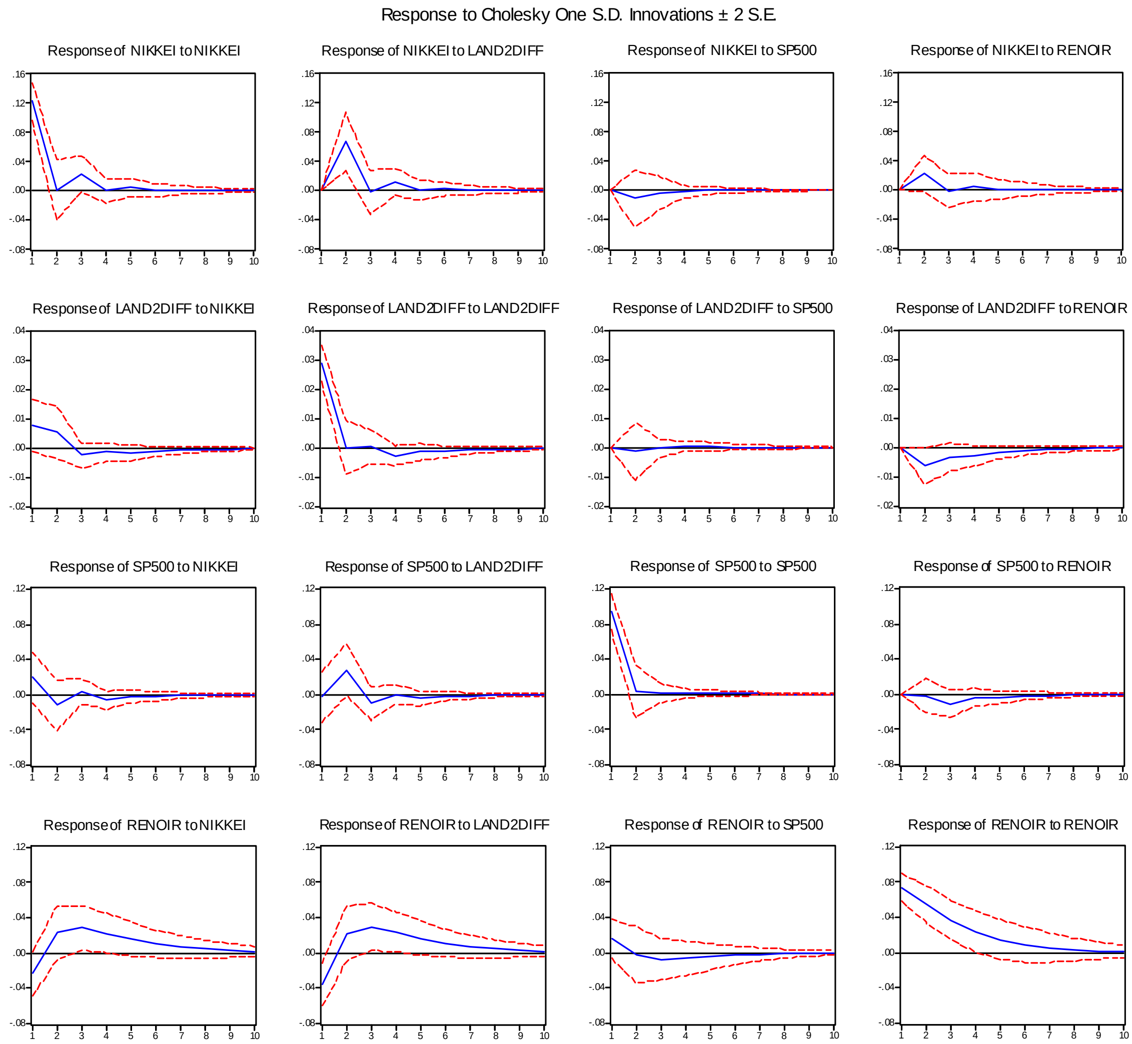
(a) System including the Art 100 index



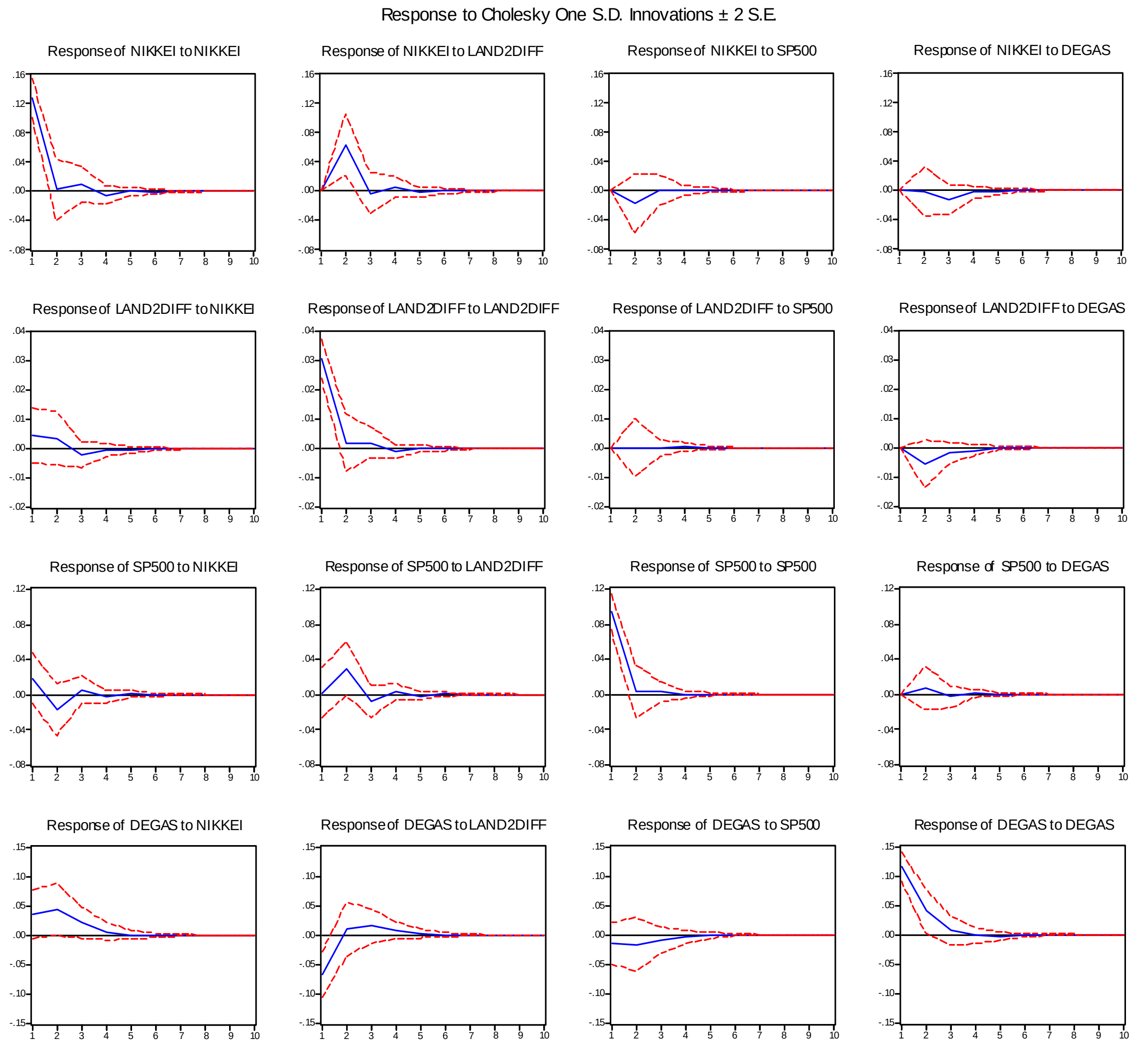
(b) System including the French Impressionist index (FRIMPR)



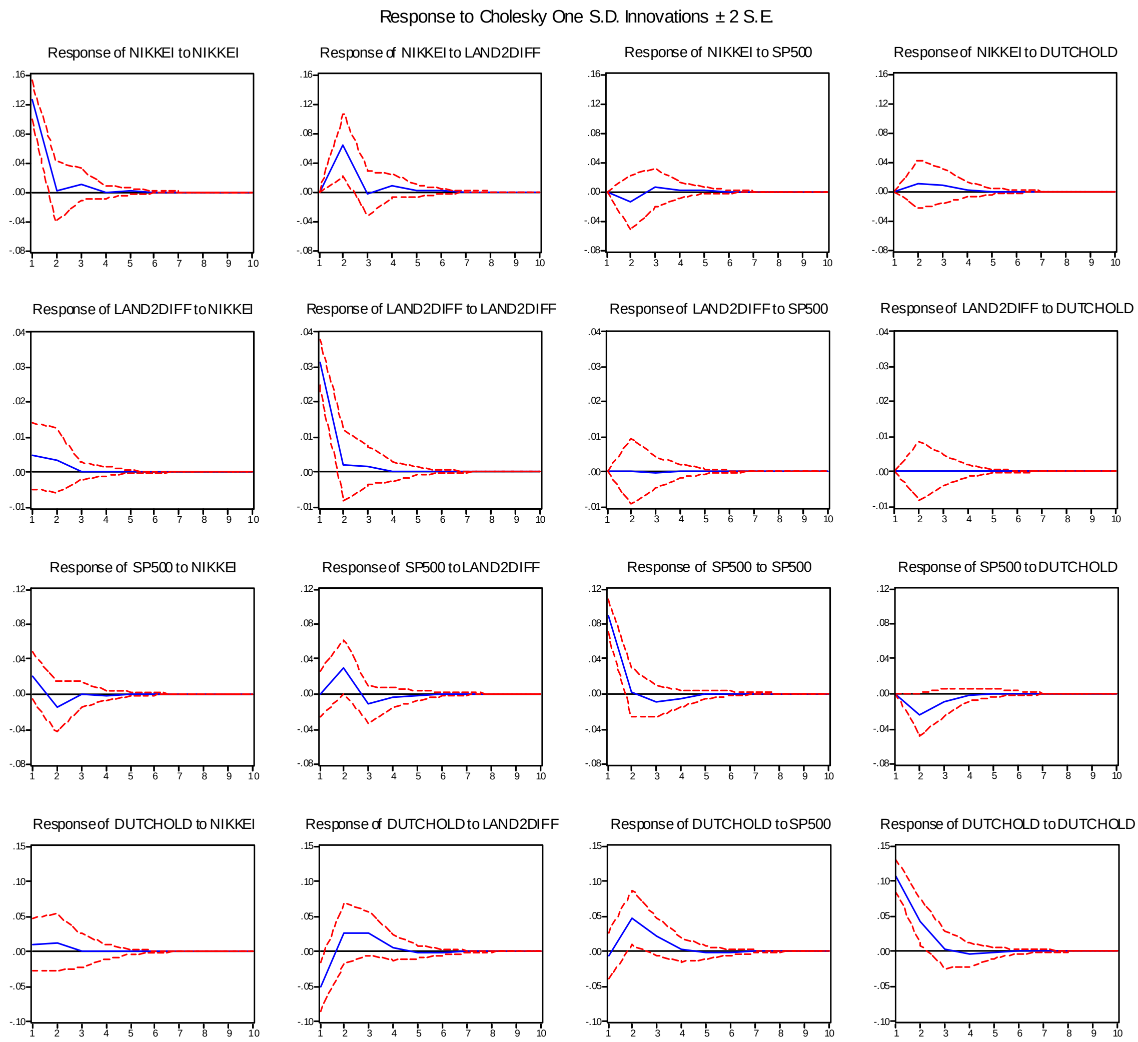
(c) System including the Pierre-Auguste Renoir index (RENOIR)



(d) System including the Edgar Degas index (DEGAS)



(e) System including the Dutch Old Master index (DUTCHOLD)



(f) System including the American Art 100 index (AMER100)