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Changes in the Intertemporal Relation Between the U.S. and Japanese Stock Markets

Rustin Paul Diehl
Utah State University

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by

Rustin Paul Diehl

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Approved:

Thesis/Project Advisor	**Department Honors Advisor**
Tyler J Bowles	***L. Dwight Israelsen***

Director of Honors Program

David Lancy

UTAH STATE UNIVERSITY
Logan, UT

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Abstract

This paper finds a decreasing relationship between daytime trading in previous-day US equity markets and the Japanese market performance in the current period. On the other hand, the connection has increased between current US equity markets and current, after-hour Japanese markets. These changes have corrected a previous violation of the efficient market hypothesis, and suggest that as internet trading has increased volumes of off-hour trading, the Japanese equity markets have been better able to digest information from current US markets.

I. Introduction and Literature Review

The Tokyo Stock Exchange (TSE) and New York Stock Exchange (NYSE) represent two of the largest exchanges in the world. As seen in figure 1, Tokyo is 14 hours ahead of New York, so there is no overlap between the two markets. Previous studies of the relationship between the two markets (Becker, Finnerty, and Gupta (1990)) found a significant relationship between US market open to close prices and next day Japanese market open to close prices. Conversely, it was found that Japanese markets have little impact on U.S. markets.

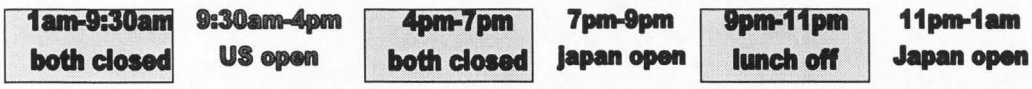
A relationship between the respective open to close prices represents a violation of the efficient market hypothesis. In theory, Japanese markets should have digested information from about the US markets and opened at an adjusted price to reflect occurrences in U.S. markets. After the Japanese markets opened, they should have followed a random walk with little connection to what happened in U.S. markets.

In their 1990 study, Becker, Finnerty, and Gupta conducted trading simulations, but found that excess profits from trading disappeared due to high transaction costs. Recent years have seen a burgeoning number of online discount brokerages, lowering trading fees. In spite of lowering transaction costs, this paper finds that, due to strengthening transmission of after-hour information between the markets in recent years, trading remains unprofitable.

One possible explanation is that the very forces which lowered transaction costs (i.e. the internet) have also caused an increase in after-hour trading. Currently, 3-5% of daily volume for large issue stocks is carried out during off-hour trading. This after-hour market now serves as an

information transfer mechanism, and the constant flow of information has bridged the previous time lag between the markets, thus deteriorating the potential to profit from the previous violations of the efficient market hypothesis.

Figure 1: Market Open Times U.S. Eastern Standard Time



II. Data and Methodology

Data was obtained for opens and closes from the S&P 500 and the Nikkei indexes (both price weighted indexes) from October 11, 1984 to February 28, 2005. This period covers diverse economic conditions, so it provides for a meaningful basis for trading analysis. To amend date differences between the US and Japanese stock exchanges, data entries were deleted when one or the other market was closed.

Regressions are estimated to determine the changing nature of the two markets over time. To model three discreet time periods, two interaction dummy variables are used: S&P (D1:1995-00) and S&P (D2:2000-Present).

To model the results of trading, a simulated "Trigger" trading system was developed using Excel. The system functions so that when the S&P increased by at least .5%, money was traded into the Nikkei, where it remained until the S&P stopped increasing by at least .5% per day.*

III. Empirical Results

Tables I, II, and III demonstrate the changing relationship between the U.S. and Japanese markets. The Table I regression indicates a recent decrease in the relationship between U.S. open to closes and next day Japanese market open and Closes. Table II data indicates an increasing relationship between daytime U.S. trading and the simultaneous after-hour Japanese Markets. Table II indicates that U.S. after-hour trading does affect Japanese daytime trading, but not to the extent that our markets affect Japan at other times.

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* Data and "triggers" were corrected to account for days when one market remained open and the other market closed. When the S&P was closed, but the Nikkei open, the monies remained in the market they had been in previous to the close.

Table I
Regression Results (Common Currency)

OLS is estimated for daily currency returns from Sept. 2, 1986 to Feb. 25, 2005. This regression tests for the relationship between the Japanese open to close and the U.S. Market performance. Through use of interaction dummy variables, the results express the relation during various time periods.

$$Nikkei = \alpha j + \beta j(S\&P\ (95\text{-}00)) + \beta j(S\&P\ (00\text{-}Pres.)) + \varepsilon j$$

Intercept	-0.000366 (-1.857)
S&P(95-00)	0.2783 (7.1668)*
S&P(00-Pres.)	0.1217 (3.7922)*
F-Value	32.8735
R-Square	0.01468

All t-values are in parentheses.
*Significant at a 5% level.

Table II
Regression Results (Common Currency)

OLS is estimated for daily currency returns from Sept. 2, 1986 to Feb. 25, 2005. This regression tests for the relationship between the previous date, night-time Japanese trading and the U.S. Market performance. Because of time differences, these occur simultaneously. Through use of interaction dummy variables, the results express the relation during various time periods.

$$Nikkei\ Previous\ P.M. = \alpha j + \beta j(S\&P\ (95\text{-}00)) + \beta j(S\&P\ (00\text{-}Pres.)) + \varepsilon j$$

Intercept	0.0002582 (4.15963)*
S&P(95-00)	0.1629 (13.325)*
S&P(00-Pres.)	0.3382 (33.46048)*
F-Value	648.6100
R-Square	0.2272

All t-values are in parentheses.
*Significant at a 5% level.

Table III
Regression Results (Common Currency)

OLS is estimated for daily currency returns from Sept. 2, 1986 to Feb. 25, 2005. This regression tests for the relationship between the Japanese open to close and the U.S. Market after-hour performance, which are happening simultaneously. Through use of interaction dummy variables, the results express the relation during various time periods.

$$Nikkei = \alpha j + \beta j(S\&P\ Current\ P.M.\ (95\text{-}00)) + \beta j(S\&P\ Current\ P.M.\ (00\text{-}Pres.)) + \varepsilon j$$

Intercept	-0.00032597 (-1.6529)
S&P Current P.M.(95-00)	0.6996 (4.6886)*
S&P Current P.M. (00-Pres.)	0.4664 (5.9454)*
F-Value	28.6707
R-Square	0.01283

All t-values are in parentheses.
*Significant at a 5% level.

Tables IV and V analyze the results of the above mentioned "Trigger" trading system. Table IV briefly reviews the predicative power of the "Trigger" trading system. Table V shows growth from 1984-Present using three different strategies: leaving money in the S&P 500, leaving money in the Nikkei, and trading into the Nikkei when the S&P increases by at least .5% utilizing the "Trigger" technique. As seen, the "Trigger" technique outperforms other methods and until 2001, positive returns were realized using the trigger system. Following that, and beginning as early as 2000, returns using the "Trigger" technique diminished.

Table IV
Performance of "Trigger" Trading Simulation
In the trading simulation, trades are made into the Nikkei index when the S&P increased by .5% or more.

Correct Prediction Negative Days	76.64%
Correct Prediction Positive Days	31.06%

Table V
Comparison of Money Growth between S&P 500 Index and Nikkei Trading Simulation
In the trading simulation, trades are made into the Nikkei index when the S&P increased by .5% or more. Transaction costs are estimated to average approximately $15.00 per round trip.

S&P Return	S&P Return	Nikkei Return	Nikkei Return	"Trigger" Technique	"Trigger" Technique
1985	27.76%	1985	13.34%	1985	19.55%
1986	15.54%	1986	43.86%	1986	21.98%
1987	0.26%	1987	14.57%	1987	41.98%
1988	8.51%	1988	42.15%	1988	31.88%
1989	28.36%	1989	29.04%	1989	9.01%
1990	**-8.19%**	1990	**-38.72%**	1990	14.66%
1991	27.77%	1991	**-3.63%**	1991	34.98%
1992	4.42%	1992	**-26.36%**	1992	1.21%
1993	7.14%	1993	2.49%	1993	3.63%
1994	**-1.33%**	1994	13.24%	1994	6.58%
1995	34.16%	1995	0.74%	1995	10.60%
1996	19.33%	1996	**-2.55%**	1996	1.05%
1997	31.67%	1997	**-21.19%**	1997	17.90%
1998	26.07%	1998	**-9.29%**	1998	8.09%
1999	19.64%	1999	41.13%	1999	31.22%
2000	0.06%	2000	0.00%	2000	0.07%
2001	**-10.53%**	2001	**-23.52%**	2001	**-4.88%**
2002	**-23.80%**	2002	**-18.63%**	2002	**-4.61%**
2003	22.32%	2003	24.45%	2003	5.32%
2004	9.33%	2004	7.61%	2004	**-5.80%**
2005	0.13%	2005	2.19%	2005	0.68%
TOTAL	**639.40%**	**TOTAL**	**9.76%**	**TOTAL**	**931.77%**

IV. Conclusion

Since 2000, the connection has been weakened between U.S. market open to close prices and next-day Japanese open to close prices. In contrast, the relationship between daytime U.S. markets and Japanese after-hour markets has strengthened.

Previous to 2000, it appears that Japanese markets were unable to properly "digest" occurrences in U.S. markets, leading to a violation in the efficient market hypothesis. During most of these years, trading costs remained too high to allow an average individual investor to exploit this relationship (Becker, Finnerty, and Gupta.)

In the mid to late 90's, however, transaction costs began to lower in both U.S. and Japanese markets. This was due largely to the implementation of electronic networks and an increase of online discount brokerages. In addition to making transaction costs cheaper, the newly acquired technology increased volumes of after-hour trading. As evidenced in table V, this eventually led to an erosion of individual investors' ability to profit from the Japanese market's lagging "digestion" of U.S. information.

References

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