

# **INTERNATIONAL EQUITY FLOWS AND MARKET RETURNS: A CASE STUDY OF JAPANESE MARKET**

by

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**Title of Project:** International Equity Flows and Market Returns: A Case Study of Japanese Market

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## **ABSTRACT**

This paper studies the relation between international equity flows and market returns in Japanese market. It highlights an increasing role of foreign investors in Japanese stock market, and its implications are discussed. This study also confirms the contemporaneous relation between international equity flows and market returns, and the herding effect in Japanese market. Using annual volatility, the study finds no significant relation between the volatility of equity flows and the volatility of market returns.

**Keywords:** Equity flows, Japan, contemporaneous relation, positive feedback trading, herding

To my lovely wife, Yuan Yuan, and my parents

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## **GLOSSARY**

<b>Nikkei 225 Index</b>	A major index for Japanese stock market
<b>Volatility</b>	Standard deviation
<b>MSCI</b>	Morgan Stanley Capital International, a major supplier of indices for international markets
<b>TIC</b>	Treasury International Capital reporting system of the US Department of Treasuries
<b>GLS</b>	Generalized Lest Squares
<b>OLS</b>	Ordinary Linear Squares

# 1 INTRODUCTION

In 2005, Japanese market is one of the best markets in the world. Nikkei 225 Index gained 37% in 2005. In the same time, during the first 9 months of 2005, the net equity flows from the US to Japan reached a record high US\$ 22.8 trillion. The Wall Street Journal reported that some large investment houses have boosted their allocation to Japan. While money is flooding into Japanese stock market, it would be worthwhile to examine the role of international equity flows in Japanese stock market and how it impacts the market returns.

Many researches have done to look into the relation between international equity flows and asset returns in developed markets as well as in developing markets. And most of them have made Japanese market as a part of their researches. Brennan and Cao (1997) report that equity flows were correlated with contemporaneous returns. Bohn and Tesar (1996) find evidence of positive feedback trading using monthly data for a large number of countries. Froot, O'Connell and Seasholes (1998) conclude that "there is very strong trend following in international inflows. The majority of the co-movement of flows and returns at quarterly intervals is actually due to returns predicting future flows." There are also some researches done to check if international equity flows destabilize stock markets. Hamao and Mei (2001) find no evidence that in Japan foreign investors tend to increase market volatility more than trading by domestic investors.

Although many researches have been done in this area as mentioned above, the data used by the researches are out of date. Since the recent developments in Japanese market are quite different from before, it would be interesting to see how the recent situation is different from before. In order to see the historical trends, the paper will analyze the relation between international equity flows and market returns in rolling 5 years, rather than a single long period

used by other researches. Another innovation is that this research is very country-specific, which allows an in-depth analysis.

The paper is organized as follows. It starts from a brief survey of literature, and then the data and data sources are discussed. After that, empirical results are presented. The empirical results include the contemporaneous relation between international equity flows and Japanese market returns, a check of positive feedback trading, and an examination of the interaction between the volatility of equity flows and the volatility of market returns. Finally, a discussion and analysis is conducted and implications to investment strategies are addressed.

## **2 LITERATURE REVIEW**

### **2.1 Contemporaneous Relation between Inflows and Returns**

Tesar and Werner (1994, 1995a, b), Bohn and Tesar (1996), and Brenna and Cao (1997) find evidence of positive and contemporaneous correlation between inflows and returns. Specifically, Brennan and Cao (1997) develop a model of international equity portfolio investment flows based on differences in informational endowments between foreign and domestic investors. They argue that when domestic investors possess a cumulative information advantage over foreign investors about their domestic market, investors tend to purchase foreign assets in periods when the return on foreign assets is high and to sell when the return is low. They look at the relation between portfolio flows and market returns in host countries and destination countries in same periods. The data on portfolio flows are taken from the US Treasury Bulletin, which reports quarterly data on transactions in equities between US residents and residents of other countries. For the US and four developed countries (Canada, U.K, Japan and Germany), market returns are taken as capital gains computed from the Goldman Sachs-Financial Times-Actuaries (FTA) dollar denominated price indices. They find empirically that portfolio flows are associated with returns on national market indices as the asymmetric information hypothesis implies. Specific to Japanese market, they find a significant positive coefficient between equity flows and Japanese market returns, which is going to be confirmed using updated data.

### **2.2 Return-chasing Behaviour**

Bohn and Tesar (1996) argue that US equity investment in foreign markets is return-chasing behaviour. Their argument is based on the positive coefficient between net purchase of foreign equities and lagged returns of national market returns. Based on that, they suggest that US

investors may adjust their portfolios to new information gradually over time, resulting in both autocorrelated net purchases and a positive linkage with lagged returns. Interestingly, they also find that while US investors over the 1980–1994 period outperformed the market portfolio, the return-chasing strategy pursued for foreign equities resulted in a mean return that is 15 basis points below what could have been obtained by holding a market-weighting portfolio of foreign equities. This loss in return was not compensated by a reduction in risk, and then they claim that US investors may be chasing returns, but apparently not in the right markets at the right time.

Froot, O’Connell and Seasholes (2000) explored further the herding or trend-following behaviour using daily international portfolio flows into and out of countries from 1994 to 1998. They confirm that flows are strongly influenced by past returns, a finding consistent with positive feedback trading by international investors. They also find that inflows have positive forecasting power for future equity returns especially for emerging markets.

While the return-chasing behaviour of international equity flows is well established, some researchers try to understand whether such behaviour can be contributed to either better information about fundamentals or price pressure. Froot and Ramadorai (2001) suggests that the cross-boarder flows do keep a measure of fundamentals in mind, and when mean-reverting discounts get unusually large, international investors sell the underlying assets, only to buy them more aggressively when the discounts are small. They also find that the predictability of local-market returns in cross-boarder flows appears mostly to be due to information rather than price pressure. In addition, Portes and Rey (1999) find that gross asset flows depend on market size in both source and destination country as well as trading costs, in which both information and the transaction technology play a role. Ahearn, Grier and Warnock (2002) also confirm the role of information costs in analyzing US holdings of foreign equities. They use the portion of a country’s market that has a public US listing as a proxy for the reduction in information asymmetries, and the proxy is a major determinant of a country’s weight in US investors’

portfolios. Gande and Parsley (2004) also find that international portfolio flows are related to sovereign credit ratings. They find that sovereign downgrades are strongly associated with outflows of capital from the downgraded country while the improvements in a country's sovereign rating are not associated with discernable changes in equity flows. However, greater transparency moderates the response, i.e., highly transparent countries experience smaller outflows around downgrades.

### **2.3 Impacts on Market Volatility and Cost of Capital**

Based on previous researches, Stulz (1999) provides an analysis of the impact of international portfolio flows on security returns, and concludes that opening a country to portfolio flows decreases its cost of capital without adverse effects on its securities markets. There is no convincing evidence that portfolio flows increase the volatility of equity returns, lead to excessive co-movement of a country's equity returns with world equity returns, or destabilize security markets.

As suggested by Stulz, international portfolio flows do not necessarily increase the volatility of market returns. On the other hand, international equity flows create stock liquidity and risk-sharing, and thus lower cost of capital. There is a large body of research that supports the view that the liquidity of securities affects their expected returns.

Merton (1987) proposes that an increase in a firm's investor base increases the firm's value. In his American Finance Association Presidential Address, Merton (1987) proposed:

*Ceteris paribus*, ... an increase in the relative size of the firm's investor base will reduce the firm's cost of capital and increase the market value of the firm. Thus, ... managers of the firm have an incentive to expand the firm's investor base.

Merton proposes a model in which investors limit the securities they hold in their portfolios to those they are “aware of”. This results in imperfect diversification of risk, which leads to a higher risk premium required by investors. An increase in the firm’s investor base thus leads to a lower required return and a higher stock price.

Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996) and Jacoby, Fowler, and Gottesman (2000) implied a direct link between liquidity and corporate cost of capital. Those studies present a model showing that liquidity, marketability or transaction costs influence investors’ portfolio decisions. Since rational investors require a higher risk premium for holding illiquid securities, cross-sectional risk-adjusted returns are lower for liquid stocks.

Amihud and Mendelson (1989) conduct cross-sectional analyses of U.S. stock returns and show that risk-adjusted returns decreasing with respect to liquidity, as measured by the bid-ask spread. Brennan, Chordia and Subrahmanyam (1998) investigate the relation between expected returns and several firm characteristics including market liquidity, as measured by trading volume. They find a significant negative relation between returns and trading volume for both NYSE and NASDAQ stocks, thus linking expected returns and liquidity. Amihud, Mendelson and Lauterbach (1997) report that liquidity improvement on the Tel Aviv Stock Exchange was associated with a positive and permanent price appreciation. Haugen and Baker (1996) report that the liquidity of stocks is one of several common factors in explaining stock returns across global markets, and the liquidity of stocks is one of the important determinants of stock returns.

## **2.4 Specific Studies on Japanese Market**

There are few researches done specifically for Japanese market on this topic. Hamao and Mei (2001) study the impact of foreign investment on Japanese financial markets, using the data from July 1974 to June 1992. They find no evidence that trading by foreign investors tends to

increase market volatility more than trading by domestic investors. In order to find the impact of foreign investment on the volatility of Japanese market, they regress monthly volatility with monthly transactions by various major investment groups, and find there is no significant relation between the volatility and trading of foreign investors. They even find that foreign investors tend to be long-term contrarian players and then add liquidity to the market. In addition, they find that Japanese banks have the best market timing performance while corporations and Japanese individual investors have the worst market timing performance during the sample period of August 1974-June 1992. Foreign investors also demonstrate some degree of market timing ability but the performance is not statistically significant.

Amihud, Mendelson and Uno (1999) study the relation between number of shareholders and stock prices in Japan. They test in Japanese market Merton's (1987) hypothesis that securities' values increase with their investor base due to the better diversification of risk. And they find that in Japan, a reduction in the minimum trading unit greatly increases a firm's base of individual investors and its stock liquidity, and is associated with a significant increase in the stock price. Further, the stock price appreciation is positively related to an increase in the number of shareholders.



### **3 DATA AND METHODOLOGY**

The key independent variable used in the paper is the equity flows in and out of Japan. In this paper, the equity flows between the US and Japan are used as a proxy of the equity flows between foreign countries and Japan. Therefore, precisely the paper studies the relation between US-Japan equity flows and the returns of Japanese market. However, since the US is the largest and the most efficient capital market the world, and its movement can have great impact to the world market and can be representative of the world market.

The US-Japan equity flows data are from the Treasury International Capital (TIC) reporting system of the US Department of Treasuries (see <http://www.treas.gov/tic>). TIC collects monthly mandatory data from banks, securities dealers, and investors on the volume of assets purchased from US residents by foreign residents (capital inflow to the US) and the volume of assets sold to US residents by foreign residents (capital outflows from the US). In this paper, we are only interested in the volume of Japanese stocks purchased from US residents by Japanese residents and the volume of assets sold to US residents. The data are reported monthly.

TIC data are widely used in the studies of international capital flows. However, some limitations should be aware before we make conclusions. First, there is two-month lag for TIC data to be released to the public, and subject to revision for up to 24 months after the reporting date. Since the paper is not about forecasting and looks at a long time period, the time lag is not an issue. Second, the TIC data identify only the country of the transactors, not the country of the issuers. As Warnock and Mason (2001) point out, for financial centres such as UK and Hong Kong, the TIC data do not work. However, since the stocks listed in Japanese market are mostly

Japanese companies (strictly speaking, Japan is not a financial centre), the second limitation is not an issue for Japanese market, too.

The market return of Japanese market used in this study is US dollar – dominated MSCI Japan Gross Return Index. Therefore, the currency effect has been included in the returns. The index is supplied by Morgan Stanley Capital International, and is widely used to study international markets. Same as TIC data, monthly data are used in this study.

The period covered by the study is from January 1977 to September 2005. The paper will also study sub-periods during the time span.

As we know, stock returns can be momentum driven. In this case, the correlation between MSCI Japan returns and 1-month lagged returns is 7%. In order to address the possible issues of serial correlation and heteroscedasticity, the research uses GLS estimation (Generalized Least-Squares). And the GLS results will be compared with OLS results.

The Matlab code of GLS regression is attached in Appendix 1.

## 4 EMPIRICAL RESULTS

This research studies contemporaneous relation of net equity flows and market returns and how the relation changes over time, positive feedback trading, and the co-movement of volatility of net equity flows with volatility of returns. Detailed results are showed as below.

### 4.1 Contemporaneous Relation

In order to check out the contemporaneous relation between net equity flows and Japanese market returns, the following equation is specified for the present analysis. The inflows are modelled as a function of recent returns on the market returns. The model specification is thus as follows:

$$\text{Return}(t) = \alpha + \beta * \text{NEF}(t)$$

*Where*

NEF(t) denotes the net equity flows into Japan during time t. Return(t) is Japanese market return during time t.

$\beta > 0$  refers to the positive contemporaneous relation between net equity flows and Japanese market returns.  $\beta < 0$  means that net equity flows and Japanese market returns move in opposite way.

Regression results confirm the positive and contemporaneous relation between net equity flows and Japanese market returns, as suggested by Tesar and Werner (1994, 1995), Bohn and Tesar (1996), and Brenna and Cao (1997). As reflected in Table 1, all OLS  $\beta$  s are positive,

which means net equity flows and market returns move in same directions. Under OLS, from January 1977 to December 2005, net equity flows can explain 6.21% of the variation of MSCI Japan Gross USD Return Index, and also the regression produces a significant t-stat.

GLS yields similar results as OLS. The similarity of GLS results and OLS results also suggests that residuals of the regression do not have a problem of autocorrelation (6%). A check of Durbin Watson test for autocorrelation of OLS yields a 1.7.

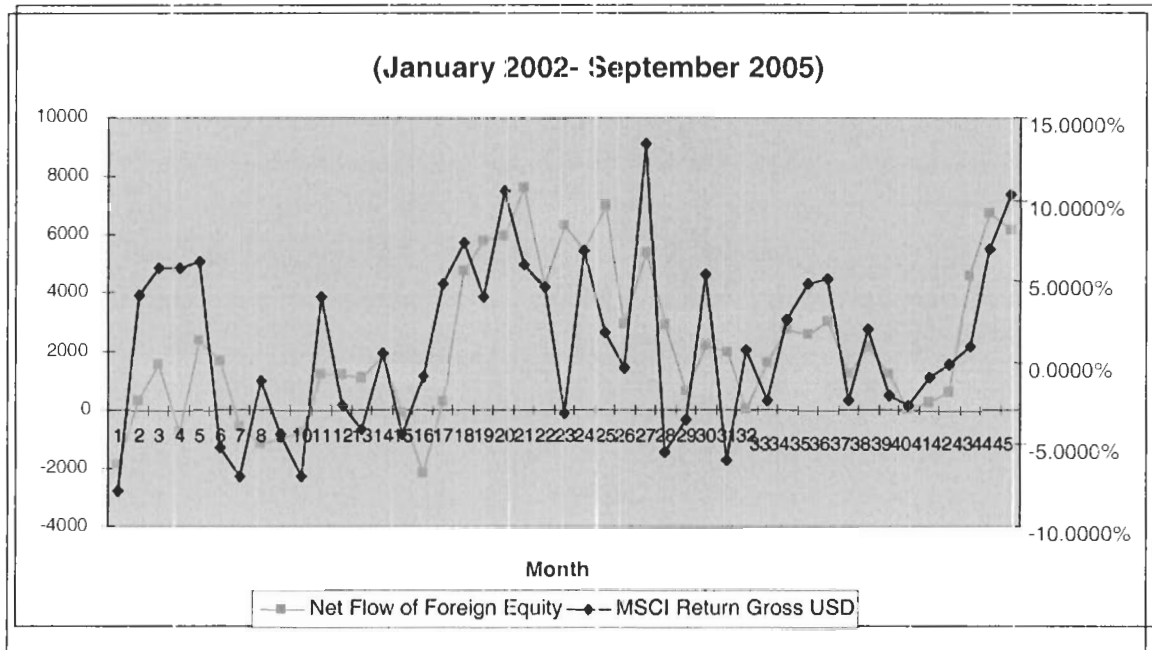
Table 4.1 also shows the regression results for every five-year during January 1977 to December 2005. The rolling-based regressions produce an interesting trend, which is the high R<sup>2</sup> in recent decade. The R<sup>2</sup> between net equity flows and market returns goes down from 14.04% in the first 5-year (1977-1981) to 4.03% in the fourth 5-year (1992-1996), and then suddenly goes up to 24.41% in the fifth 5-year and 34.40% in the sixth 5-year. The high correlations (R<sup>2</sup> of 24.41% and 34.40%) between net equity flows and Japanese market returns in recent decade may suggest a fundamental change of the role of foreign investors in Japanese stock market. An increasing role of foreign investors will certainly produce in-depth influence to Corporate Japan and the investment strategies in Japanese market. Further analysis of this phenomenon will be conducted in next Section.

**Table 4-1: Regression Results (MSCI Japan Index vs. Net Equity Flows)**

Time Period	GLS R <sup>2</sup>	GLS T-stat	OLS R <sup>2</sup>	OLS T-stat	OLS β
Jan 1977 - Dec 2005	6.21%	4.72	6.22%	4.77	9.48E-06
Jan 1977 - Dec 1981	14.04%	3.08	14.04%	3.08	0.000238
Jan 1982 - Dec 1986	10.54%	2.80	10.78%	2.65	9.71E-05
Jan 1987 - Dec 1991	6.80%	2.02	6.84%	2.06	2.77E-05
Jan 1992 - Dec 1996	4.03%	1.59	4.05%	1.56	1.06E-05
Jan 1997 - Dec 2001	24.41%	4.45	24.41%	4.33	1.23E-05
Jan 2002 - Sep 2005	34.40%	5.03	34.40%	4.75	1.18E-05

In order to look into the trend in recent years intuitively, Figure 4.1 shows the co-movement of net equity flow with MSCI Japan Index from January 2002 to September 2005. The co-movement between net equity flow and MSCI Japan Index is quite clear in recent 4 years.

**Figure 4-1: Net Equity Flow vs. MSCI Japan Return Gross USD Index**



## 4.2 Positive Feedback Trading

We model positive feedback trading as follows:

$$NEF(t) = \alpha + \gamma * Return(t-1)$$

Where

NEF(t) denotes the net equity flows into Japan during time t. Equity flows are measured by billions of US dollars. Return(t-1) is Japanese market return during time t-1.

If  $\gamma > 0$  and the regression is significant, then it means the past return drives the net equity flows. If the past return is high, then the today's net equity flows will be high. On the other hand, bad past returns will depress the net equity flows.

The positive feedback trading or return chasing behaviour is also confirmed using the most updated data (from January 1997 to September 2005), especially for the most recent period (1997-2005). As mentioned, in order to check the positive feedback trading, net equity flow in month  $t$  is regressed with the MSCI Japan Return in month  $t-1$ . The Betas,  $R^2$  and T-stats of the regression are showed in Table 4.2.

**Table 4-2: Positive Feedback Trading (January 1977 – September 2005)**

<b>Time Period</b>	$\gamma$	<b>R<sup>2</sup></b>	<b>T-stat</b>
Jan 1977 - Dec 2005	4,967.97599	3.55%	3.54
Jan 1977 - Dec 1981	-34.8833	0.05%	-0.17
Jan 1982 - Dec 1986	300.039	0.78%	0.68
Jan 1987 - Dec 1991	1,076.737	1.31%	0.87
Jan 1992 - Dec 1996	2,785.322	2.10%	1.12
Jan 1997 - Dec 2001	16,163.18	16.30%	3.36
Jan 2002 - Sep 2005	29,225.22	33.45%	4.65

From Table 2, we can see that from 1997 to 2005, the T-stat for the whole period is significant. However, from 1977 to 1991 the relation between net equity flows and Japanese market returns is not significant. There is even a negative coefficient between net equity flows and market returns from 1977 to 1981. The result for 1977-1991 is consistent to Hamao and Mei (2001)'s research done for the period of 1974 -1992. In their research, they find that foreign investors tend to be long-term contrarian players in the market. However, the contrarian behaviour is replaced by a return-chasing pattern in recent decade, as indicated by Table 4.2. The

high correlation between net equity flows with past return suggests that foreign investors are driven by herding effect, which means they tend to buy stocks when past return is high, and sell stock when past return goes down. The positive feedback trading phenomenon may also be explained by the high autocorrelation of net equity flows.

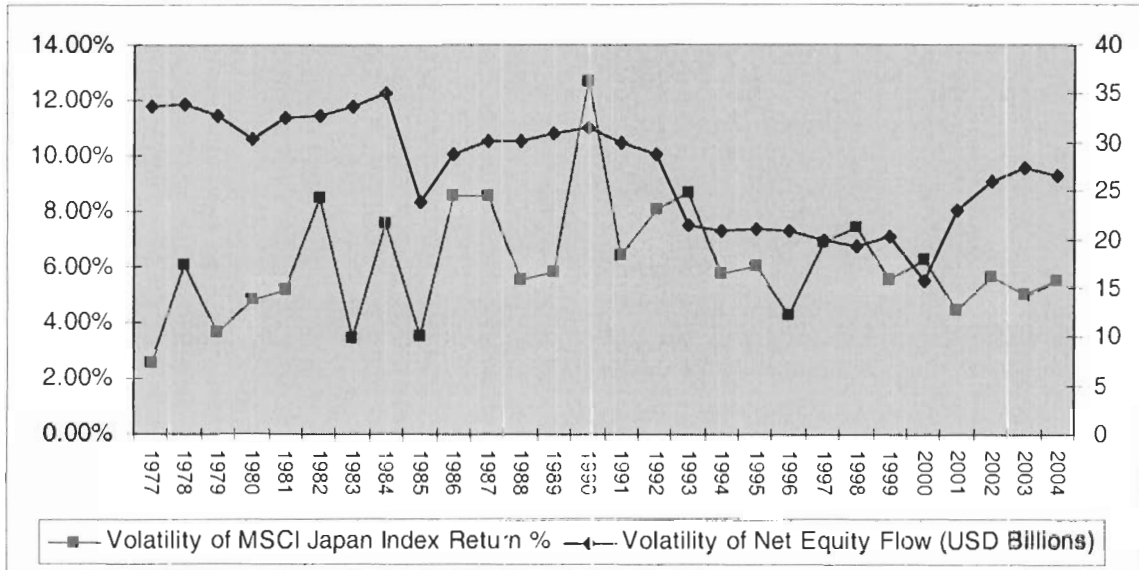
The change of investment pattern of foreign investors in Japanese market is an interesting topic and will be discussed in next section.

### **4.3 Does Foreign Investors Add Volatility to the Market?**

As mentioned in Literature Review section, Hamao and Mei (2001) find no evidence supporting the claims that foreign investors tend to increase volatility of the market in Japan. The research confirms their conclusion. However, annual volatility of net equity flows is used in this research rather than the monthly trading volume which Hamao and Mei use. The volatilities of new equity flows and market returns are showed in Table 4.3 as below. The annual volatilities are calculated using monthly data and listed in Appendix 2.

The correlation between volatility of Japanese market returns and the volatility of net equity flows from 1997 to 2004 is only 1.5%. The results show that there is no significant relation between the volatility of net equity flows and the volatility of market returns in Japan. A casual observation (Figure 4.2) also shows the weak co-movement between the volatility of net equity flows and volatility of Japanese market returns.

Figure 4-2: The Volatility of Net Equity Flows and Market Returns in Japan (1997-2004)





## **5 DISCUSSION AND CONCLUSION**

### **5.1 Overall Conclusion**

This study confirms the contemporaneous relation between net equity flows and market returns, and the positive feedback trading in Japanese market, as suggested by Tesar and Werner (1994), Bohn and Tesar (1996), and Brenna and Cao (1997). It also confirms that there is no significant relation between international equity flows and the volatility of Japanese stock market, as suggested by Hamao and Mai (2001).

### **5.2 An Increasing Role of Foreign Investors in Japanese Market**

The study also discovers a dramatic change in the role of international equity flows in Japanese stock market in recent decade. Foreign investors have become a significant factor in the market.

The increasing importance of foreign investors is confirmed by some investment banks such as Credit Suisse First Boston and Morgan Stanley. According to a research report from Credit Suisse First Boston, foreign investors has held near 25% of Japanese stocks in March 2005, compared with a merely 5% in March 1987, while banks' shareholdings of Japanese stocks have dropped from 15% to near 5% in the same time period. In addition, Morgan Stanley's analysts in Japan reports that most of the incremental capital in Japanese stock market this year is from aboard.

The role of foreign investors is also confirmed by data from Japanese stock exchanges. Foreign investors have continuously occupied 40-50% of trading value every month in recent

months. Table 5.1 shows the trading value by different categories of investors in the three major stock exchanges in Japan.

**Table 5-1: Trading Value (in billion Yen) by Different Categories of Investors in the Three Major Stock Exchanges (Tokyo, Osaka and Nagoya)**

Category	Nov-05			Oct-05		
	Sales	Purchase	Balance / Total	Sales	Purchase	Balance / Total
<b>INSTITUTION</b> (%)	6,863 14.2	6,697 13.7	-166 / 13,560 14	5,230 15.9	4,670 14	-560 / 9,900 14.9
<b>INDIVIDUALS</b> (%)	20,412 42.3	19,500 40	-912 / 39,912 41.2	12,207 37.2	12,323 36.8	116 / 24,530 37
<b>FOREIGNERS</b> (%)	20,226 41.9	21,871 44.9	1,645 / 42,097 43.4	14,943 45.5	16,006 47.9	1,063 / 30,949 46.7
<b>SECURITIES</b> (%)	735 1.5	677 1.4	-58 / 1,412 1.5	449 1.4	443 1.3	-0.006726457 1.6
<b>TOTAL</b> (%)	48,236 100	48,745 100	509 / 96,981 100	32,829 100	33,442 100	613 / 66,271 100

Note: Data from the 1st and 2nd sections of the Tokyo, Osaka and Nagoya exchange markets

In my view, the increasing role of foreign investors in Japanese market is a positive catalyst to corporate restructuring and economic recovery in Japan. International investors will demand better corporate governance and bring US style of management to the rigid Japanese system. In particular, the decreasing role of banks will foster the effective use of capital. All these will push Japan towards a shareholder economy and lead the country to an economic recovery.

First, with an aging population, the saving rate has reached the lowest point. Consumers are highly levered; in the same time, virtually every Japanese financial institution has been overwhelmed by the major declines in stock and real estate prices, non-performing loans, very low interest rate spread for bank. Also, the government has huge deficit. Therefore, there is a lack of aggregate demand, and this is the reason of one-decade of stagnation. However, the incremental capital from foreign investors can help stimulate demands. For example, with high market level, Japanese companies may find easier to find capital for their expansion, which in

turn will boost capital spending and employment. The stimulation from foreign investment can help pull the country out of deflation and create demand.

Second, the replacement of banks by foreign investors in holding stocks in Japan can be positive. Banks' holding of a large number of stocks leads to inefficient use of capital by Japanese business. Unlike Japanese banks, foreign investors will demand a more transparent structure and a more rational decision process, finally leading to a higher ROA and ROE. For example, it is reported that many Japanese companies have cumulated lots of cash in their balance sheets. International investors may guide those companies to spend their money in an efficient way, rather than letting those companies to do whatever they want to do in the past. In addition, foreign investors will bring in strong human capital, which is most needed in Japanese capital market.

### **5.3 Implications of Increasing Liquidity and Risk-sharing**

As mentioned in Literature Review section, liquidity and risk-sharing affect security returns. Increasing equity flows (both inflows and outflows) of foreign investors can create lots of liquidity for Japanese market, and thus diminish required return. In addition, As Merton (1987) and Amihud, Mendelson and Uno (1999) suggest, increase in investor base can result to an increase in securities' values due to the better diversification of risk. Therefore, as foreign investors broaden investor base and create additional liquidity for Japanese stock market, the market premium is diminished and then the valuation of assets in Japanese market is improved.

On the other hand, as suggested by the weak linkage between international equity flows and the volatility of Japanese stock market, international equity flows actually do not add volatility to Japanese stock market. Therefore, the improved valuation of assets due to better liquidity and risk-sharing is not accompanied with higher volatility, which results in a net gain for Japanese stock market.

## **5.4 Be Cautious about the Herding Effect**

Finally, the herding effect of international equity flows into Japan can be alarming to foreign investors. As the strong inflows have pumped up Japanese market to a recent new high, foreign investors shall be cautious and pay more attention to the fundamentals. On the other hand, close monitoring of international equity flows can help make judgement on the market movements, as international equity flows are playing an important role in Japanese market.

## APPENDICES

### Appendix 1: Matlab Code for GLS Regression

```
cd \data

addpath(genpath('C:\matlab6p5\toolbox\jpl'))

Flow=japan1(:,1);
Return=japan1(:,2);

% Make regression between Growth and Spread
X=[ones(size(Flow)),Flow];
results=ols(Return,X)

% Plot residuals with time
time=(1:345)';
plot(time, results.resid);

% Calculate serial corrcoeff
rho=corrcoef([results.resid(1:344) results.resid(2:345)])

% Construct the variance-covariance matrix for GLS
S=eye(345);
for i=1:344
    for j=(i+1): 345
        S(i,j)=rho(2,1)^(j-i);
        S(j,i)=S(i,j);
    end
end

% Calculate GLS beta
Beta_gls=inv(X'*inv(S)*X)*(X'*inv(S)*Return)

% T stats for GLS beta
u=Return - X*Beta_gls; % error
```

```

SBgls=(1/(345-2))*(u'*u)*inv(X'*inv(S)*X) % variance of gls beta

t_stat= Beta_gls./sqrt(diag(SBgls)) % t-stats

% Cochrane-Orcutt ols Regression for AR1 errors
'Cochrane-Orcutt ols Regression'
results=olsc(Return, X)

% Calculate rsqr GLS
ESS=(Return - X*Beta_gls(1:2))'(Return - X*Beta_gls(1:2));
TSS=(Return - mean(Return))*(Return - mean(Return));
'rsqr GLS'
rsqr=1-ESS/TSS
%*****

```

## Appendix 2: Volatility of Japanese Market Return and Net Equity Flow

	Volatility of MSCI Japan Index Return %	Volatility of Net Equity Flow (USD Billions)
1977	2.58%	33.60
1978	6.06%	33.85
1979	3.66%	32.65
1980	4.84%	30.32
1981	5.18%	32.54
1982	8.47%	32.62
1983	3.47%	33.68
1984	7.61%	35.01
1985	3.55%	23.84
1986	8.54%	28.81
1987	8.55%	30.20
1988	5.53%	30.06
1989	5.76%	30.87
1990	12.66%	31.52
1991	6.39%	29.93
1992	8.04%	28.74
1993	8.71%	21.56
1994	5.74%	20.88
1995	6.02%	21.02
1996	4.31%	20.89
1997	6.88%	19.85
1998	7.45%	19.40
1999	5.53%	20.22
2000	6.27%	15.82
2001	4.42%	22.96
2002	5.61%	26.09
2003	4.94%	27.33
2004	5.48%	26.54

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