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Corresponding Author: Prof. Christos A. Alexakis,

Corresponding Author's Institution: University of Piraeus

First Author: Christos A. Alexakis

Order of Authors: Christos A. Alexakis; Christos Alexakis; Apostolos Dasilas

Abstract: This paper examines "causality" effects between mutual fund flows and stock index prices in Japan. In particular, both the short and long run dynamics between stock prices and fund units are investigated. The novelty of our paper is the use of the hidden cointegration technique which attempts to capture heterogeneous fund flow reactions when stock index prices move up or down. Moreover, we employ the crouching error correction model (CECM) to assess the relationship between stock market movements and fund flow changes. The results show that stock prices and mutual fund units are cointegrated. In the case of positive movements there is bi-directional effect interconnecting them, whereas for negative movements, causality runs only from fund flows to stock prices. The dynamics structure provides evidence that market microstructure, taxation and investors' sentiment affect stock price and units formation.

Detailed Response to Reviewers

Dear Brian,

I uploaded the clean PDF of the manuscript.

Thanks for your guidance.

Christos

Highlights (for review)

- We examine "causality" effects between mutual fund flows and stock index prices in Japan.

- We use hidden cointegration technique.

- The results show that stock prices and mutual fund units are cointegrated.

- For positive movements there is bi-directional causality whereas for negative movements, causality runs only from fund flows to stock prices.

- The dynamics structure provides evidence that market microstructure, taxation and investors' sentiment affect stock price and units formation.

Asymmetric dynamic relations between stock prices and mutual fund units in Japan. An application of Hidden Cointegration Technique.

Christos Alexakis
Department of Economics,
University of Piraeus
80 Karaoli and Dimitriou
18534 Piraeus, Greece
Tel: +30-210 414 2337
Fax: +30 210
E-mail: alexakis@unipi.gr

Apostolos Dasilas
School of Economics and Business Administration
International Hellenic University
14th klm Thessaloniki-Moudania
57101 Thessaloniki. Greece
Tel: +30-231 080-7544
Fax: +30 231 047-4520
E-mail: a.dasilas@ihu.edu.gr

and

Chris Grose
School of Economics and Business Administration
International Hellenic University
14th klm Thessaloniki-Moudania
57101 Thessaloniki. Greece
Tel: +30 231 047-4579
Fax: +30 231 047-4520
E-mail: c.grose@ihu.edu.gr

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Abstract

This paper examines "causality" effects between mutual fund flows and stock index prices in Japan. In particular, both the short and long run dynamics between stock prices and fund units are investigated. The novelty of our paper is the use of the hidden cointegration technique which attempts to capture heterogeneous fund flow reactions when stock index prices move up or down. Moreover, we employ the crouching error correction model (CECM) to assess the relationship between stock market movements and fund flow changes. The results show that stock prices and mutual fund units are cointegrated. In the case of positive movements there is bi-directional effect interconnecting them, whereas for negative movements, causality runs only from fund flows to stock prices. The dynamics structure provides evidence that market microstructure, taxation and investors' sentiment affect stock price and units formation.

JEL Classification: G11, G14, G32

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1. Introduction

The mutual fund industry has received much media coverage and academic research due to its exponentially increasing importance in financial markets and its explosive growth in terms of money invested and investors' interest. The fact that mutual funds have become a major investment instrument in the asset management process is evident from the immense relevant literature in the last three decades. This growing focus on mutual funds induced by the ever increasing demand for profitable investments and risk hedging are alleged to be associated with remarkable price fluctuations in capital markets. However, prior research attempting to unveil the relationship between market volatility and investor decisions mainly relied on the predictive ability of forecasting models. As a natural response, scholars strive for formulating the mechanisms that associate stock market behavior with investors' sentiment as captured by the bulk of purchases and redemptions of mutual fund units.

Behavioral aspects of mutual funds trading activity, though relatively underestimated, are perceived to be one of the driving forces behind the market reaction to mutual funds transactions. The theoretical framework behind the behavioral finance approach underlines that, over certain conditions, institutional investors' trading activity could result in the deviation of asset prices from the assumptions of the rational discounted cash flows hypothesis (Indro, 2004). If investors' sentiment is the irrevocable tie between mutual fund flows and market returns, then disentangling the particular premises that underpin this relationship could strengthen investment managers' capabilities to exploit potential excess returns.

Theory was built upon two closely related hypotheses, namely, the information and the feedback trading hypotheses. The former posits that inflows and outflows of funds react to good and bad news in the underlying stock market indices, while the latter argues that positive or negative past period returns directly affect fund flows either way, respectively. Additionally, the temporary price pressure hypothesis sheds further light on the issue identifying a concurrent impact of fund flows on security prices that is reversed in the coming periods (Ben-Rephael et al., 2011).

In addition to the behavioral approach, market microstructure characteristics may also influence stock price formation and mutual fund flows. Market microstructure is concerned with the trading mechanisms used for financial securities such as clearance, settlement, depository facilities, as well as the auction principles used to discover stock prices. Research on market microstructure focuses on the ways in which the working processes of a market affects determinants of transaction costs, prices, quotes, volume, and trading behavior. A basic premise of market microstructure theory is that asset prices not need to reflect all available information due to a variety of market frictions such as bid-ask spreads, taxes, transaction costs, etc. Therefore, market microstructure conjectures that under "imperfect" capital markets, significant departure from the assumptions of the efficient market hypothesis is anticipated.

In this context the aim of this paper is twofold. First, it attempts to explore the long-run causality effect between mutual fund flows and stock market prices in the Japanese market, a relatively under-researched developed international market as opposed to US and UK markets. Second, it examines the short- and long-run dynamics between stock index fluctuations and mutual fund inflows and outflows. We employ the hidden cointegration technique along with the crouching error correction models (CECM) to construe the above relations. Hidden cointegration is a nonlinear cointegration which tests whether the impact of positive shocks is separated from the impact of negative shocks. Therefore, hidden cointegration allows us to decode the heterogeneous short-term dynamics that might exist between stock index returns and fund inflows and outflows. For this purpose, we decompose stock index returns based on the direction of change (increases vs. decreases) and we relate these changes to positive or negative fund flows.

We believe that our paper contributes to the ongoing debate on the existence of a feedback process that links mutual fund flows and market returns. We also shed new light to the impact of concurrent and lagged fund flows on market volatility by looking through the aspects of fund investment behavior and taking into account the liquidity of the underlying stocks during periods of market volatility. Finally, the novelty of our paper is the investigation of the market returns-fund flow relation using tools and assumptions from the behavioral and market microstructure finance.

The remainder of this paper is organized as follows: Section two presents the pertinent literature. Section three describes the structure and the institutional framework that underlines the Japanese funds market. Section four describes the data and the methodology used in this study, while section five presents the empirical results. A summary of the main findings and conclusions of this study are offered in the last section.

2. Literature Review

The literature that examines the relationship between managed fund flows and stock market returns in the micro and macro level has gradually revived in recent years. At the micro level, research focuses on comprehending the relationship between same asset class funds and investor clientele. On the other hand, the micro level discussion describes the competition among individual funds for larger market share (Cao et al., 2008). In line with Ippolito (1992) and Sirri and Tufano (1998), Gharghori et al. (2007) put forward the so called “smart money effect” whereby fund managers switch flows to funds that are expected to outperform their counterparts, and conclude that fund managers are persistent returns seekers, choosing those funds that continuously attract money flows.

Better future performance can also be expected for small-cap funds expanding their diversification perspective as a result of inflows of funds (Pollet and Wilson, 2008). On the “downside” effects of active stock portfolio reallocations, Coval and Stafford (2007) observe liquidity driven factors to induce financially distressed funds to sell units below their fair values. When testing for a possibly negative price impact on underlying stock prices by liquidity motivated trading, they find compelling results to the affirmative, an impact, however, interestingly mitigated by ensuing insider corporate trading sucking up the unduly sold stocks (Ali et al., 2011).

When reviewing the aggregate fund flow effect on stock market returns, the extant literature is rich, especially in recent years. At the macro level, inflows and outflows from specific funds are irrelevant, as “smart money” usually remains invested within the same asset class and aggregate flows are the sole factor worth analyzing with regard to market-wide volatility. Edelen and Warner (2001) find that the macro level impact on market returns stems from the indubitable correlation between fund flows and returns. While confirming the bi-directionality between fund flows and returns, after finding correlation between previous day returns and present day flows, Edelen and Warner (2001) employ a VAR model using high frequency intraday data and probe deeper into the effects of intraday flows of funds on returns. In contrast to Edelen and Warner (2001), Cao et al. (2008) document no market reaction to flows in late trading. However, a progressively stronger intraday relationship is found, especially when examining outflows, probably due to the fact that fund managers have to meet redeemed units’ liquidity requirements, which is not an absolute necessity when dealing with sudden inflows. The above contradiction observed (also in many other country specific studies) does not imply that this research area is void of useful inferences regarding the flow-returns volatility relationship. In this context, Ben-Rephael et al. (2011) examine aggregate daily mutual fund flows in Israel and find that mutual fund investors affect stock market prices. Nonetheless, these investors are lured by the rising equity prices that stimulate them to invest more. The findings of Ben-Rephael et al. (2011) lend support to the price pressure hypothesis according to which stock price deviations, stemming from flows, are reversed within ten trading days. In line with Ben-Rephael et al. (2011), Braverman et al. (2005) believe that any stock price impact resulting from net fund flows in the same month is expected to be reversed in the future.

In the same country specific framework, sentiment issues that drive mutual fund flows are highlighted in Ben-Rephael et al. (2012) who consider net exchanges[1], a proxy for reallocations among bond and equity mutual funds, as being correlated with simultaneous stock price changes. Interestingly, bullish sentiment, arising from newsletter recommendations, is also the driving force for aggregate fund flows as documented by Goetzmann and Massa (2003) and Indro (2004). Sentiment factors that drive fund flows include daylight length and ensuing seasonal depression (Kamstra et al., 2011). Education level and income are also some factors that determine investment decisions regarding mutual fund flows, while trend chasing rather than past performance seeking, seems to influence them as well (Bailey et al., 2011).

The Japanese mutual fund market, which is the focus of our paper, is relatively under-explored. Using a sample of weekly fund flows from the Tokyo Stock Exchange, Kamesaka et al. (2003) reiterate the commonly held opinion that fund flows in the stock market is a function of money inflows and outflows in mutual funds, thus producing a direct causal relationship between fund flows and stock prices. The absence of market timing elements on the part of fund managers raises the question of whether there exists any association between stock prices and fund units. Sentiment driven irrationalities regarding the Japanese market are first addressed by Brown et al. (2003) who argue that investors exhibit independent sentiments towards the Japanese and U.S. markets and flock into bull and bear funds which is an indication of speculative herding. Using a sample of Japanese non open-end funds, Kim and Nofsinger (2005)[2] also detect institutional herding. Cha and Kim (2010) use Granger and Sims causality testing to formulate a unidirectional relationship between fund units and stock prices under conditions of equity volatility, which is seen as both a sentiment driven reaction

[1] They term net exchanges as fund transfers within the same fund family, calculated as “exchanges in” minus ‘exchanges out”, thus summing up to zero for the whole fund family population.
[2] Institutional herding and its impact on stock prices in Japan was first addressed in Iihara et al. (2001).

and a short-run portfolio rebalancing mechanism. However, the relationship between fund flows and equity market returns, as an underlying mechanism explaining incomprehensible market movements, still remains underexplored in Japan[3] especially and worldwide in general.

Relevant studies on investigating fund flows and market returns in the wider geographical region are limited. Watson and Wickramanayake (2012), using Granger causality test for an Australian data set expanding from 1990 to 2009, report unidirectional causality between mutual fund flows and past period stock market returns, although the opposite does not apply[4]. They conclude that herding is evident, complementing Edwards and Zhang (1998) who find similar results using an extended U.S. sample. Herding in the form of naïve fund chasing is also reported in Gharghori et al. (2007), while Chiao et al. (2010) capture information impounding of institutional trading on stock prices in Taiwan. Contradictory evidence regarding the existence of a bi-directional relationship between excess market returns and fund flows is illustrated in the study of Oh and Parwada (2007). In particular, Oh and Parwada (2007) using a sample of Korean mutual funds, observe that fund flows Granger-cause returns on the buy side, while the opposite is also confirmed to be even more persistent. In summary, empirical findings on the relationship between fund flows and stock returns are mixed, largely country specific and subject to methodological approaches, thus leaving ample space for further investigation.

3. The Mutual Fund Industry in Japan

The Japanese mutual fund market is of large size in a global perspective. It is ranked eighth amongst developed markets, with approximately $785 billion under management and 3,905 operating funds at the end of 2007 (Investment Trusts in Japan, 2011). However, it remains relatively small compared to the U.S. market which has a size in funds under management approximately ten times larger than that of Japan (see Table 1). The Japanese mutual fund market was initially set up by the Security Investment Trust Law of 1951. The stock market bubble that burst in the early 90s provided the necessary impetus towards the organized equity funds market and the consequent need for professional fund management services

[3] Other Japan related studies examining behavioral elements include Takahashi (2010), who examined whether fund managers might be influenced in stock picking by board members or managers with whom they hold some sort of academic connection, confirming this tendency on the part of mutual fund managers.

[4] They point out, however, that unexpected cash flows in mutual funds and excess stock market returns do have a unidirectional relationship.

during the bull market period. Iwai (2008) points out that the market entered into a new phase in early of 2000s after the implementation of new legislative framework that allowed Japanese investment trusts[5] to move in line with the evolutions in developed markets mutual fund legislation, with specific emphasis on the conditions of the market, broader distribution channels, new investment products base and rising demographics. Even though the prescribed growth has been greatly fueled by a stock market rally that lasted up to 2007 and the concurrent depreciation of the national currency, macroeconomic factors provided further boost to the development of Japanese mutual funds. For example, the net asset value of mutual funds (NAV) relative to GDP was relatively low, at 11.72% (Cha and Kim, 2010), constituting just a 4% of household financial assets (Iwai, 2008), while the comparable U.S. figure was 23%, indicative of the prospective growth opportunities in the Japanese market. Certain institutional characteristics still remain points of concern for the future sustainability and prospect of the Japanese market such as the rules governing pension plans and market consolidation. Stock investment trusts reached historical high records in terms of total net assets in 2007, exceeding $800 billion, just before the eruption of the global credit crisis of 2008 that adversely affected the local market[6].

[Insert Table 1 here]

The idiosyncrasy of the Japanese market is marked with the existence of both open type and unit type funds. Unit type funds designate specific redemption dates and are not open to new funds, while open type funds have the known functionality of mutual funds worldwide. Even though unit type funds used to represent a significant fraction of funds under management until the late 1990s, in 2011 they constituted less than 2% of mutual funds (Investment Trusts in Japan, 2011). Therefore, given that our data set spans from 1998 to 2007, this peculiarity is of reduced importance in our analysis. Another idiosyncrasy of the

[5]Cai et al. (1997) explain why Japanese mutual funds are in essence investment trusts distinguishing them from the U.S. notion of mutual fund corporations as slightly altered rules apply for investment trusts relating to higher upfront fees paid when buying mutual fund units. As quoted in Brown et al. (2003) unit trusts also contain closed-end funds. Today and during our examination period, these market irregularities are not applicable, while we cater for this market segmentation in our data set, hence the terms mutual funds, investment trusts and unit trusts are used interchangeably throughout the paper. Our analysis refers solely to stock investment trusts belonging to publicly offered investment securities which constituted 64.80% of total net assets of the organised funds market in 2010.

[6] For a detailed historical evolvement of the organized funds market in Japan, see the Investment Trusts in Japan 2011 report which is published every year by the Japanese Investment Trusts Association.

Japanese market is the existence of both contractual and corporate type funds. The notable difference between these two types of funds is that the former are mainly open-end, while the latter issue shares and are traded in stock exchanges, thus being mainly closed-end type. The focus of our study is on the first category of funds.

The current tax treatment of equity mutual fund redemptions entails a 20% tax on returns which temporarily was reduced to 10%[7]. Interestingly, capital gains or losses from mutual funds can be offset with gains or losses from common stocks, thus placing a further peculiar microstructure element in the Japanese market. The net asset value of mutual funds reported daily is net of management and agent fees, transaction and other costs (i.e. financial reports, audit fees). Mutual fund companies are prerogative to impose purchase and redemption fees, while other investment characteristics, such as the classification of mutual funds by investment assets or transactions procedures, do not differ from the standard practices of the mutual fund industry worldwide.

Other notable characteristics that highlight the uniqueness of the Japanese market are the non-overlapping trading hours with the U.S. and European markets (Jares and Lavin, 2004), herding behavior in various investor classes (Iihara et al., 2001), foreign vis-a-vis domestic fund sentiment that distinguishes flows towards Japanese and U.S. equity funds (Brown et al., 2003), considerable institutional cross-holdings (Kim and Nofsinger, 2005) and strong day-of-the week effects (Mazumder et al., 2010). However, the most notable idiosyncrasy is the so called “Japanese open-end fund puzzle” whereby tax dilution is held responsible for the inexplicably high underperformance of Japanese fund managers, thus acquitting them of the alleged continuous inefficient management in the 80s and 90s (Brown et al., 2001). Japanese equity mutual funds manage in 2011 approximately 86% of total net assets with remaining assets being invested in bond and money market funds (Investment Trusts in Japan, 2011). Managed funds in equity unit trusts investing primarily in local stocks were $670 billion at the end of 2010. A prime facie statistical analysis suggests that cyclicality in total net assets closely follows the volatility of the major underlying benchmark index, the Nikkei 225.

4. Data and Methodology

4.1 Data

[7] The tax is withheld from profits and investors are not required to file a return.

This study utilizes aggregate data on net flows of Japanese equity mutual funds, as expressed by the net change of mutual fund units. Mutual fund units were calculated by dividing the total market value of mutual fund assets by the net asset value per share on a daily basis. To test the collective impact of flows on stock prices and vice versa we aggregate fund units and calculate daily differences subsequently. We also use market returns calculated as the natural logarithm of daily closing prices of the main index of the Tokyo Stock Exchange (Nikkei 225). The period under examination spans from January 1st 1998 to December 31st 2007. To avoid side effects from the outbreak of the global credit crunch in 2008 and the consequent international financial turmoil[8], we excluded 2008 and the subsequent years. We downloaded data on stock index prices and mutual fund units from Bloomberg. To form the final sample we imposed some selection criteria such as (a) the availability of fund units throughout the examination period (i.e. we excluded funds that ceased to exist at some point of time) and (b) the inclusion of only domestically operated equity (i.e. funds that invest their money only to Japanese stocks). These selection criteria rendered a final sample of 99 equity mutual funds giving a total of 2,607 observations.

4.2 Methodology

Cointegration and causality techniques are extensively used in the mutual fund literature, using data such as net asset values, fund flows, stock prices and other macroeconomic variables[9]. A correlation between fund premiums and investment flows is exhibited in a global sample of closed-end funds by Nishiotis (2006). Moreover, long-term price linkages between equity funds and benchmark stock indices as well as between equity funds and macroeconomic variables are analysed in Chu (2010 and 2011). A cointegration approach is used to determine the relationship between stock fund returns and the underlying stock index in Spain by Matallin and Nieto (2002) who find limited opportunities for passive asset management through mutual funds. Copeland and Wang (2000), using a similar approach, investigate the relationship between net asset values and investment trust prices.

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[8] Until the fall of 2008, Japanese companies were not affected seriously by the US financial crisis because they invested relatively small amounts of their portfolios in subprime-related financial products, but they were more seriously affected by capital losses arising from their equity shareholdings as stock prices declined sharply due to the eruption of the global financial crisis.

[9] A bidirectional Granger causality between fund flows and stock returns in a relatively small developed market (i.e. Greece) is documented by Alexakis et al. (2005) and Caporale et al. (2004).

In this context, we employ cointegration tests to determine the direction of the relation between mutual fund flows and stock market returns. In specific, we use the error correction test to explore whether stock market returns drive fund flows or vice versa. Identifying the above direction supplements the price pressure hypothesis (Oh and Parwada, 2007). In specific, if fund flows induce the market index then price pressure exists between mutual funds and the stock market (ibid).

Prior to the implementation of the cointegration technique, we have to ascertain that the time series are stationary[10] (i.e. the time series have no unit roots). To test for stationarity of the time series, we perform the Augmented Dickey Fuller (ADF) unit root test. Once the order of integration is determined for the two time series, cointegration is then performed to check whether the net asset value of fund flows and the stock market index become stationary when they are linearly combined (Chu, 2011). The basic idea of cointegration is that when two or more time series move closely together in the long run, though the series themselves are trended, the difference between them is constant. We regard the cointegrating series as a long-run equilibrium relationship where the difference among the series being stationary. The term equilibrium in this case suggests a relationship which, on average, has been maintained by a set of variables for a long period (Hall and Hendry, 1988). Cointegrated variables in the bivariate case must possess temporal causality in the Granger sense, in at least one direction, since for a pair of series to have an attainable equilibrium, there must be some causation between them to provide the necessary dynamics (Alexakis et al, 2005).

Following Engle and Granger (1987), we define that two series, say, X_t and Y_t, are cointegrated when both series are I~(1) and a linear combination between X and Y which takes the following form:

$$z_t = X_t - \alpha Y_t \tag{1}$$

is stationary I~(0). Then X and Y are cointegrated and α is the cointegrating parameter.

If two series are cointegrated according to the Granger representation theorem, there is an Error Correction Model (ECM) which takes following form (Engle and Granger, 1987):

$$\Delta Y_t = a_0 + \sum_{i=1}^{n} \beta_{1t} \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_{2t} \Delta X_{t-i} + \psi_1 z_{t-1} + \varepsilon_{1t} \tag{2}$$

and

[10] According to Chu (2010 and 2011), “a time series is assumed to be stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends only on the distance or gap

$$\Delta X_t = \gamma_0 + \sum_{i=1}^{n} \delta_{1t} \, \Delta Y_{t-i} + \sum_{i=1}^{n} \delta_{2t} \, \Delta X_{t-i} + \psi_2 \, z_{t-1} + \varepsilon_{2t} \tag{3}$$

Temporal causality exists when the ECM incorporates errors from cointegrating regressions (Granger, 1983). To achieve equilibrium for a pair of series, there must exist some kind of causation between the two series and display the necessary dynamics. This implies that if z_{t-1} appears in one of the Error Correction Model equations, this will result in a better forecasting ability for at least in one of X_t and Y_t. Therefore, it comes from the cointegration literature that, in an efficient speculative market, prices cannot be cointegrated (Engle and Granger, 1987). Moreover, temporal causality can be reached through either the sum of the coefficients of the lagged change variables (the standard Granger test) or the coefficient of the lagged error correction term. Standard Granger causality tests neglects the latter route. Theoretically, temporal causality can occur through the error correction term alone.

Even though standard cointegration approach helps testing the relationships among time series, hidden cointegration allows us to decompose the positive and negative components of each time series and, thus identify the dynamics between them. Similar technique was adopted by prior studies that reported heterogeneous stock price behavior under different market conditions (see Gombola and Liu, 1993; Lunde and Timmermann, 2004).

The hidden cointegration approach assumes that X_t and Y_t are two random walk time series which take the following form:

$$X_t = X_{t-1} + \varepsilon_t = X_0 + \sum_{i=1}^{t} \varepsilon_t \tag{4}$$

and

$$Y_t = Y_{t-1} + \eta_t = Y_0 + \sum_{i=1}^{t} \eta_t \tag{5}$$

where X_0 and Y_0 are initial values and ε_i and η_i are mean zero white noise disturbance terms, respectively.

According to Granger and Yoon (2002), hidden cointegration intends to exploit the cumulative distribution of positive and negative changes of two time series. Specifically, if the positive and negative components of two data series are cointegrated, then the two series are said to have a hidden cointegration. Following Granger and Yoon (2002), we define

or lag between the two time periods and not the actual time at which the covariance is computed. If the time series is non-stationary, the deflection from the mean will be permanent”.

positive and negative shocks as follows:

$$\varepsilon^{+} = \max(\varepsilon_i, d),\ \varepsilon^{-} = \min(\varepsilon_i, d),\ \eta^{+} = \max(\eta_i, d) \text{ and } \eta^{-} = \min(\eta_i, d), \tag{6}$$

where d stands for an unknown threshold value (with d = 0 as the most popular choice). Equations 4 and 5 are transformed to:

$$X_t = X_{t-1} + \varepsilon_t = X_0 + \sum_1^t \varepsilon^{+} + \sum_1^t \varepsilon^{-} \tag{7}$$

and

$$Y_t = Y_{t-1} + \eta_t = Y_0 + \sum_1^t \eta^{+} + \sum_1^t \eta^{-} \tag{8}$$

According to Granger and Yoon (2002) we have:

$$X_t^{+} = \sum_1^t \varepsilon_i^{+},\ X_t^{-} = \sum_1^t \varepsilon_i^{-},\ Y_t^{+} = \sum_1^t \eta_i^{+}, Y_t^{-} = \sum_1^t \eta_i^{-}, \tag{9}$$

and

$$X_t = X_0 + X^{+} + X^{-} \text{and } Y_t = Y_0 + Y^{+} + Y^{-} \tag{10}$$

Then, it follows that

$$\Delta X_t^{+} = \varepsilon^{+},\ \Delta X_t^{-} = \varepsilon^{-},\ \Delta Y_t^{+} = \eta^{+},\ \Delta Y_t^{-} = \eta^{-} \tag{11}$$

In order to apply the hidden cointegration technique, we have to compute the first difference (e.g. $\Delta X_t = X_t - X_{t-1}$) for both time series {$X_t$, Y_t} and then sort observations according to the sign of direction, that is, to positive and negative changes (e.g. $\Delta X_t^{+}, \Delta X^{-}$ etc). Next, we calculate the cumulative sum of positive and negative changes in a specific time of period for all (four) variables (e.g. $X_t^{+} = \sum \Delta X^{+}$, $X_t^{-} = \sum \Delta X^{-}$ etc). Variables X and Y are hidden cointegrated if their positive and negative components are cointegrated. According to Granger and Yoon (2002), we might detect one of the following cases between the selected pairs of Y and X: {X_t^{+},Y_t^{+}} or {X_t^{-}, Y_t^{-}}:

Case 1: Neither {X_t^{+},Y_t^{+}} nor {X_t^{-}, Y_t^{-}} are hidden cointegrated.

Case 2: Either {X_t^{+},Y_t^{+}} or {X_t^{-}, Y_t^{-}}, but not both, are hidden cointegrated. In this case, X and Y are subject to positive or negative shocks.

Case 3: Both {X_t^{+},Y_t^{+}} and {X_t^{-}, Y_t^{-}} are hidden cointegrated, but with different cointegrating vectors. In this case, the common shocks of X and Y are not cointegrated.

Case 4*:* Both {X_t^{+},Y_t^{+}} and {X_t^{-}, Y_t^{-}} are hidden cointegrated. In this case, X and Y are cointegrated with the same cointegrating vector.

Granger and Yoon (2002) refer to the ECM emanating from the hidden cointegration as "the crouching error correction model" (CECM). In line with the aforementioned four "cases" we can derive the following CECM.

For Case 2, we assume that $\{X_t^+, Y_t^+\}$ are the only components that are cointegrated with a cointegrating vector of (1,−1) for convenience. Then the CECM model can be specified as:

$$\Delta Y_t^+ = \beta_0 + \sum_{i=0}^{j1} \beta_{1t}\, \Delta Y_{t-i}^+ + \sum_{i=0}^{j2} \beta_{2t}\, \Delta X_{t-i}^+ + \psi_1 (Y_{t-1}^+ - X_{t-1}^+) + \xi_{1t} \tag{12}$$

and

$$\Delta X_t^+ = \delta_0 + \sum_{i=1}^{k1} \delta_{1t}\, \Delta Y_{t-i}^+ + \sum_{i=1}^{k2} \delta_{2t}\, \Delta X_{t-i}^+ + \psi_2 (Y_{t-1}^+ - X_{t-1}^+) + \xi_{2t} \tag{13}$$

Alternatively, if $\{X_t^-, Y_t^-\}$ are the cointegrated components, then we can derive the CECM for negative movements.

For Case 3, we conjecture that $\{X_t^-, Y_t^-\}$ are the cointegrated components with a cointegrating vector of $(1,-k)$, where $k \neq 1$. Then, we have the following CECM:

$$\Delta X_t = \delta_0 + \sum_{i=1}^{k1} \delta_{1t}\, \Delta Y_{t-i}^- + \sum_{i=1}^{k2} \delta_{2t}\, \Delta X_{t-i}^- + \sum_{i=1}^{k3} \delta_{3t}\, \Delta Y_{t-i}^+ + \sum_{i=1}^{k4} \delta_{4t}\, \Delta X_{t-i}^+ +$$

$$\psi_3 (X_{t-1}^+ - Y_{t-1}^+) + \psi_4 (X_{t-1}^- - kY_{t-1}^-) + \eta_t \tag{14}$$

and

$$\Delta Y_t = \beta_0 + \sum_{i=0}^{j1} \beta_{1t}\, \Delta Y_{t-i}^+ + \sum_{i=0}^{j2} \beta_{2t}\, \Delta X_{t-i}^+ + \sum_{i=1}^{J3} \beta_{3t}\, \Delta Y_{t-i}^- + \sum_{i=1}^{J4} \beta_{4t}\, \Delta X_{t-i}^- +$$

$$\rho_1 (X_{t-1}^+ - Y_{t-1}^+) + \rho_2 (X_{t-1}^- - kY_{t-1}^-) + \xi_t \tag{15}$$

For Case 4, we assume the existence of a common cointegrating vector (1,−1) where X and Y have the following standard ECM:

$$\Delta X_t = \delta_0 + \sum_{i=1}^{k1} \delta_{1t}\, \Delta Y_{t-i}^- + \sum_{i=1}^{k2} \delta_{2t}\, \Delta X_{t-i}^- + \sum_{i=1}^{k3} \delta_{3t}\, \Delta Y_{t-i}^+ + \sum_{i=1}^{k4} \delta_{4t}\, \Delta X_{t-i}^+ +$$

$$\psi\ (X_{t-1}^+ - Y_{t-1}^+) + \psi\ (X_{t-1}^- - Y_{t-1}^-) + \eta_t \tag{16}$$

where $\psi = \psi_3 = \psi_4$ (from Equation 14). Additionally, the coefficients of ΔX_{t-i}^- and ΔX_{t-i}^+ should be the same. Similarly holds for ΔY_{t-i}^+ and ΔY_{t-i}^-.

Finally, for Case 1 no CECM can be derived since no pair of components is cointegrated.

5. Results

The descriptive statistics for the two variables under investigation, that is, Nikkei stock index returns and mutual fund flows changes are presented in Table 2. The results show that stock index returns are positive with a skewness and kurtosis close to normal values, while mutual fund units display a negative mean and are highly leptokurtic.

[Insert Table 2 here]

Table 3 presents the unit root test results for the stock index prices and mutual fund units (expressed in log forms) using the Augmented Dickey-Fuller test. The ADF statistic is -1.428 and -0.867 for stock index prices and mutual fund units, respectively. Therefore, the null hypothesis of a unit root in the two series is not rejected. This implies that both stock index prices and fund flow units are non-stationary displaying a trend as time varies. To detrend the two series we take their first difference and check again for unit roots. We see that the calculated t-statistics are higher (in absolute values) than the critical values of ADF. Therefore, we reject the null hypothesis that there is a unit root.

[Insert Table 3 here]

Since both time series under investigation are integrated of order one, we check for possible long-run equilibrium between the two series using the error correction test. Table 4 presents the results from the bivariate cointegration between mutual fund units and stock market prices using unrestricted cointegration rank test (trace method). As there are only two variables, we have two outcomes: either one or no cointegrating relationship. The results show that one cointegrating vector (r=1) between stock market prices and mutual fund units was traced. Specifically, for the level form of stock index prices and fund units the trace statistic is 19.95, much higher than the critical value (15.49) at the 5 percent significance level. When decomposing stock prices and fund units according to the sign of change, we observe similar results. There is one cointegrating vector between positive stock prices and positive mutual fund units (fund inflows) and one between negative stock prices and negative mutual fund units (fund outflows).

[Insert Table 4 here]

Next, we employ the crouching error correction model (CECM) to explore possible short-run and long-run dynamics between index stock prices and mutual fund flows. According to the empirical results, as shown in Tables 5 and 6, the error correction term appears to have the expected sign and be statistically significant in at least one equation of the pair regressions. Specifically, for the case of positive components, we detect statistically bi-directional long-run causality. This may imply that as stock prices rise, there is a cash influx since the lure is the upward trend and the consequent positive abnormal returns. In turn, stock prices are fueled by the cash injections emanating from mutual fund investors. Fund managers increase buy trades in the hope of reaping profits, which appears to be indiscriminate of buy or sell signals at least during periods of high volatility (Oh and Parwada, 2007). We believe that the tax offsetting power of possible capital losses, as explained in section 3, can be partially responsible for this phenomenon. We conjecture that in an uptrend equity market an investor already positioned in the underlying market can risk setting up a new position in mutual funds since if he sustains losses at some stage, these losses will offset his capital gains tax arising from stocks.

[Insert Table 5 here]

For the case of negative components we find unidirectional long-run causality running from fund flows to stock prices. This may imply that as investors short their fund units, mutual fund companies sell shares in order to obtain the necessary liquidity to pay off investors. This results in driving down the stock index. In behavioral finance terms, we propound that this lack of bi-directionality in the negative components is driven by the loss aversion that investors show when they realize that all profits are about to be eliminated. According to the prospect theory of Kahneman and Tversky (1979), loss aversion refers to people’s tendency to strongly prefer avoiding losses to acquiring gains. Moreover, Shefrin and Statman (1985) pose that people dislike incurring losses much more than they like incurring gains and are willing to gamble in the domain of losses.

The tax treatment of mutual funds in Japan could also play a role in explaining the aforementioned unidirectional relationship. In a bear equity market one may opt for realizing even marginal stock returns and avoid redeeming the mutual fund units in the hope that, if the stock market continues to slide, the ensuing possible losses from the mutual fund units will at least offset taxes due from the capital gains captured previously from the stock market. Therefore, it is common to find no fund outflows when the stock index plummets. To put differently, the main intuition is that stock prices will bounce back up and mutual fund units will become profitable again, so that profits through both stocks and mutual fund units may be realized. The aforementioned mechanism, of course, could also potentially work adversely, even though our empirical results indicate that falling units have a negative impact on stock prices.

[Insert Table 6 here]

Regarding the short-run causality as expressed by the lagged terms in the equations, there appears to be no statistical relationship between past and present stock returns. However, the fund flows variable appears to be highly autocorrelated. Fund flows at time t-1 affect stock returns at time t and stock returns at times t-1 and t-2 affect fund flows at time t.

6. Summary and Conclusions

In this paper we empirically investigate the relationship between stock market prices and mutual fund flows employing data from the Japanese market, a relatively under-researched developed market. We abstain from using standard causality testing, since similar approaches have been extensively used in recent years[11]. Instead we use a hidden cointegration technique in order to examine short- and long-run dynamics between fund flows and security returns. In particular, we separate the stock index returns according to the direction of change (increases vs. decreases) and we relate these changes to positive or negative fund flows. We believe that this novel econometric technique will be useful to fund managers to reach in optimal investment decisions when stock market conditions fluctuate and market volatility changes.

Our results show that stock prices and mutual fund units are cointegrated. Cointegration holds for both the positive and negative components of data. However, the crouching error correction models provide the most intriguing results. For the data set of positive changes in stock prices and fund units, the results show that there is a bi-directional "causality" between stock index prices and fund units. This result is in sharp contrast with Cha and Kim (2010) who contend that the notion of increased money flows in mutual funds

[11] Indicatively, in the greater Southeastern Asia region, Oh and Parwada (2007) and Watson and Wickramanayake (2012).

driving stock returns is not supported. Furthermore, our empirical findings display that, the error correction term appears to be statistically significant in both models. We rely on market microstructure irregularities to interpret the observed bi-directional causality between positive changes in index prices and fund inflows. We argue that as equity fund managers receive cash injections from investors when they buy fund units, they invest further in the stock market, as obliged by the law, driving up stock prices. The causality which runs from stock prices to fund units can be explained within the framework of behavioral finance, whereby stock price rally induces new money flows to be directed to mutual funds in the hope of keeping up with the stock upsurge. Therefore, it seems that market participants take into account prior information about positive stock price movements when taking investing decisions in the mutual fund industry.

Regarding the negative change in stock index prices and fund units, the empirical results indicate unidirectional causality running from fund units to stock index prices. We attribute this unidirectional causality to market microstructure factors prevailing in the market. Specifically, as investors short their fund units, mutual fund companies sell shares in order to obtain the adequate cash for redemption, driving the stock index down. A further reason explaining this behavior is the tax counterbalancing ability offered to investors by the Japanese legislation, allowing the tax due from capital gains in stocks to be offset with possible losses from redemption of equity mutual funds and vice versa. However, in the case of the negative change of units and stock prices, the causality running from stock prices to units does not hold. This asymmetry may be based on a loss aversion explanation. In specific, as investors realize losses they avoid selling their fund units, due to a strong dislike for admitting loss psychological effect, thus awaiting for a later price reversal. As far as the short dynamics are concerned, the statistical significance of fund units at time t-1 (i.e. the previous day) possibly has to do with the settlement procedures, which is in line with the microstructure framework.

Asset managers and portfolio investors alike could benefit from a momentum strategy whereby, relying on our findings, they could follow the drift by going long on mutual funds when underlying stock prices go up. An increase in mutual fund units could also be a buy signal in the underlying market. Our most striking finding, however, is that when experiencing negative returns in the Japanese stock market, mutual fund units have no informational content since loss aversion deters investors from selling units. Nonetheless, momentum seekers can be assured that a fall in units is likely to negatively affect the underlying stock index. Future research should be directed to verify our results using an extended sample of mutual funds comprising of world-wide data and test whether our findings are country-specific or a global phenomenon.

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Table 1. Worldwide data on mutual funds at the end of 2007

	Number of Mutual Funds	Total Net Assets of Mutual Funds (in millions of USD)	Net sales of Mutual Funds (in millions of USD)
Japan	2,997	713,998	120,308
US	8,027	12,002,283	1,112,556
UK	2,057	897,460	430
World	66,348	26,132,316	1,533,465
Americas	15,460	13,423,909	1,204,158
Europe	35,210	8,934,860	101,766
Asia and Pacific	14,847	3,678,326	217,849

Source: Investment company fact book (2011)

Table 2. Descriptive statistics

	Mean	Maximum	Minimum	Std. Deviation	Skewness	Kurtosis
Nikkei Index returns	0.0001	0.0599	-0.0723	0.0134	-0.1951	4.8042
Mutual fund flows changes	-0.0001	0.0219	-0.0357	0.0019	-3.3428	66.1899

Table 3. Augmented Dickey Fuller (ADF) test of the series

	ADF statistic	Probability
Index prices	-1.428	0.569
Mutual fund units	-0.867	0.799
First differences in index prices	-50.794**	0.000
First differences in mutual fund units	-7.829**	0.000

** indicates significance at 1% confidence level.

Table 4. The Johansen cointegration regression results

Prices and fund units			
Ho	Eigenvalue	Trace statistic	5% critical value
r =1	0.0075	19.95*	15.49
Positive prices and positive units			
Ho	Eigenvalue	Trace statistic	5% critical value
r =1	0.0163	43.69*	15.49
Negative prices and negative units			
Ho	Eigenvalue	Trace statistic	5% critical value
r =1	0.0076	20.06*	15.49

* indicates significant at the 5% level.

Table 5. Results from the crouching error correction model (CECM) for positive index prices and fund flows

Dependent value: Δ (positive stock index prices)			Dependent value: Δ (positive mutual fund flows)		
Variable	**Estimate**	**t-statistic**	**Variable**	**Estimate**	**t-statistic**
Constant	0.0045	20.16**	Constant	0.0004	16.30**
ECT_{t-1}	-0.0004	-3.59**	ECT_{t-1}	-0.0001	-5.59**
Δ (stock price)$_{t-1}$	0.0155	0.79	Δ (stock price)$_{t-1}$	-0.0169	-7.57**
Δ (stock price)$_{t-2}$	-0.0140	-0.71	Δ (stock price)$_{t-2}$	-0.0111	-4.95**
Δ (fund flows)$_{t-1}$	0.6291	3.77**	Δ (fund flows)$_{t-1}$	0.2480	12.99**
Δ (fund flows)$_{t-2}$	0.1041	0.63	Δ (fund flows)$_{t-2}$	0.2246	11.80**
R^2-adjusted	0.013		R^2-adjusted	0.188	

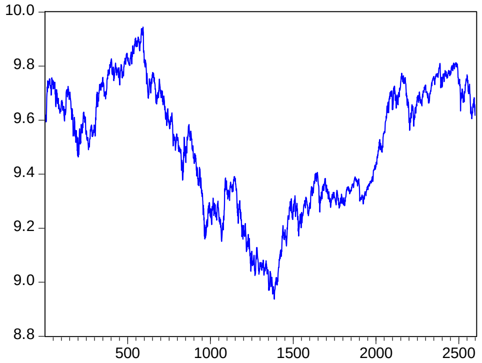
* * denotes statistical significance at 1% significance level.

Table 6. Results from the crouching error correction model (CECM) for negative index prices and fund flows

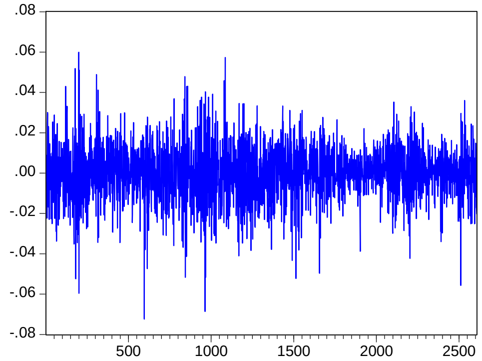
Dependent value: Δ (negative stock index prices)			Dependent value: Δ (negative mutual fund flows)		
Variable	**Estimate**	**t-statistic**	**Variable**	**Estimate**	**t-statistic**
Constant	-0.0050	-21.60**	Constant	-0.0005	-12.48**
ECT_{t-1}	-0.0003	-4.29**	ECT_{t-1}	-0.0001	-1.05
Δ (stock price)$_{t-1}$	0.0178	0.90	Δ (stock price)$_{t-1}$	-0.0162	-5.08**
Δ (stock price)$_{t-2}$	0.0227	1.15	Δ (stock price)$_{t-2}$	-0.0146	-4.55**
Δ (fund flows)$_{t-1}$	-0.2450	-2.07**	Δ (fund flows)$_{t-1}$	0.3166	16.37**
Δ (fund flows)$_{t-2}$	-0.1700	-1.44	Δ (fund flows)$_{t-2}$	0.1534	7.98**
R^2-adjusted	0.010		R^2-adjusted	0.189	

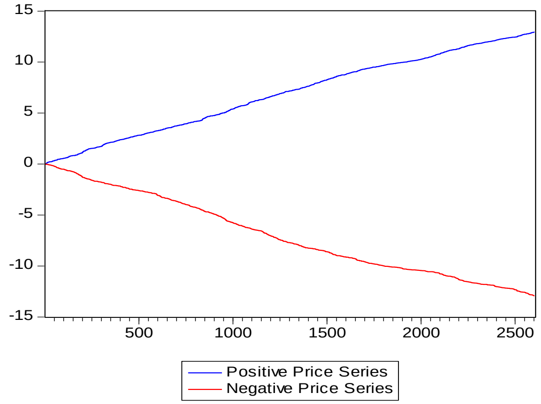
** denote statistical significance at the 1% significance level.

Stock Prices: Jan '98 - Dec 2007

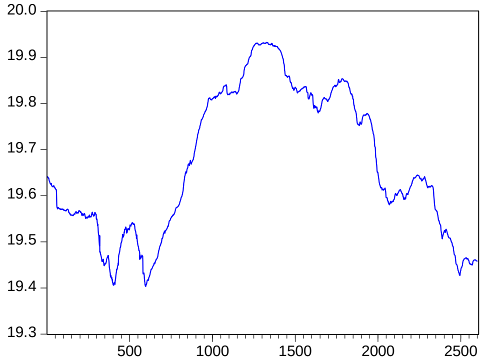


Stock Returns: Jan 1998 - Dec 2007





Fund Units: Jan '98 - Dec '07



Unit % Changes: Jan '98 - Dec '07