“Are Japanese financial markets rational? Evidence from bank merger events”

AUTHORS	Heather Montgomery Yuki Takahashi

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Heather Montgomery (Japan), Yuki Takahashi (USA)

Are Japanese financial markets rational? Evidence from bank merger events

Abstract

The theory of rational expectations states that people make decisions based on their future expectations and using all currently available information. This was a significant shift in the field of economics from traditional adaptive learning models. This study applies the theory of rational expectations to financial markets, empirically examining whether the Japanese stock market is rational by analyzing bank stock price reactions to bank merger announcements and completions. Using event study methodology, this study finds evidence that the Japanese stock market is rational. Bank stock prices change in an unpredicted way on merger announcement but not merger completion. Cumulative abnormal returns of bank stocks are statistically significantly different from zero on merger announcement dates, but insignificantly different from zero on merger completion dates.

Keywords: bank, merger, event study, Japan.
JEL Classification: G21, G34.

Introduction

"Chimp beats professional analysts at picking stocks." So ran headlines of the Swedish newspaper *Expressen*, which some years ago performed a natural experiment of sorts, giving out $1,250 dollars each to five stock analysts and a chimpanzee named Ola and challenging them to each make as much money as they could by investing in the stock market over a period of one month. While the stock experts carefully considered their portfolios, Ola made his choices by throwing darts at the names of companies listed on the Stockholm Stock Exchange. Ola the chimpanzee won, earning an impressive return of over 10% on his investments and beating out the professionals.

You might think that academic economists would try to play down this event as an anomaly. In fact, it memorably illustrates one of the main concepts we try to convey to undergraduate students: markets are efficient. Capital markets are extremely efficient at reflecting information and when new information is released, it quickly spreads and is "priced in", or incorporated into the prices of securities. Thus, prices always fully reflect all known information. In the well-known stock market primer *A Random Walk Down Wall Street*, author Burton Malkiel explains that the implication is that a blindfolded chimpanzee throwing darts at *The Wall Street Journal* could select a stock portfolio just as well as the experts. *Expressen* simply put Malkiel's idea into practice.

In this study, the authors examine one implication of the efficient markets hypothesis: that markets are forward looking reflect new information rapidly. This suggests that markets should react only to *new* information and not to events that were previously announced and, therefore, should have been expected and priced-in to the market by rational, forward-looking investors making full use of publicly available information. Using data on both the announcement and completion of bank mergers in Japan, we test whether markets – particularly, stock prices – react to the news of bank mergers, and if so, whether markets react at announcement or implementation. The efficient markets hypothesis implies that stock prices should respond only at announcement, when the news of the bank merger is new, and not at implementation, when an efficient market would have already priced-in the effects of the merger on stock valuation. Despite some evidence to the contrary (see Nagayasu, 2003, discussed below), our hypothesis is that Japanese capital markets are efficient, and that stock prices will react only on announcement and not on implementation.

This paper is organized as follows. The next section reviews the existing academic literature on the efficient markets hypothesis. Section 2 explains the efficient markets hypothesis theory of rational expectations and sets up analytical framework with which the authors test their hypothesis. Section 3 describes authors data set and the empirical methodology used to test their hypothesis. Section 4 discusses their empirical results and the final section concludes the paper.

1. Literature review

The efficient markets hypothesis is really just the application of a broader theory, the theory of rational expectations, a theory pioneered by Muth (1960, 1961) and made famous by Lucas (1976), to financial markets. The theory of rational expectations proposes the thesis that economic actors such as individuals or firms use all available relevant information in forming expectations. Thus, while each individual expectation may not always be correct,

expectations will be identical to the "optimal forecast", or the best guess, and, therefore, be correct on average. Being correct "on average" implies that there will be no systematic error or bias in the expectations and any error in expectations, when aggregated across many individuals, will be random.

The theory of rational expectations revolutionized the world of economics, which had until then assumed that expectations were adaptive, based on learning from past experience and outcomes. Now, models in nearly every field of economics are forward looking models in which actors are assumed to form expectations based on all available relevant information. The theory of rational expectations has now become so widely accepted by economists that it is considered an important part of an orthodox education in economics and is included in its simplest forms in undergraduate textbooks. Rational expectations also form an important underpinning for much research in economics, and has made important contributions to the field of academic research in macroeconomics (see, for example, Mishkin (1995) and Sargent (2008)) and in actual economic policymaking, increasing the awareness of policy makers that the credibility of their policy has important implications for its effectiveness.

When applied to financial markets, the theory of rational expectations – or the theory of efficient markets – implies that if the flow of information in unimpeded and information is immediately reflected in stock prices, then tomorrow's price change will reflect only tomorrow's news and will be independent of the price changes today. Since news is by definition unpredictable, the resulting price changes must be unpredictable and random. Current prices should fully reflect all known information and even uninformed investors (or chimpanzees throwing darts at the financial section of a newspaper) can obtain a rate of return as generous as that achieved by expert stock analysts. Behind this result lies the assumption that there is no arbitrage: no unexploited profit opportunity. Thus, while market pricing may not always be perfectly correct, it is not possible to "earn above-average risk adjusted returns", to use the words of Malkiel (2003, p. 60), the well-known author of *A Random Walk Down Wall Street.*

Although the theory of rational expectations and its application to financial markets, the efficient markets hypothesis, have now become part of the conventional wisdom of financial economics, research in recent years has begun to challenge the premise that financial markets are efficient. Some economists argue that recent bubbles provide evidence that markets are in fact irrational. Some go so far as to say that there may be trading algorithms based on so-called fundamental analysis that allows investors to earn excess returns without taking on extra risk. More modest claims point at least to predictable patterns of returns that violate the efficient markets hypothesis. The latter are based on evidence from studies of long-run reversals or short-run momentum (including so-called PEAD, post-earnings announcement drift or drift after dividend initiations or omissions) and seasonal or weekly patterns in stock returns. There are also some puzzles around the "underperformance" of IPOs or SEOs and the "outperformance" of share repurchases. The so-called "twin studies" suggest that arbitrage is not perfect and there is evidence that non-informative events such as inclusion in well-known stock indices, can affect stock prices.

For example, Banz (1981) and Reinganum (1981) documented the so-called size effect: the fact that small-capitalization firms on the New York Stock Exchange earned higher average returns than is predicted by the CAPM Model of Sharpe (1964) and Lintner (1965). Keim (1983) and Reinganum (1983) then showed that the small-firm effect was most evident at the start of the year, spawning a series of papers on the "January Effect", while French (1980) documented another calendar anomaly that challenged the efficient markets hypothesis (or, at least, as was later argued, the CAPM model), the "Weekend Effect". Many of these effects seems to have dissipated over time, perhaps reflecting that markets *are* efficient as information of possible arbitrage opportunities enter the public information set and are exploited. But there still exists a debate between two seemingly contradictory challenges to the efficient market hypothesis, the possibility of earning high abnormal returns through either value trading (for an early paper on the value effect see Basu (1977) or Basu (1983)) and momentum trades (see, for example, Fama and French (1996).

Most of the research challenging the efficient markets hypothesis is based on financial market data in the United States, but Nagayasu (2003), for example, examines the rationality of Japanese financial markets and finds inconsistencies with the efficient market hypothesis.

2. The theory of rational expectations

Before the application of rational expectation to financial markets, price expectations were assumed to be adaptive, which would imply that current stock prices are the arithmetic or weighted average of past stock prices:

$$p_t = \sum_{k=0}^{t-1} w_k p_k, \tag{1}$$

where w_k is weight such that $\sum_{k=0}^{t-1} w_k = 1$. One of the revolutionary contributions of rational expectations is that it was *forward looking.* The theory of

rational expectations implies that the price of a security is determined by the present value of the security's future payments. Thus, stock prices are determined by the present value of the expected future dividend stream (Mishkin, 2012, p. 185). Financial economists categorize the implications of rational expectations into its weak, strong and semi-strong.

Under the semi-strong form of the efficient market hypothesis, the price of a given stock is expressed by equation (2):

$$p_t = E(\sum_{k=t+1}^{\infty} \frac{d_k}{(1+r_t)^{k-t}} | I_t^{Public}), \quad (2)$$

where p_t is the stock price at time t, d_k is the dividend payment at time k, r_t is the interest rate at time t and I_t^{Public} is the information publicly available at time t. E is expectation operator. This equation implies that the stock price changes *if and only if* there is a chance that the future dividend stream changes: if and only if new, unexpected information is provided publicity.

The so-called "weak form" of the theory of rational expectations states that stock price already accounts for past information but not current information. Thus for the weak form we should replace I_t^{Public} in equation (2) with I_{t-1}^{Public} information publicly available at time t-1. The so-called "strong form" of the theory of rational expectations states that stock prices already account for private information as well as public and past information. Thus, for the strong from we should replace I_t^{Public} in equation (2) with $I_t^{Private}$, information available at time t, both publicly and privately. Under the weak form of the theory of rational expectations, market participants can exploit profit by analyzing the stock's fundamental value, currently available information. Under the strong form of the theory of rational expectations, market participants cannot exploit any profit, even with access to private information.

When financial economists refer to the efficient markets hypothesis, they are often referring to the "semi-strong form" of the theory of rational expectations expressed mathematically above in equation (2). Under semi-strong form of the theory of rational expectation – or the efficient markets hypothesis – market participants can exploit profit only by having access to private information about the stock.

Applying the semi-strong form efficient market hypothesis to bank mergers implies the following hypothesis: while we might see a reaction in stock valuation when the merger is first announced publicly (if it is new information), when the merger actually occurs there should be no response from investors and no change in the stock price. The expected impact of the merger on the stock dividends and, therefore, current price should already be "priced-in" and, to use the language of Fama (1970), be already "fully reflected" in the current stock price immediately after announcement. A reaction in the price after announcement, upon completion of the merger, would violate the efficient markets hypothesis.

3. Empirical methodology and data

3.1. Empirical methodology. *3.1.1. Obtaining abnormal returns*. The authors first estimate banks' abnormal returns around merger announcement date. We estimate abnormal return with what MacKinlay (1997) refers to as a "market model":

$$r_{i,t}^{Stock} = \alpha_i + \beta_i r_t^{Market} + \varepsilon_{i,t}, \quad (3)$$

where $r_{i,t}^{Stock}$ and r_t^{Market} are the return on stock i at time t (return on stock i over a holding period from t-1 to t) and return on market index at time t, respectively. We use a market capitalization-weighted index for banking sector, TOPIX-Banking, for the market index. α_i and β_i are coefficients to be estimated for stock i. $\varepsilon_{i,t}$ is the error term of stock i at time t, which is orthogonal to the information available at time t-1, I_{t-1}, $E[\varepsilon_t | I_{t-1}] = 0$. This suggests that ordinary least squares (OLS) gives unbiased and efficient estimates and thus preferred specification for equation (3). Time frequency is daily, excluding non-business days.

Abnormal return is defined as a difference between normal and actual returns, and normal return is obtained with out-of-sample prediction. We first estimate equation (3) over estimation window and obtain coefficient estimates $\hat{a}_i$ and. $\hat{\beta}_i$.Then, we plug them in equation (3) and calculate normal return, $r_{i,t}^{Stock-Normal}$, over the event window:

$$r_{i,t}^{Stock-Normal} = \hat{\alpha}_i + \hat{\beta}_i r_t^{Market}. \quad (4)$$

Because these coefficients are estimated before the effect of the event takes place, this normal return represents return in the absence of merger announcement.

Abnormal return, $AR_{i,t}$, is obtained by subtracting this predicted normal return from the actual return:

$$AR_{i,t} = r_{i,t}^{Stock} - r_{i,t}^{Stock-Normal}. \quad (5)$$

This abnormal return is deviation from the return in absence of merger announcement and thus represents excess return caused by the merger announcement.

Since abnormal return only shows the excess return on a certain day and not during a certain period, event window, over which we consider the merger announcement affects stock return. To see this

overall effect, we aggregate abnormal return over the event window and calculate cumulative abnormal return, CAR_i:

$$CAR_i = \sum_t AR_{i,t}. \quad (6)$$

Under null hypothesis abnormal return follows normal distribution:

$$AR_{i,t} \sim N(0, \sigma_i^2), \quad (7)$$

where σ^2_i is variance of $AR_{i,t}$ which consists of variance of the error term in equation (3), σ^2_ε and the variance due to the sampling error, which approaches to zero with large enough estimation window.

Under null hypothesis, cumulative abnormal return asymptotically follows normal distribution:

$$CAR_i \sim N(0, L\sigma_i^2), \quad (8)$$

where L is the number of days in event window.

We use 3 event windows: pre-announcement windows: (t - 30, t - 1), announcement windows: (t - 1,t + +1) and post-announcement window: (t + 1, t + 30), where t is the announcement date. Estimation windows consist of 120 days, starting from 120 days before the first day of each event window, or in case of post-announcement window 120 days before the event day.

As authors stock price data already account for stock splits and dividend payments, return on stock i at time t is simply defined as the price change over a day:

$$r_{i,t} = \frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}}, \quad (9)$$

where $p_{i,t}$ and $p_{i,t-1}$ are price of stock i at time t and t-1, respectively.

3.1.2. Testing stock market rationality. The authors employ simple methods to test market rationality. The authors take mean of cumulative abnormal returns around announcement dates and test whether it is statistically significantly different from zero using paired t-test. Given that cumulative abnormal return is an estimate, we also examine median cumulative abnormal returns and test whether it is statistically significantly different from zero using Wilcoxon signed-ranks test. We do the same for completion date cumulative abnormal returns. We expect that if market is rational cumulative abnormal returns around merger announcement dates are statistically significantly different from zero and cumulative abnormal returns around merger completion dates are statistically insignificant.

3.2. Data. The authors use bank stock data to obtain banks' abnormal return. The data is from Nikkei NEEDS database. Our data contains each bank's stock price as well as TOPIX-Banking, which is market capitalization-weighted average for banking sector. The stock price already accounts for stock splits and dividend payments. The authors data covers from 1990 to 2011.

Merger announcement and completion dates are obtained from Nikkei Telecom 21, a Nikkei newspaper article archive. With the help of the JBA's list of transition of Japanese banks[1] we check Nihon Keizai Shimbun (Economic Newspaper) and Nikkei Kinyu Shimbun (Finance Newspaper) for period for which we have sufficient stock data to estimate market model and choose the date in which the merger news first appears as the announcement date. We set the announcement date as the next day if the news appears in the evening edition. We obtain 38 announcement dates from October 1994 to July 2010. The corresponding completion dates are checked in a similar way and double-checked with the JBA's "Transition of Japanese Banks" database[2]. Event dates are set to those merger dates but to next business days if the merger dates are on non-business days.

The authors consider mergers and acquisitions (including "subsidiarization") among banks with different bank holding companies and bank holding company formations. We do not consider mergers and acquisitions in which both acquirer and target are in a same bank holding company or acquirer already owns majority of the target's share (but we include the merger between SMBC and Wakashio Bank as an exceptional case). The authors also do not consider "rescue" mergers in which the target bank is already insolvent and under governmental control.

For analysis of abnormal return we exclude banks that have returns of zero for more than 1/2 of the days in the estimation window or event window. This step drops 1 event and 4 banks and leaves us a sample of 37 announcement events with 66 listed banks from 1994 to 2010. The same step for completion date gives us 20 events with 24 listed banks. Table 1 provides summary statistics of our merger data.

Table 1. Summary statistics

	Announcement	Completion
Number of events	37	20
Number of banks	66	24

Notes: Excludes cumulative abnormal returns with returns of zero for more than 1/2 of the days in the estimation window or event window. Excludes rescue mergers and mergers within a same bank holding company.

[1] http://www.zenginkyo.or.jp/inquiry/affiliation/index/touhai.pdf.

[2] http://koueki.net/bank/Search.html.

4. Results

Table 2 reports cumulative abnormal returns around merger announcement dates.

Table 2. Abnormal returns – merger announcement

	Pre-announcement CAR on (*t*-30,*t*-1)	Announcement CAR on (*t*-1,*t*+1)	Post-announcement CAR on (*t*+1,*t*+30)
Mean	-0.003	0.024**	-0.031
p-value	[0.81]	[0.02]	[0.19]
Median	0.005	0.017**	-0.015
p-value	[0.96]	[0.02]	[0.26]
Obs.	65	63	64

Notes: *, **, *** indicate statistical significance at the 10, 5 and 1 percent level, respectively. *P*-values in brackets below each mean and median value. Mean and median statistical significance are calculated with paired *t*-test and the Wilcoxon signed-ranks test, respectively. The null hypothesis is that the value is 0. Excludes cumulative abnormal returns with returns of zero for more than 1/2 of the days in the estimation window or event window. Excludes rescue mergers and mergers within a same bank holding company.

Column 1 shows that there is no evidence that stock price changed 1 month before the merger announcement: cumulative abnormal returns are statistically indifferent from zero, consistent with the implication of rational expectations theory that in the absence of unexpected news stock price does not change. Looking at column 3, we also see that cumulative abnormal returns are statistically insignificant 1 month after the announcement.

Column 2, however, shows that stock price changed differently from the prediction on the merger announcement date: cumulative abnormal returns are statistically and quantitatively significant at 5% for both mean (2.4%) and median (1.7%). This suggests that Japanese stock market reacted rationally to the merger announcement news: given new, unpredicted news, the market participants changed their expectations on the future dividend stream of the bank stocks.

Table 3 reports cumulative abnormal returns around merger completion dates. It is also consistent with the rational expectations theory. Column 1 shows that 1 month before the completion there was no unpredictable price change as evidenced by the cumulative abnormal returns that are statistically insignificant. Column 3 is also consistent with the stock market rationality that 1 month after the completion there was no unpredictable stock price change.

Table 3. Abnormal returns – merger completion

	Pre-announcement CAR on (*t*-30,*t*-1)	Announcement CAR on (*t*-1,*t*+1)	Post-announcement CAR on (*t*+1,*t*+30)
Mean	0.013	0.00003	-0.002
p-value	[0.59]	[1.00]	[0.94]
Median	-0.001	-0.006	0.025
p-value	-0.001	[0.95]	[0.80]
Obs.	24	24	24

Notes: *, **, *** indicate statistical significance at the 10, 5 and 1 percent level, respectively. *P*-values in brackets below each mean and median value. Mean and median statistical significance are calculated with paired *t*-test and the Wilcoxon signed-ranks test, respectively. The null hypothesis is that the value is 0. Excludes cumulative abnormal returns with returns of zero for more than 1/2 of the days in the estimation window or event window. Excludes rescue mergers and mergers within a same bank holding company.

Column 2 also supports rationality of Japanese stock market: cumulative abnormal returns on the merger completion dates are statistically indifferent from zero for both mean and median. This suggests that merger completions were already anticipated by the market participants and the stock prices did not change unexpectedly. If market participants are not rational, then the stock price should not have changed on merger announcement date and should have changed at merger completion date. Thus, we see evidence from Tables 2 and 3 that Japanese stock market is rational.

Conclusions

This study examines the rationality of the Japanese stock market using bank stock price reaction to bank merger announcements and completions. Using event study methodology, this study finds evidence that the Japanese stock market is rational. Bank stock prices show abnormal returns upon merger announcements, which presumably reveal new information, but not upon the actual merger completion. Cummulative abnormal returns of bank stocks are statistically significantly different from zero on merger announcement dates and insignificantly different from zero on merger completion dates.

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