The Japanese Accounting Review

Volume 1
2011

Market Efficiency, Role of Earnings Information, and Stock Returns: A Vector Autoregressive Model Approach*

Keiichi Kubota†
Graduate School of Strategic Management
Chuo University

Hitoshi Takehara
Graduate School of Finance, Accounting and Law
Waseda University

ABSTRACT

This paper investigates how the information content contained in components of earnings is impounded into stock prices and provides new evidence on market efficiency for firms listed on the Tokyo Stock Exchange First and Second Sections. First, we conduct a conventional pooled Mishkin test to examine whether stocks are rationally priced or not, and claim how this particular test can result in misleading observations if we erroneously pool the data for the overall sample period by completely disregarding the time-series properties of accounting numbers. Next, we conduct time-series analyses on properties of the components of accounting earnings and cast doubt on the forecasting equation used in conventional Mishkin tests. In order to fully investigate the degrees of market efficiency and examine interrelationships between components of accounting earnings, we employ a vector autoregressive approach and propose a new framework to test rational pricing of the accounting information. We find that for 82% of firms listed on the Tokyo Stock Exchange the hypothesis of rational pricing cannot be rejected. This result implies that pooled estimation of the forecasting equation, which disregards the interacting structure among relevant variables, may lead us to incorrect inferences about the degree of informational efficiency in capital markets. The paper further confirms the robustness of our estimation results with some simulations studies.

JEL Classifications: M41; G14; C32; C52
Key Words: Accounting Accruals; Rational Expectations; Mishkin Test; Augmented Dickey-Fuller Test; Impulse Response Functions

* This paper was presented at the 2011 Nippon Finance Association Annual Meeting and the 2011 Japanese Accounting Review Conference, and the authors thank Takashi Obinata and Shyam Sunder for their helpful comments. Also, by any means the author would like to acknowledge the continuous and heated discussion with late Kazuyuki Suda without whom we could not have explored this interesting and important topic in the positive accounting research field. Moreover, the authors also acknowledge helpful discussion with George Constantinides, Zhaoyang Gu, Yuji Ijiri, Ramesh Rao, Srinivasan Sankaraguruswamy, Kenji Wada, and Takeshi Yamada. The authors thank financial support from the Grant-in-Aid for Scientific Research ((A) 21243029) from the Ministry of Education, Culture, Sports, Science and Technology of Japan. All remaining errors are our own.
† Corresponding Author. *Address* Chuo University 1-13-27, Kasuga, Bunkyo-ku, 112-8551, Tokyo, JAPAN.
Telephone +81 (3) 3817-7478 *E-mail* kekubota@tamacc.chuo-u.ac.jp.

Received June 23, 2011; accepted August 26, 2011

1. Introduction

There are a large number of empirical studies which have tested mispricing phenomena obtained from accrual components of accounting earnings for U.S. data (Sloan (1996) and Xie (2001) among others). These studies find that the market misjudges implications from accounting accruals and that there exists market mispricing which is resolved by the time the next years' earnings become available to capital market participants.[1] However, comparable studies with Japanese accounting accruals data are relative few although they have been increasing (Kubota, Suda, and Takehara, 2010). In the current study, we focus on the information content of accounting accruals vis-à-vis cash flows information and earnings numbers for the sample of Tokyo Stock Exchange (denoted TSE) firms with a new research framework we propose below.

Under the efficient capital market hypothesis in a semi-strong form, all publicly available information is instantaneously and accurately impounded into stock prices. However, evidence against the efficient market hypothesis has recently increased in the U.S (Shleifer (2000) and Lakonishok, Shleifer, and Vishny (1994), for example). Kubota, Suda and Takehara (2009) find that the "value-to-price ratios" defined by Frankel and Lee (1998) help investors earn excess returns after controlling for the three risk factors by Fama and French (1993) for Japanese data and thus present evidence against market efficiency.

In this paper we focus, in particular, on the time-series properties of accounting numbers. We conduct the Mishkin test employed in the accounting literature, which was first proposed by Sloan (1996) and used by Xie (2001), to the pooled sample of the firms listed on the First and Second Sections of the Tokyo Stock Exchange. First, we examine whether these stocks are rationally priced or not with this conventional approach. Next, we estimate the detailed stochastic processes of accounting numbers at the individual firm level and conduct the Augmented Dickey and Fuller (ADF) test. Finally, we employ a vector autoregressive model approach to explicitly take into consideration the interacting structure among the components of earning numbers in a simultaneous equation system of the forecasting/valuation equations based on the original Mishkin (1983) book,[2] and test the hypothesis of rational pricing with this new framework. Furthermore, we conduct some simulations to confirm the robustness of our results.

Section 2 motivates our research methodology in terms of the market efficiency hypothesis. Section 3 explains the method for constructing the components of accounting accruals. Section 4 describes our new testing method of rational pricing and the data we use. After reporting empirical results from the Mishkin and ADF tests, in Section 5 we demonstrate the estimated structure of the vector autoregressive model and results from the test of rational pricing. In Section 6 we further investigate the cross-sectional and time-series inter-relationship between the components of accounting earnings by employing the impulse response function (IRF) analysis and also report the results from simulation studies. Section 7 concludes.

[1] Such evidence is with respect to the components of accounting accruals. Sloan (1996) points out that the post-announcement drifts of earnings numbers found by Bernard and Thomas (1990) are only limited to quarterly reports. Kubota, Suda, and Takehara (2010) find that the return anomaly found in fiscal year end reports begins to disappear around the time when semi-annual reports are disclosed for the Japanese sample.

[2] Mishkin (1983, p. 2) recommends his testing method as a simpler method of testing the rational expectations hypothesis rather than the full scale test by Hansen and Sargent (1981). We also employ this Mishkin testing methodology. See also Sargent (1973) for the definition of rational expectations vis-à-vis one of adaptive expectations.

2. Market Efficiency and Accounting Reporting

In order to examine whether market participants rationally price accounting numbers or not, the Mishkin test is often times used. Mishkin (1983) developed this cross-equation testing framework for the purpose of examining the rational expectations hypothesis in macroeconomics, and Sloan (1996) employed this framework to test the rational pricing of accounting numbers. This method has become a *de facto* standard tool among accounting researchers.

As we will discuss in detail in Section 4, the Mishkin test uses the system of equations composed of the 'forecasting equation' and the 'valuation equation'. In the 'forecasting equation' market participants forecast the next year's earnings by using components of earnings (such as cash flows from operations and accounting accruals) in the current year, and, in the 'valuation equation,' they try to associate components of earnings with future stock returns. The hypothesis tested in the Mishkin test is whether estimated parameters in the forecasting equation are different from estimated parameters in the valuation equation. If the parameter values turn out to be different, it forms evidence that the market is not fully utilizing the information content of components of earnings in a rational manner; i.e., the asset market is inefficient.

By using this Mishkin test the majority of empirical studies in accounting in early dates tend to reject market efficiency with respect to components of accounting numbers for U.S. data. For example, Sloan (1996) concludes that accounting accruals are less persistent than cash flows from operations and that the market overprices accruals information. Xie (2001) decomposes total accruals into normal and abnormal accruals after applying the cross-sectional vresion of Jones model as proposed by DeFond and Jiambalvo (1994), and concludes that abnormal accruals are the least persistent among components of earnings and that the market overprices abnormal accruals to a larger extent than normal accruals.

However, most of these previous studies which rejected rational pricing used the pooled sample estimation method in conducting the Mishkin test. According to our view, two serious problems arise using the Mishkin test in this way. First, the result from the Mishkin test may be misleading, if we erroneously pool all the data during the overall sample period by completely disregarding time-series properties of accounting numbers. For example, relating to the problem caused by pooling all the samples, Teets and Wasley (1996) show that earnings response coefficients estimated using pooled data are downward biased. Second, the base model used in Sloan (1996) and Xie (2001) disregards the interacting structure among the components of earnings related information of our interest in their system of equations. As Chan, Jegadeesh and Sougiannis (2004) have clearly pointed it out, the predictability of future earnings can be improved significantly by employing the vector autoregressive model, which explicitly takes into consideration time-series interactions between components of earnings. Note that we can also further explore the dynamic impact of random disturbance terms in the system of components of earnings by analyzing impulse response functions with the vector autoregressive approach.

In the current study, we carefully examine the persistency of individual firm's earnings numbers as well as their components. We will conduct unit-root tests and demonstrate that abnormal accruals are more persistent than cash flows from operations and normal accruals. Based on results from these unit-root tests, we construct a vector autoregressive model with lag one, which explicitly takes into consideration the interacting structure of components of earnings when testing forecasting/valuation equations, and propose a new framework to test the rational pricing of accounting numbers, based on the very original formulations by Mishkin (1983, p.13, lines 11-12).

3. Construction of Accruals from Financial Statements in Japan

We use the net income after tax wherein extraordinary gain and losses are added back (denoted *EBEI* below) as a base line income number for our analysis. This income concept, so called "current earnings after tax," is the bottom line net income number which financial analysts in Japan often times follow and predict. This net income number contains the performance from financing decisions of firms except for items of other comprehensive income, which are currently directly charged to the equity account as dirty surplus in accordance with Japanese accounting standards.

This earnings number, *EBEI*, can be decomposed into cash flows from operations (*CFO*) and total accounting accruals (*ACC*). We use total assets at the beginning of the period as a common divisor to construct all variables, as it is more conventional in the literature (Sloan (1996, fn.7)) instead of the market value of common equity. Also, since cash flows statements are not available before fiscal year 2000 in Japan, we compute the four components accruals, ΔCOA, ΔCOL, $\Delta NCOL$ and *DEPR* from the balance sheet and income statement items in individual financial statements as follows.[3]

$$\Delta COA = (\text{changes in current assets} - \text{changes in cash and deposits}) \tag{1}$$
$$\Delta COL = -(\text{changes in current liabilities} - \text{changes in financing items}) \tag{2}$$
$$\begin{aligned}\Delta NCOL = -(&\text{ changes in loss allowances for accounts receivable}\\ &+ \text{changes in reserve for bonus payable and salary payable}\\ &+ \text{changes in short-term reserve accounts}\\ &+ \text{changes in allowance for future retirement bonus}\\ &+ \text{changes in long-term reserve accounts}\\ &+ \text{changes in amortization})\end{aligned} \tag{3}$$
$$DEPR = -(\text{depreciation}) \tag{4}$$

Changes in financing items in equation (2) are composed of changes in short-term borrowing, changes in outstanding commercial papers, changes in long-term debt due within one year, and straight bonds and convertible bonds due within one year. Note that ΔCOL, $\Delta NCOL$, and *DEPR* are defined as negative numbers throughout the paper so that the amount of total accruals, *ACC*, becomes larger (smaller) as these numbers become larger (smaller).

By using notations defined in equations (1) through (4), total accounting accruals, *ACC*, used in this study are defined as follows.

$$ACC = \Delta COA + \Delta COL + \Delta NCOL + DEPR \tag{5}$$

Because total accruals (*ACC*) are the gaps between accounting earnings (*EBEI*) and cash flows from operations, cash flows from operations (*CFO*) is defined as

$$CFO = EBEI - ACC. \tag{6}$$

All variables appear in equation (6), *EBEI*, *ACC* and *CFO*, are standardized by a divisor at the beginning of the period book-value of total assets as mentioned above. All of the above procedures are standard in earnings management-related empirical studies, which have been conducted for U.S.

[3] After fiscal year 2003 we switch to the items from the consolidated financial statements to compute the component of accruals.

data (see Dechow et al. 1995, and Sloan, 1996).

Next, we decompose total accruals into so-called "normal (non-discretionary)" and "abnormal (discretionary)" sub-components. In order to estimate normal and abnormal accruals, we use the CFO modified-Jones model proposed by Kasznik (1999). For each sample firm-year we estimate the following cross sectional model:

$$ACC_{j,p} = \alpha_p + \beta_{1,p}\Delta ADJREV_{j,p} + \beta_{2,p}PPE_{j,p} + \beta_{3,p}\Delta CFO_{j,p} + \varepsilon_{j,p} \tag{7}$$

where $\Delta ADJREV$ is the change in sales revenues (adjusted for the change in receivables), PPE is the gross property, plant and equipment, and ΔCFO is the change in cash flows from operations. The subscript j denotes the firm index for the number of firms within each estimated portfolio p. Based on the 33 industry classifications of the Tokyo Stock Exchange, we then classify all non-financial firms into 27 sectors and define each sector portfolio as sector p. All explanatory variables for each firm in equation (7) are deflated by total assets at the beginning of the fiscal year.[4]

Finally, the fitted values from OLS estimation are used as normal accruals (NAC), which represent the normal accounting accrual level for each firm, and the deviations from these fitted values are used as abnormal accruals (*ABNAC*), which represent firm specific accrual components. We decompose the accrual component into the normal component and the abnormal component in this way and investigate the persistency and variability of these numbers potentially managed by company managers and controllers in order to test the rational pricing of stock prices in capital markets.

4. Testing Methods and the Data

4.1 The Mishkin Test

Mishkin (1983) developed a new framework to test the rational expectations hypothesis in macroeconomics. Then Sloan (1996) employed this Mishkin test for the first time to examine whether the components of accounting earnings are priced rationally or not. This framework proposed by Sloan (1996) has been extensively used as the *de facto* standard among accounting researchers.

The rational expectations hypothesis asserts that the subjective probability distribution of any variable held by market participants is identical to the objective distribution of the same variable conditional on all available past information (Mishkin 1983, and Sargent 1973). With respect to the expected value of asset future values, Fama (1970) states this as the market efficiency hypothesis (see also Lehman (1991)).

For any given economic variable X, the rationality conditions can be written as

$$E_m[X_t|F_{t-1}] = E[X_t|F_{t-1}], \tag{8}$$

where F_{t-1} is the information set publicly available at time t–1, $E_m[\cdot|F_{t-1}]$ is the subjective expectations assessed by the market and $E[\cdot|F_{t-1}]$ is the objective expectations conditional on F_{t-1}. Let r_t denote the return from holding a security from t–1 to t. Then the rational expectation hypothesis as defined

[4] We computed with the Jones model, the modified Jones model, the CFO Jones model and the CFO modified Jones model. Based on these four estimation models, we estimated abnormal accruals not only by conducting industry-wide cross-sectional regression analyses, but also by conducting time-series regression analyses using individual firm's accounting data. Thus, we confirmed that the likelihood ratios reported in Table 3 are less susceptible to the choice of estimation methods for abnormal accruals. The results from these tests are available upon request from the authors.

in equation (8) implies the following condition to hold:

$$E[r_t - E_m(r_t | F_{t-1}) | F_{t-1}] = 0. \tag{9}$$

Because the above condition is too general to be testable,[5] one must specify the market equilibrium condition that relates $E_m(r_t | F_{t-1})$ to some subset of past information, Ω_{t-1},[6]

$$E_m(r_t | F_{t-1}) = f(\Omega_{t-1}) = r_t^*. \tag{10}$$

Combining equations (9) and (10) we obtain the following efficient market conditions.

$$E[r_t - r_t^* | F_{t-1}] = 0. \tag{11}$$

This condition implies that the term $(r_t - r_t^*)$ should not be correlated with the past information set F_{t-1}. That is, any forecasts based on the information set have to be orthogonal to the above term.

Let us denote Y_t as any set of variables which is relevant to the pricing of security at time t. As shown by Mishkin (1983, p.11), a model which satisfies the efficient market condition in (11) is

$$r_t - r_t^* = (Y_t - Y_t^{opt})^t \beta + \varepsilon_t, \tag{12}$$

where Y_t^{opt} is the one-period-ahead optimal forecast of Y_t, ε_t is the disturbance with the property $E[\varepsilon_t | F_{t-1}] = 0$, and β is a vector of slope coefficients. Note we suppressed for firm subscript i in the above and will in the following equations for simplicity.

In the test framework proposed by Sloan (1996) the value relevance variable Y_t is the accounting earnings, *EBEI*, of firms. Following Freeman, Ohlson and Penman (1982), Sloan (1996) assumes that the future earnings performance can be expressed as:

$$EBEI_t = \gamma_0 + \gamma_1 EBEI_{t-1} + \nu_t. \tag{13}$$

Combining the above forecasting equation (13) with the rational pricing model (12), we can obtain the following system of equations:

$$\begin{aligned} EBEI_t &= \gamma_0 + \gamma_1 EBEI_{t-1} + \nu_t, \\ r_t - r_t^* &= (EBEI_t - \gamma_0^* - \gamma_1^* EBEI_{t-1})\beta + \varepsilon_t. \end{aligned} \tag{14}$$

The first equation is called a forecasting equation and the second equation a valuation equation. The slope coefficient vector β in the valuation equation is called the earnings response coefficient (ERC).

Because the following identity equation holds by definition,

$$EBEI_t = CFO_t + ACC_t = CFO_t + NAC_t + ABNAC_t, \tag{15}$$

combining equation (15) with system (14) gives us the following two alternative versions of the

[5] The limitations from testing any asset pricing theory with the subset of conditional information are discussed in Cochrane (2001, pp. 145-146).

[6] Or with no arbitrage conditions (Lehmann, 1991).

extended models.

$$EBEI_t = \gamma_0 + \gamma_1 CFO_{t-1} + \gamma_2 ACC_{t-1} + \nu_t, \qquad (16)$$
$$r_t - r_t^* = \beta(EBEI_t - \gamma_0^* - \gamma_1^* CFO_{t-1} - \gamma_2^* ACC_{t-1}) + \varepsilon_t.$$

$$EBEI_t = \gamma_0 + \gamma_1 CFO_{t-1} + \gamma_2 NAC_{t-1} + \gamma_3 ABNAC_{t-1} + \nu_t, \qquad (17)$$
$$r_t - r_t^* = \beta(EBEI_t - \gamma_0^* - \gamma_1^* CFO_{t-1} - \gamma_2^* NAC_{t-1} - \gamma_3^* ABNAC_{t-1}) + \varepsilon_t.$$

The first model (16) was proposed by Sloan (1996) and the second model (17) was by Xie (2001). In these systems of equations, whenever the rationality assumption holds, γ s has to coincide with γ^* s element by element (Mishkin, 1983).

With the use of the correctly specified asset pricing theory, computations of abnormal returns $(r_t - r_t^*)$ in this valuation equation require risk adjustments of normal returns, r_t^*. For this purpose we use Fama and French's (1993) three factor model as a benchmark model for our data following Jagannathan, Kubota, and Takehara (1998), and estimate Jensen's alpha for each firm. In the regression equation (18), we regress 12 monthly returns of firm j on Fama and French's three risk factors in the same period from July of year t through June of year t+1 and obtain Jensen's alpha $\alpha_{j,t}$ as the estimates of this regression equation.

$$r_{j,t,k} - r_{f,t,k} = \alpha_{j,t} + \beta_{j,t}(r_{M,t,k} - r_{f,t,k}) + \gamma_{j,t} SMB_{t,k} + \delta_{j,t} HML_{t,k} + \varepsilon_{j,t,k},\ k = 1,\ldots,12, \qquad (18)$$

In the next step, the abnormal return, $r_{j,t,} - r^*_{j,t,}$, can be constructed as the annualized Jensen's alpha $(=12 \times \alpha_{j,t})$.

As Mishkin (1983) originally proposed, in the first stage we estimate the parameters of the model with no equality constraints on γ s and γ^* s, and in the second stage we estimate the model with equality constraints, $(\gamma_i = \gamma_i^*,\ i = 0,\ldots,l)$, l =2 or 3. Then, the likelihood ratio statistics LR are constructed as $2N \ln(SSR^c / SSR^u)$, in which N is the number of observations, SSR^c, SSR^u are the sums of squared residuals from constrained regressions in the first stage and unconstrained regressions in the second stage, respectively. Mishkin (1983) further proves that these LR statistics are asymptotically distributed as $\chi^2(k)$ variables, and hence the null hypothesis of rational pricing for components of earnings is rejected, whenever the LR statistics are sufficiently large.

4.2 Unit-Root Tests of Accounting Numbers

Although there is ample evidence for U.S. data for time-series properties of accounting numbers, there are only a few for Japanese firms. In this paper we present evidence of the first-order autocorrelations using OLS estimation and conduct the Augmented Dickey and Fuller unit root test (Hamilton, 1994).

$$X_t = a + \rho \cdot X_{t-1} + u_t \qquad (19)$$

We use the sample that covers at least consecutive 10 years of observations. In the above equation u_t s are assumed to be distributed with Gaussian white noise and the initial value X_0 is assumed to be zero. When the true ρ is close to one, it is well known that the estimated ρ from the OLS regression is underestimated (Harvey (1981)). Accordingly, in the case that the true ρ equals one, the distributions of ρ are not well defined in a normal manner, and alternative Augmented Dickey and Fuller tests are called for, for which the numerator is the chi-square distributed variable and the denominator is the normally distributed variable.

If the unit root hypothesis is not rejected, the model becomes a random walk model, and we say that the accounting numbers are highly "persistent" in the sense of Kormendi and Lipe (1986).[7] On the other hand, if the null hypothesis of the unit-root is rejected and the AR (1) model is implied, it is called "less persistent". This is the reason why we test the existence of unit roots for each component of accounting numbers.

4.3 On Vector Autoregressive Model Approach

The Mishkin test based on the models (16) or (17) have been used in the past with a pooled sample method for the purpose of testing rational pricing of accounting numbers, and there is a wide spread belief that abnormal accruals are the least persistent among the component of earnings. However, a number of recent studies have made critical attacks on these models as well as on the interpretation of the empirical results obtained by Sloan (1996) and Xie (2001). For instance, Kraft, Leone and Wasley (2007) point out the imminent 'omitted variable problems,' and demonstrate that rational pricing of accruals is not rejected, if the additional explanatory variables are included in the forecasting/valuation equations. Another study which reports the evidence against Sloan (1996) is the one by Francis and Smith (2004). They evaluate persistence using firm specific time-series based estimations and demonstrate that more than 85% of firms in the U.S. do not show any evidence that accruals are less persistent than cash flows.

As we will show in the next section, the distributions of first order auto-correlations and corresponding probability values from the Augmented Dickey Fuller test demonstrate that abnormal accruals are more persistent than cash flows and normal accruals in Japan. These findings along with previous studies on U.S. data can give us an important clue that time-series properties of earnings components may not be captured in an appropriate manner by models (16) and (17). If that were the case, we would have to build an alternative model for forecasting and valuing, which can well take into consideration interactions among components of earnings in current and future time periods. Those being the reasons, we employ a vector autoregressive model in the same way as Chan, Jegadeesh and Sougiannis (2004) proposed.

We assume that cash flows from operations, normal accruals, and abnormal accruals are all relevant variables in explaining and predicting stock returns. In this case the variable, Y_t in equation (12) becomes a three dimensional vector, consisting of CFO_t, NAC_t, and $ABNAC_t$. We assume these variables are well represented by a first order vector autoregressive process based on our prior univariate time series tests. Under these assumptions the VAR (1) forecasting equation can be described as follows:

$$Y_t = \begin{pmatrix} CFO_t \\ NAC_t \\ ABNAC_t \end{pmatrix} = \begin{pmatrix} \gamma_{01} \\ \gamma_{02} \\ \gamma_{03} \end{pmatrix} + \begin{pmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{pmatrix} \begin{pmatrix} CFO_{t-1} \\ NAC_{t-1} \\ ABNAC_{t-1} \end{pmatrix} + \begin{pmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{pmatrix} = \Gamma_0 + \Gamma Y_{t-1} + v_t. \tag{20}$$

Because Y_t^*, the optimal forecast of Y_t, is given by $\Gamma_0 + \Gamma Y_{t-1}$, the valuation equation paired with the forecasting equation (20) becomes the following (21).

[7] As for the definition of the earnings quality, see the literature review by Shipper and Vincent (2003).

$$r_t - r_t^* = (Y_t - \Gamma^*_0 - \Gamma^* Y_{t-1})^t \beta + \varepsilon_t \tag{21}$$

The vector β in the valuation equation (21) is named 'Component Earnings Response Coefficients' (Component ERC) in this study, because these coefficients denote estimated relationships between the unanticipated changes in components of earnings and stock returns. Note in this formulation we assume that investors form their expectations on the components of earnings separately; i.e., one for normal accruals and another for abnormal accruals. The former will be based on their forecasts of the industry-wise economic conditions and latter of the individual unsystematic conditions. Then, if the information contained in the stochastic process of Y_t is rationally priced in the stock market, the intercept Γ_0 has to coincide with Γ^*_0 and the slope matrix Γ also has to coincide with Γ^* element by element. Since there are 12 overall parameters in the forecasting equations, the likelihood ratio statistics are asymptotically distributed as χ^2 (12) under the null hypothesis.

4.4 Data

The primary source for accounting variables of the Tokyo Stock Exchange First and Second Sections firms is the Nikkei NEEDS database supplied by Nihon Keizai Shinbun Inc. The primary source for monthly return data is the Nikkei PortfolioMaster Database. For each *EBEI*, *CFO*, *ACC*, *NAC* and *ABNAC* variable, we exclude the top 0.5% and bottom 0.5% of the sample as an outlier. The sampling period in the study is from 1978 through 2008, and the number of total pooled sample observations after excluding the extreme observations is 30,438 firm-years. The minimum yearly observation is 653 for 1979 and the maximum is 1,304 for 2005, with an average of 982 firms per year.

We limit our sample to non-financial firms listed on the First and Second Sections of the Tokyo Stock Exchange and exclude financial firms due to the reason that representations of these firms are quite different from non-financial firms. Since most Japanese firms' fiscal year end March 31st, we compute the next year's portfolio returns starting July 1st, while in previous research for the U.S., market portfolio returns were usually computed starting April 1st for firms with a December 31st fiscal year end. In order to align calendar days, we also exclude firms whose fiscal years are not at the end of March, which consists of less than 10 percent of the total sample.

5. Empirical Results

5.1 Basic Observation

In Table 1 we report descriptive statistics for the pooled sample data from fiscal year 1978 through 2008. The average value of abnormal accruals (*ABNAC*) computed from the CFO modified-Jones model (Kasznik, 1999) should be zero since *ABNAC* is the residual term from the regression equation (7). However, note the estimated average value of *ABNAC* is slightly different from zero because of the exclusion of outliers every period as mentioned above. While the estimated standard deviation of earnings (*EBEI*) is relatively low at 2.925, standard deviations of both cash flows from operations (*CFO*) and total accruals (*ACC*) are quite high at 5.672 and 5.144, respectively. We infer that it may be evidence from earnings-smoothing behavior because the earnings are the simple sum of cash flows and total accruals by definition.

Table 2 reports the correlation matrix for cash flows, earnings and their components. The

TABLE 1: DESCRIPTIVE STATISTICS

	Mean	S.D.	1stQu.	Median	3rdQu.
EBEI	2.309	2.925	0.839	2.019	3.702
CFO	5.062	5.672	1.615	4.993	8.442
ACC	-2.753	5.144	-5.797	-2.855	0.201
NAC	-2.748	4.264	-5.315	-2.827	-0.254
ABNAC	-0.004	3.391	-2.052	0.006	2.028

Note: The sample consists of 30,798 firm-years between 1978 and 2008. Firm characteristics are defined as follows: EBEI: earnings before extraordinary items; CFO: cash flows from operations; ACC: total accruals; NAC: normal accruals; ABNAC: abnormal accruals. All variables are divided by total assets at the beginning of the period. Mean, S.D., 1st Qu., Median and 3rd Qu. denote sample means, standard deviations, first quintiles, medians, and third quintiles, respectively.

TABLE 2: CORRELATION MATRIX

	EBEI	CFO	ACC	NAC	ABNAC
EBEI		0.419	0.046	-0.009	0.085
		0.000	*0.000*	*0.125*	*0.000*
CFO	0.430		-0.843	-0.660	-0.416
	0.000		*0.000*	*0.000*	*0.000*
ACC	0.094	-0.858		0.734	0.531
	0.000	*0.000*		*0.000*	*0.000*
NAC	0.000	-0.685	0.756		-0.108
	0.955	*0.000*	*0.000*		*0.000*
ABNAC	0.144	-0.440	0.567	-0.111	
	0.000	*0.000*	*0.000*	*0.000*	

Note: The sample consists of 30,798 firm-years between 1978 and 2008. Firm characteristics are defined as follows: EBEI: earnings before extraordinary items; CFO: cash flows from operations; ACC: total accruals; NAC: normal accruals; ABNAC: abnormal accruals. All variables are divided by total assets at the beginning of the period. The figures in the above diagonal matrix are Spearman's rank correlations and the numbers in below the diagonal matrix are Pearson's correlation. The figures shown in italics in lower cells are corresponding significance probabilities (p-values).

correlation between cash flows (*CFO*) and total accruals (*ACC*) is negative with a very high number of –0.843 for Spearman's rank correlation and even higher with –0.858 for the Pearson correlation. The result may indicate that the higher the cash flows the lower the earning management behavior, for which firm managers and accountants try to boost their corporate earnings. The correlation between cash flows and abnormal accruals is lower at -0.416 and -0.440, respectively. The correlation between normal and abnormal accruals is also low at -0.108 and -0.111, respectively, which indicates that these two components may be proxies for different accrual accounting behavior. In a later sub-section of this paper we present evidence which demonstrates that abnormal accruals contain its unique information in comparison with the other two accruals components. The total accruals (*ACC*) and normal accruals (*NAC*) are highly correlated at 0.734 and 0.756, respectively, and this result reveals the relatively large weight normal accruals have among accruals components.

5.2 *The Result from the Mishkin Test*

The results from the market efficiency test as proposed by both Sloan (1996) and Xie (2001) are

Table 3: Nonlinear Generalized Least Squares Estimation (Mishkin Test) of CFO, ACC, NAC and ABNAC with Respect to One-Year Ahead Earnings and the Rational Market Pricing

Panel A: Market Pricing of Earnings Components with Respect to One-Year Ahead Earnings.

Model 1.

Parameter	Forecast	Valuation
γ_0(Intercept)	0.683	-0.304
γ_1(CFO)	0.647	0.673
γ_2(ACC)	0.625	0.675
β(ERC)	---	2.162

Model 2.

Parameter	Forecast	Valuation
γ_0(Intercept)	0.677	-0.376
γ_1(CFO)	0.656	0.655
γ_2(NAC)	0.639	0.612
γ_3(ABNAC)	0.626	0.746
β(ERC)	---	2.189

Note: Model 1 is first proposed and examined by Sloan (1996) and Model 2 is proposed by Xie (2001), in which total accruals are decomposed into normal and abnormal components. The sample consists of 30,798 firm-years between 1978 and 2008. ERC denotes the estimated earnings response coefficient.

Model 1. (Equation (16))

$$EBEI_t = \gamma_0 + \gamma_1 CFO_{t-1} + \gamma_2 ACC_{t-1} + \nu_t.$$
$$Abnret_t = \beta\ (EBEI_t - \gamma_0^* - \gamma_1^* CFO_{t-1} - \gamma_2^* ACC_{t-1}) + \varepsilon_t.$$

Model 2. (Equation (17))

$$EBEI_t = \gamma_0 + \gamma_1 CFO_{t-1} + \gamma_2 NAC_{t-1} + \gamma_3 ABNAC_{t-1} + \nu_t.$$
$$Abnret_t = \beta\ (EBEI_t - \gamma_0^* - \gamma_1^* CFO_{t-1} - \gamma_2^* NAC_{t-1} - \gamma_3 ABNAC_{t-1}) + \varepsilon_t.$$

Panel B: Tests of Rational Pricing of Components of Earnings

	Null Hypothesis	Likelihood Ratio Statistic	Marginal Significance Level
Model 1.	CFO, ACC ($\gamma_0^*=\gamma_0, \gamma_1^*=\gamma_1, \gamma_2^*=\gamma_2$)	250.431	0.000
Model 2.	CFO, NAC, ABNAC ($\gamma_0^*=\gamma_0, \gamma_1^*=\gamma_1, \gamma_2^*=\gamma_2, \gamma_3^*=\gamma$)	291.470	0.000

Note: Likelihood ratio statistics = $2N \cdot \ln\ (SSR^c\ /\ SSR^u)$ where N is the number of observations, SSR^c, SSR^u are the sum of squared residuals from the constrained regressions in the first stage and unconstrained regressions in the second stage (Mishkin, 1983, p. 19).

reported in Table 3. Model 1 in equation (16) corresponds to the case in which both *CFO* and *ACC* are used and Model 2 in equation (17) corresponds to the case in which all *CFO*, *NAC*, and *ABNAC* variables are used in simultaneously estimating the forecasting and valuation equations. As discussed in the foregoing, the market efficiency condition implies that γ estimates equal to γ^* estimates element by element. Sloan (1996) constructed a null hypothesis in which the persistence of current earnings is decreasing in the magnitude of accruals and increasing in the magnitude of cash flows, which means that estimated γ_1 should be larger than γ_2 and γ_1^* larger than γ_2^* in two equations.

Panel A of Table 3 reports the estimated parameter values in forecasting and valuation equations. In Model 1 the estimated coefficient for γ_1 in the forecasting equation is 0.647 and is larger than 0.625 for γ_2. This indicates that the total accruals series is less persistent than cash flows. Moreover, in the valuation equation γ_2^* is slightly larger than γ_1^* at 0.675 in comparison to 0.673. This suggests that the market overprices accruals information to some extent. These findings are also similar in the case of Model 2, wherein we find that the abnormal accruals variable is the least persistent and the most overpriced (0.746 vs. 0.655 and 0.612) among different specifications of components of the earnings. The latter finding seems to be in accordance with previous findings for U.S. data by Sloan (1996) and Xie (2001).

From Panel B of Table 3 we find that the hypothesis of rational pricing is rejected for our data both for Model 1 and Model 2 with corresponding likelihood ratios and the significance level as shown in Panel B. Accordingly, there is clear evidence against rational pricing for Japanese data similar to previous evidence for U.S data.[8]

Accordingly, if the model framework and the estimation method proposed by Sloan (1996) were indeed appropriate to test the rational pricing of accounting accruals, our results could have successfully demonstrated that abnormal accruals are the least persistent among the components of earnings and the stock market overprices abnormal accruals information for the Japanese market and we overall reject the rational pricing hypothesis.

However, the fundamental query we raise here is whether one-period ahead earnings forecasts can be rationally or even in an adaptive sense, (Sargent 1971) predicted correctly by the use of a single equation AR (1) specification as in equation (13).[9] In other words, we cast doubt whether the pooling of the sample is indeed allowed in the rationality test of accounting earnings numbers.

In order to formally answer this important but not yet explored question for Japanese data we extensively investigate time-series properties of cash flows, earnings, and their components in the next sub-section. Based on this result we then propose a vector autoregressive version of the Mishkin test originally formulated by Mishkin (1983, p.13, lines 11-12) and proceed to test the rational pricing hypothesis.

5.3 Unit-root Tests of Accounting Number Series

In previous empirical accounting literature, the word "persistency" generally meant the estimated time-series regression coefficients of candidate accounting numbers on the lagged one series of the same variable. As was shown by Kormendi and Lipe (1987), if a univariate autoregressive model can better approximate the market expectations of earnings, it leads us to the prediction that the higher the persistency of accounting earnings, the larger the influence of unanticipated changes in earnings upon stock returns.

The upper panel of Table 4 reveals sampling distributions of first order autocorrelation coefficients of earnings, cash flows, total accruals, normal accruals, and abnormal accruals. The results suggest the possible persistency of earnings and their components as follows. As for *EBEI* and *ABNAC*, some of the first order autocorrelations are high and close to 1.0. For example, the 90 percentile estimates for *EBEI* and *ABNAC* are 0.738 and 0.518, respectively, and are much higher than the ones for *CFO*, *ACC*, and *NAC*. Accordingly, from this result the *EBEI* and *ABNAC* series seem more persistent than other three series, as can be also observed from Figure 1.

However, it is also well known that the regression coefficients of the variable on the lagged one variable are downwardly biased from one even when the model is in fact a random walk (Harvey 1981, p. 29). Accordingly, the usual use of the univariate time-series regression coefficients applied to each firm is not recommended, nor can we conclude about the estimated coefficients shown above.

Thus, in order to assess correctly the nature of the stochastic processes of these accounting numbers, we conduct the Augmented Dickey-Fuller test and the corresponding test statistics (*t*-values)

---

[8] Chordia et al. (2010) present evidence that the stock market was somewhat inefficient in the U.S. and recently has become more efficient with respect to the information set including accounting accruals.

[9] Although there may be an omitted variable problem with this specification, we do not deal with this problem in this paper and only investigate the joint time-series properties *per se* of the three variables of our interests, *CFO*, *NAC*, and *ABNAC*.

Table 4: Summary Statistics of Autocorrelation and Dickey-Fuller Statistics

Panel A: Distribution of First Order Auto-Correlation

	EBEI	CFO	ACC	NAC	ABNAC
10%ile	0.053	-0.311	-0.363	-0.529	-0.020
1st Qu.	0.249	-0.170	-0.215	-0.400	0.121
Median	0.452	0.004	-0.049	-0.260	0.267
Mean	0.420	0.008	-0.043	-0.236	0.257
3rd Qu.	0.621	0.186	0.125	-0.092	0.407
90%ile	0.738	0.343	0.294	0.081	0.518

Panel B: Distribution of Dickey-Fuller t Statistics

	EBEI	CFO	ACC	NAC	ABNAC
10%ile	-3.975	-6.543	-6.968	-8.541	-4.716
1st Qu.	-3.152	-5.459	-5.839	-7.330	-3.998
Median	-2.423	-4.394	-4.638	-5.853	-3.255
Mean	-2.491	-4.502	-4.779	-5.989	-3.325
3rd Qu.	-1.786	-3.396	-3.615	-4.533	-2.615
90%ile	-1.206	-2.653	-2.820	-3.548	-2.059
%H_0 Rejected	28.531	82.186	85.238	94.180	57.559

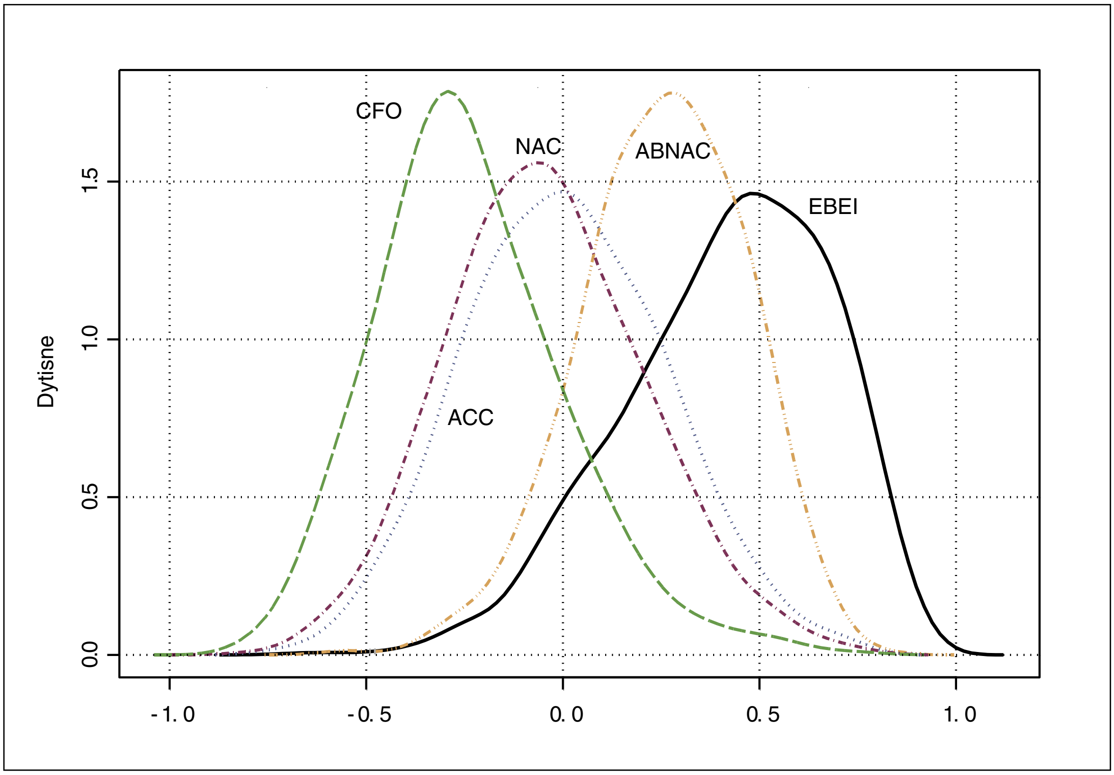
Note: The summary of the estimation results of autocorrelation coefficients and Augmented Dickey-Fuller t statistics with 1,409 sample firms for which the time-series observations for accounting numbers were available for at least 10 consecutive years. The observation years are between 1978 and 2009. CFO is cash flows from operations, ACC is total accruals, NAC is normal accruals, ABNAC is abnormal accruals, and EBEI is earnings after tax and before extraordinary items. '%H_0 Rejected' is the percentage of the firms on which a null hypothesis of unit-root is rejected.

are reported in the lower panel of Table 4. In ADF tests we set the minimum requirement for the number of annual observations for each firm sample at 10, while most of our data had 32 years of observations. We have 1,409 firm samples which satisfy these conditions within our accounting data set. As for earnings, *EBEI*, we find that only in 28.53 percent of the cases the random walk model is rejected, as shown in the upper most to the left bottom row of the table. The results suggest that EBEI series are the most persistent among these five series.[10]

As for abnormal accruals, the same fraction is 57.559 percent, and thus there is a 42.441 percent chance that the underlying model follows a random walk model and a 57.559 percent chance that it follows a mean-reverting process. Hence, this series is the next persistent. Note the mean reversing process is called "less persistent" by the definition of Schipper and Vincent (2003). On the other hand, as for cash flow series, for 82.186 percent of the sample the estimated *t*-values reject the random walk hypothesis, 85.238 percent for accruals, and 94.180 percent for normal accruals, respectively. In sum, we conclude that the latter three series, *CFO*, *ACC*, and *NAC* follow mean-reverting processes with a very high chance. Note among these variables that the most mean-reverting is the normal accruals series. Because accounting deferral or the accrual process has to revert itself most of the time within one period (Francis and Smith, 2005) , this finding is not surprising and also it re-confirms the mechanism which works for the accrual and deferral processes for our data.

[10] It may be the case that possible earnings management causes earnings series to be persistent for Japanese data, whose point we will not explore further in the paper.

Figure 1: Comparison of the Estimated Density Function of First Order Auto-Correlation of EBEI, CFO, ACC, NAC, ABNAC



Note: Non-parametric estimates of the probability density of the first order autocorrelation of earnings, cash flows, total accruals, normal accruals and abnormal accruals are depicted. The observation years are between 1978 and 2009 and there are 1,409 sample firms for which the time-series observations for accounting numbers were available for at least 10 consecutive years.

5.4 Results from the Mishkin Test based on Vector Autoregressive Model

Once we estimate the VAR (1) models for each firm, we are able to test the rational pricing of accounting numbers by the framework proposed by Mishkin (1983, p. 15). If the market prices rationally all the information contained in the components of accounting earnings, the estimated parameters in forecasting equation (20) must coincide with those in valuation equation (21). In this case the null hypothesis H_0 becomes a joint hypothesis that $\Gamma_0 = \Gamma_0^*, \Gamma = \Gamma^*$.

However, before conducting the Mishkin test on the system of equations (20) and (21), we compare estimated parameters in forecasting equation (20) to those in valuation equation (21) as our first diagnosis check. We estimate the system of equations (20) and (21) for each firm which has at least 10 consecutive years of accounting data. The numbers of firms which satisfy this criterion are 1,264. Table 5 reports distributions of estimated parameters in the system of equations (20) and (21). When we compare the median values of parameters in the forecasting and the valuation equation, we find that these are quite similar. However, by reading through the percentile statistics, we find that distributions are more widely dispersed for the valuation equation with its extreme 90 percentile and 10 percentile values larger in absolute values than for the forecasting equation. Figure 2 reports distributions of marginal significance of estimated likelihood ratios as defined by Mishkin (1983,

TABLE 5: DISTRIBUTION OF ESTIMATED PARAMETERS IN THE VAR(1) MODEL

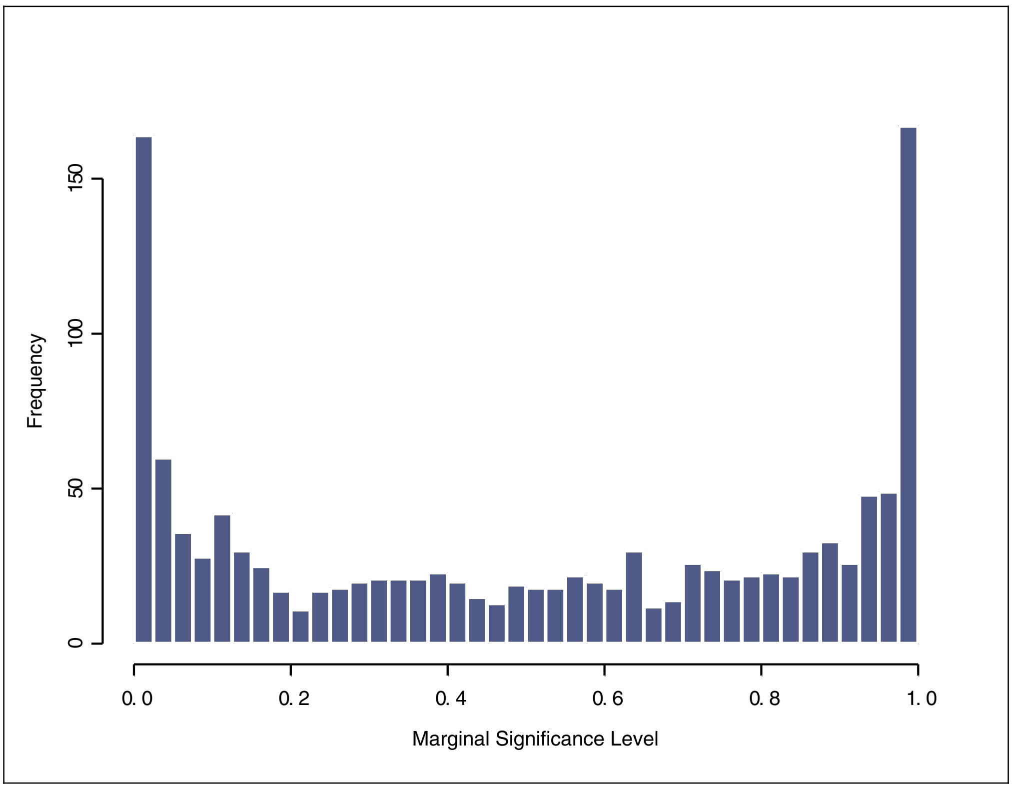
	Panel A: Forecasting Equation						*Panel B: Valuation Equation*					
	10%ile	1st Qu.	Median	Mean	3rd Qu.	90%ile	10%ile	1st Qu.	Median	Mean	3rd Qu.	90%ile
γ_{11}	-0.826	-0.179	0.301	0.259	0.717	1.227	-2.403	-0.860	0.281	0.111	1.371	2.817
γ_{12}	-0.961	-0.290	0.245	0.225	0.783	1.392	-2.956	-1.010	0.247	-0.106	1.388	2.917
γ_{13}	-0.726	-0.092	0.442	0.433	0.995	1.580	-2.689	-0.703	0.518	0.406	1.655	3.149
γ_{21}	-0.351	0.016	0.336	0.385	0.706	1.099	-1.872	-0.435	0.370	0.459	1.229	2.556
γ_{22}	-0.789	-0.361	0.020	0.057	0.401	0.885	-2.028	-0.778	0.090	0.498	1.041	2.683
γ_{23}	-0.947	-0.562	-0.200	-0.143	0.196	0.646	-2.594	-1.044	-0.196	-0.273	0.733	2.286
γ_{31}	-0.722	-0.398	-0.091	-0.132	0.160	0.492	-2.120	-0.812	-0.082	-0.064	0.654	2.017
γ_{32}	-0.438	-0.088	0.222	0.199	0.517	0.900	-1.925	-0.620	0.225	0.050	1.064	2.481
γ_{33}	-0.426	-0.091	0.240	0.195	0.547	0.856	-2.125	-0.629	0.208	0.333	1.036	2.403

Note: We estimate the firm-specific parameters in the VAR (1) forecasting equation (20) and the valuation equation (21) with 1,264 sample firms, for which time-series observations for accounting numbers were available for at least 10 consecutive years. Distributions of the estimates of firm specific parameters Γ in (20) are shown in Panel A and Γ^* in (21) is shown in Panel B.

$$Y_t = \Gamma_0 + \Gamma Y_{t-1} + \nu_t \tag{20}$$

$$r_t - r_t^* = (Y_t - \Gamma_0 + \Gamma Y_{t-1})\beta + \varepsilon_t \tag{21}$$

FIGURE 2: DISTRIBUTION OF MARGINAL SIGNIFICANCE LEVEL OF LR TEST STATISTICS



Note: The number of firms for which we conduct a Mishkin test based on VAR (1) structure is 1,264. The number of firms whose marginal significance level (p-value corresponding to the LR test statistic) is less than 0.05 is 224. It means that for 82.3% of the firms listed in the TSE the rational pricing of accounting numbers is not rejected at the 5% level.

Table 6: Distribution of Estimated Component ERCs

	10%ile	1st Qu.	Median	Mean	3rd Qu.	90%ile	t-value	p-value
β_1 (CFO)	-6.378	-1.866	2.457	2.859	1.371	2.817	---	---
β_2 (NAC)	-8.047	-2.670	2.311	2.908	1.388	2.917	---	---
β_3(ABNAC)	-7.232	-2.060	2.320	2.532	1.655	3.149	---	---
$\beta_1-\beta_2$	-4.314	-2.237	-0.153	-0.050	2.037	4.424	-0.427	0.669
$\beta_1-\beta_3$	-4.903	-2.298	0.116	0.326	2.861	5.762	2.176	0.030
$\beta_2-\beta_3$	-6.936	-3.514	0.258	0.376	3.842	8.251	1.773	0.076

Note: Distributions of the estimates of firm-specific Component ERCs are shown. The lower panel reports the paired t- test statistics (t-value) along with the corresponding probability values (p-value) as well as the sample means and percentile figures of the estimated component ERCs.

p. 19), in which we use p-values to summarize the results. Surprisingly we find that rational pricing cannot be rejected for 82.3 percent of the firm samples at the 5 percent significance level.

Next, Table 6 reports distributions of the "Components ERC" which are defined as the estimated vector valued β in valuation equation (21). Table 6 also reports simple paired t-test results for the differences between estimated βs for each firm in the lower panel. From the upper panel, we find that both median values are 2.457, 2.311, and 2.320, and average values are 2.859, 2.908, and 2.532 with the consecutive sequences of the *CFO*, *NAC*, and *ABNAC* variable, respectively. In comparison with the univariate time-series model case in Table 4 for which ERC was 2.162, we find that Components ERC is larger. More importantly, when we read the percentile numbers of these vector-valued betas, we find that distributions are skewed to the left, and there is more concentration of the probability mass above these high median values.

The lower panel of Table 6 reports the paired t-test results for the differences between components ERC for each firm. From p-values shown in the upper-most right column we find that there is no difference in the size of responses between cash flows and normal accruals in the valuation equation. However, the difference of responses of the valuation equation between cash flows and abnormal accruals is significant at the 5 percent level and the one between the normal and abnormal accruals is significant at the 10 percent level. Accordingly, we infer from these results that market responses to abnormal accruals are somewhat different from ones to cash flows and normal accruals. We further investigate this point and explore how the response to abnormal accruals is different by analyzing impulse response functions in the next section.

6. Impulse Response Function Analysis

Impulse response functions trace the effects of a unit shock to one of the components of earnings onto other components in the VAR. Because we employ a first order vector autoregressive model, the relation between the Y_t and k period lead variable Y_{t+k} is described as in the equation (22). From (22) we see that the unit shock to Y_{t-1} is conveyed through the matrix $\boldsymbol{\Gamma}^k$ and the impulse response function is identical to this $\boldsymbol{\Gamma}^k$.

$$\begin{aligned} Y_t &= \Gamma_0 + \Gamma Y_{t-1} + v_t \\ Y_{t+k} &= \left(I + \sum_{j=1}^{k} \Gamma^{j-1}\right)\Gamma_0 + \Gamma^{k+1} Y_{t-1} + \left(v_{t+k} + \sum_{j=1}^{k} \Gamma^k v_{t+k-j}\right) \end{aligned} \tag{22}$$

Table 7: Distribution of Pearson Correlation Among the Component of Earnings

	10%ile	1st Qu.	Median	Mean	3rd Qu.	90%ile
CFO-ACC	-0.987	-0.972	-0.935	-0.896	-0.865	-0.752
CFO-NAC	-0.874	-0.811	-0.735	-0.708	-0.635	-0.518
CFO-ABNAC	-0.723	-0.619	-0.480	-0.450	-0.313	-0.134
NAC-ABNAC	-0.449	-0.275	-0.101	-0.104	0.080	0.229

Note: The sample means and percentile figures of Pearson moment correlations among cash flows (CFO), normal accruals (NAC), and abnormal accruals are reported for1,409 individual firms for which CFOs, NACs and ABNACs are available for at least 10 consecutive years and Pearson correlations were estimated.

First, as a guide to the intuition of the results, Table 7 shows distributions of Pearson correlations between each paired variable. This is the result computed from individual data rather than results from pooled data that we previously reported in Table 2, where we criticized the use of pooled data. It is noteworthy that cash flows and total accruals have strongly negative correlations with median value -0.935. Cash flows and normal accruals are also strongly and negatively correlated with -0.735. Although somewhat weaker, cash flows and abnormal accruals are also negatively correlated with -0.480. In addition, we find that the correlation between normal and abnormal accruals is close to zero (mean -0.104 and median -0.101).

The final Table 8 reports the result from estimated impulse response functions, and Figure 3 depicts oscillation and convergence patterns of these response functions over time. As for the persistence of shocks, from Panel A and Figure 3 we find that cash flows shocks diminish rather slowly (onto *CFO*, the median is 0.301 in year 1 and 0.163 in year 2 and so forth). Also, from Panel B and C and Figure 3, we find that the shock from abnormal accruals takes a shorter time to decay, but takes longer than the shock from normal accruals.

As for the prediction of abnormal accrual, we find the current increase of cash flows increase abnormal accruals in the next year as shown in median values (0.442 in year 1 and 0.111 in year 2). On the other hand, the current increase in normal accruals will result in a decrease of abnormal accruals in the next year (-0.200 in year 1). Because we know that cash flows and normal accruals are strongly and negatively correlated (-0.735), when the cash flows amount is increased, the abnormal accruals amount will be increased in a following year, and the concurrent decrease of normal accruals may further amplify the amount of abnormal accruals in relative terms. On the other hand, for the reason the autocorrelations of abnormal accruals may become high as was the case for cash flows, because these numbers are negatively and highly correlated, and the dissipation of abnormal accruals shocks takes time.

Table 9 reports the results from our simulation experiments for 100 years based on our VAR estimates obtained for each firm. Here we report distributions of the first order autocorrelations computed from simulation paths for all sample firms. We find that the VAR (1) model we have estimated above indeed succeeded in replicating well the actual autocorrelation coefficients reported in Table 4. For example, median values of earnings are 0.452 (Table 4) vs. 0.508 (Table 9); cash flows, 0.004 vs. 0.282; total accruals, -0.049 vs. 0.230; normal accruals, -0.260 vs. 0.073; and finally, abnormal accruals, 0.267 vs. 0.367.

These simulation results confirm that our initially estimated VAR model, which was never conducted for Japanese data at individual firm levels for such a long series, can indeed well replicate actual time-series distributions at the univariate level for cash flows, earnings, and components of earnings, which in fact support rational pricing of accounting data for Japan. Thus, we find that our estimation results and the tests of hypotheses are robust, and the evidence supports market efficiency

Table 8: Distribution of Impulse Response Up to 10 Years

Panel A: Impulse Response From CFO

To:		Year 1	2	3	4	5	6	7	8	9	Year 10
	25%ile	-0.179	-0.106	-0.048	-0.008	-0.010	-0.002	-0.003	-0.001	-0.001	0.000
CFO	Median	0.301	0.163	0.094	0.063	0.026	0.018	0.007	0.005	0.002	0.001
	75%ile	0.717	0.450	0.303	0.215	0.140	0.105	0.069	0.048	0.033	0.025
	25%ile	-0.290	-0.116	-0.015	-0.026	-0.005	-0.006	-0.001	-0.002	0.000	0.000
NAC	Median	0.245	0.113	0.107	0.040	0.031	0.011	0.008	0.003	0.002	0.001
	75%ile	0.783	0.417	0.328	0.183	0.147	0.088	0.070	0.042	0.034	0.020
	25%ile	-0.092	-0.096	-0.054	-0.021	-0.008	-0.004	-0.003	-0.002	-0.001	0.000
ABNAC	Median	0.442	0.111	0.063	0.041	0.025	0.012	0.006	0.003	0.002	0.001
	75%ile	0.995	0.430	0.264	0.196	0.136	0.086	0.058	0.040	0.028	0.018

Panel B: Impulse Response From NAC

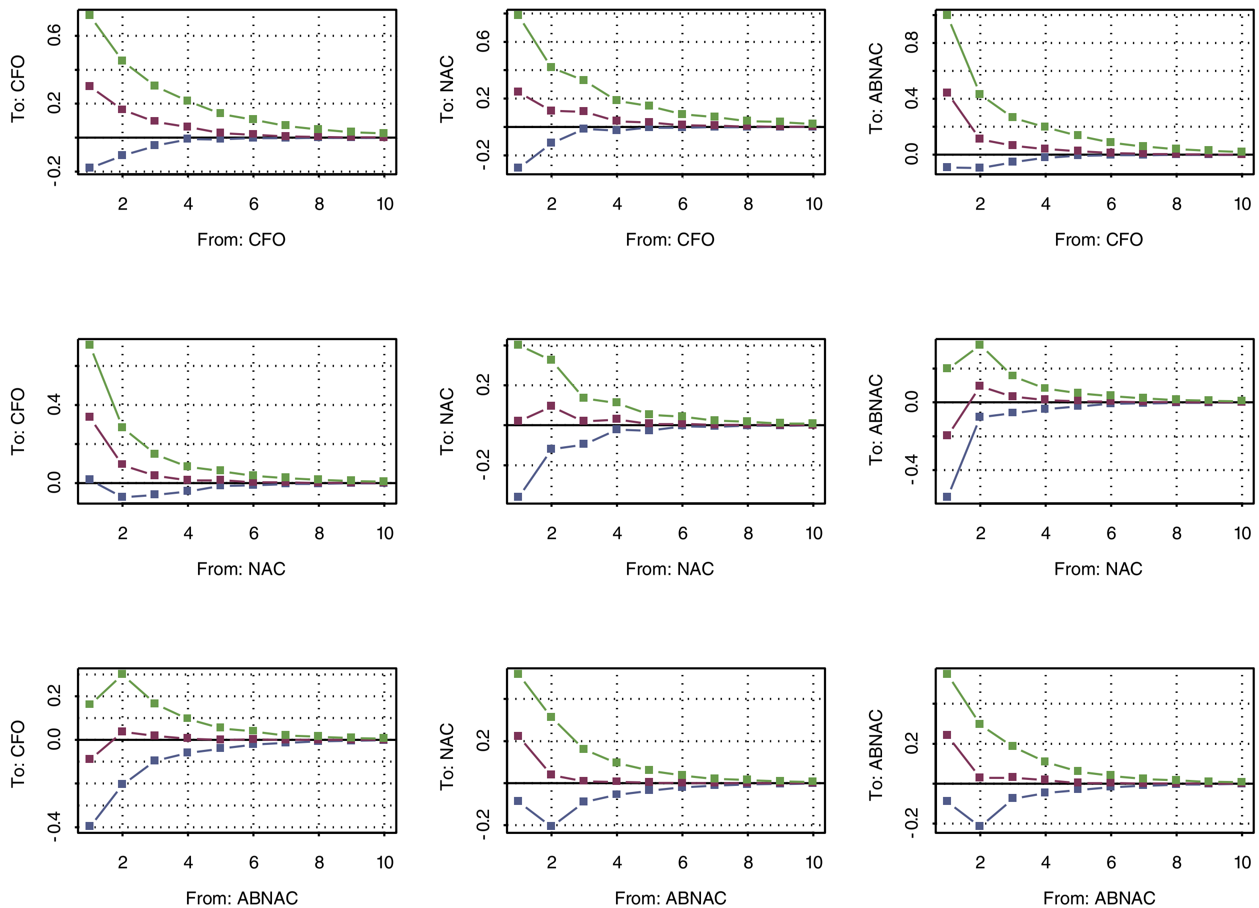
To:		Year 1	2	3	4	5	6	7	8	9	Year 10
	25%ile	0.016	-0.074	-0.061	-0.043	-0.014	-0.012	-0.005	-0.004	-0.001	-0.001
CFO	Median	0.336	0.092	0.038	0.013	0.014	0.004	0.003	0.001	0.001	0.000
	75%ile	0.706	0.283	0.147	0.083	0.062	0.036	0.026	0.015	0.011	0.006
	25%ile	-0.361	-0.121	-0.096	-0.022	-0.027	-0.005	-0.008	-0.002	-0.003	-0.001
NAC	Median	0.020	0.093	0.018	0.029	0.005	0.007	0.002	0.002	0.000	0.000
	75%ile	0.401	0.325	0.134	0.111	0.053	0.043	0.024	0.017	0.009	0.008
	25%ile	-0.562	-0.087	-0.064	-0.040	-0.023	-0.009	-0.006	-0.003	-0.002	-0.001
ABNAC	Median	-0.200	0.094	0.034	0.014	0.007	0.005	0.002	0.001	0.000	0.000
	75%ile	0.196	0.338	0.155	0.081	0.055	0.038	0.023	0.015	0.010	0.006

Panel C: Impulse Response From ABNAC

To:		Year 1	2	3	4	5	6	7	8	9	Year 10
	25%ile	-0.398	-0.205	-0.095	-0.060	-0.040	-0.022	-0.014	-0.006	-0.004	-0.002
CFO	Median	-0.091	0.037	0.019	0.006	0.000	0.001	0.000	0.000	0.000	0.000
	75%ile	0.160	0.300	0.166	0.096	0.054	0.038	0.020	0.015	0.008	0.006
	25%ile	-0.088	-0.207	-0.090	-0.056	-0.036	-0.019	-0.011	-0.006	-0.004	-0.002
NAC	Median	0.222	0.039	0.008	0.006	0.003	0.001	0.001	0.000	0.000	0.000
	75%ile	0.517	0.312	0.160	0.095	0.060	0.036	0.020	0.015	0.009	0.006
	25%ile	-0.091	-0.217	-0.076	-0.047	-0.032	-0.018	-0.011	-0.006	-0.003	-0.002
ABNAC	Median	0.240	0.029	0.030	0.017	0.003	0.002	0.001	0.001	0.000	0.000
	75%ile	0.547	0.295	0.185	0.108	0.060	0.039	0.023	0.016	0.009	0.007

Note : Based on the firm-specific estimates of the transition matrix Γ in the VAR(1) forecasting equation (20), we compute the impulse responses from the current period one unit shock in the component of earnings to itself and other components in future periods. The number of firm samples is 1,264, and 25 percentile, median and 75 percentile numbers are reported.

FIGURE 3: DISTRIBUTION OF IMPULSE RESPONSE



Note: Impulse responses of the CFO, NAC, and ABNAC variables triggered by a unit shock of each variable, respectively, in the system of estimated VAR equations.

TABLE 9: SUMMARY STATISTICS OF THE FIRST ORDER AUTOCORRELATION COMPUTED FROM SIMULATED SAMPLE PATHS

Distribution of First Order Auto-Correlation					
	EBEI	CFO	ACC	NAC	ABNAC
10%ile	0.052	-0.269	-0.335	-0.418	-0.058
1st Qu.	0.294	-0.021	-0.079	-0.186	0.138
Median	0.508	0.282	0.230	0.073	0.367
Mean	0.455	0.257	0.197	0.067	0.348
3rd Qu.	0.672	0.570	0.505	0.318	0.584
90%ile	0.802	0.749	0.697	0.557	0.752

Note: Based on firm-specific estimates of transition matrix Γ in the VAR (1) forecasting equation (20), we simulate the forecasting model for each firm and re-compute the first order autocorrelation of earnings and its components from these simulated paths. Sample means and percentile figures of 1,264 firms are shown in the table.

of components of earnings information for Tokyo Stock Exchange firms.

7. Conclusion

This paper investigates how the information content contained in components of earnings numbers is impounded into stock prices and provides new evidence on the market efficiency for the firm sample listed on the Tokyo Stock Exchange. First, we conduct a conventional pooled Mishkin test to examine whether stocks are rationally priced, and suggest how this particular test result can be misleading if we erroneously pool the data for the entire sample period by disregarding time-series properties of accounting numbers. Next, we conduct time-series analyses on the properties of components of accounting numbers and cast doubt on the forecasting equation used in conventional Mishkin tests, a first in the accounting literature for Japanese data. Then we employ a vector autoregressive model approach and proposed a new framework to test rational pricing of accounting information. We find that for 82% of the firms listed on the Tokyo Stock Exchange, the hypothesis of rational pricing is not rejected. This implies that the pooled estimation of the forecasting equation, which disregards the interacting structure among the value-relevant variables, may lead us to incorrect inferences about the degree of information efficiency in the Japanese capital market. The paper also reconfirms the robustness of our estimates by conducting simulations for 100 years.

REFERECENCES

ALI, A., AND P. ZAROWIN. 1992. Permanent versus transitory components of annual earnings and estimation error in earnings response coefficients. *Journal of Accounting and Economics* 15 (June/September): 249-264.

BERNARD, V. L., AND J. K. THOMAS. 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* 13 (December): 305-340.

CHAN, K., N. JEGADEESH, AND T. SOUGIANNIS. 2004. The accrual effect on future earnings. *Review of Quantitative Finance and Accounting* 22 (March): 97-121.

CHORDIA, T., A. SUBRAHMANYAM, AND Q. TONG. 2010. Trends in cross-section of expected stock returns. *Paper presented at 2010 Australasian Finance and Banking Conference*.

COCHRANE, J. 2001. *Asset Pricing.* Princeton, NJ: Princeton University Press.

DECHOW, P. M., R. G. SLOAN, AND A. P. SWEENEY. 1995. Detecting earnings management. *The Accounting Review* 70 (April): 193-225.

DEFOND, M. L., AND J. JIAMBAMBALVO. 1994. Debt covenant violation and manipulation of accruals: Accounting choices in troubled companies. *Journal of Accounting and Economics* 17 (January): 145-176.

FAMA, E. F. 1970. Efficient capital markets: A review of theory and empirical work. *The Journal of Finance* 25 (May): 383-417.

FAMA, E. F., AND K. R. FRENCH. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33 (February): 3-56.

FRANCIS, J., AND M. SMITH. 2005. A reexamination of the persistence of accruals and cash flows. *Journal of Accounting Research* 43 (June): 413-451.

FRANKEL, R., AND C. LEE. 1998. Accounting valuation, market expectation, and the book-to-market effect. *Journal of Accounting and Economics* 25 : 209-234 .

FREEMAN, R., J. OHLSON, AND S. PENMAN. 1982. Book-rate-of return and prediction of earnings changes: An empirical investigation. *Journal of Accounting Research* 20 : 3-42.

HAMILTON, J. A. 1994. *Time Series Analysis*. Princeton, NJ: Princeton University Press.

HANSEN, L. P., AND T. J. SARGENT. 1980. Formulating and estimating dynamic linear rational expectations models. *Journal of Economic Dynamics and Control* 2: 7-46.

HARVEY, A. 1981. *The Econometric Analysis of Time Series*. Hertfordshire, UK: Philip Allan.

JAGANNATHAN, R., K. KUBOTA, AND H. TAKEHARA. 1998. Relationship between labor-income risk and average return: Empirical evidence from the Japanese stock market. *The Journal of Business* 71 (July): 319-347.

KASZNIK, R. 1999. On the association between voluntary disclosure and earnings management. *Journal of Accounting Research* 37 (Spring): 57-81.

Kormendi, R., and R. Lipe. 1987. Earnings innovations, earnings persistence, and stock returns. *The Journal of Business* 60 (July): 323-345.

KUBOTA, K., K. SUDA, AND H. TAKEHARA. 2009. Common risk factors vs. mispricing factor of Tokyo Stock Exchange firms: Inquiries into the fundamental price derived from analysts' earnings forecasts. *International Review of Finance* 9 (September) : 269-294.

KUBOTA, K., K. SUDA, AND H. TAKEHARA. 2010. Dissemination of accruals information, role of semi-annual reporting, and analysts' earnings forecasts: Evidence from Japan. *Journal of International Financial Management and Accounting* 21 (Summer): 120-160.

KRAFT, A., A. LEONE, AND C. WASLEY. 2007. Regression-based tests of the market pricing of accounting numbers: The Mishkin test and ordinary least squares. *Journal of Accounting Research* 45 (December): 1081-1114.

LAKONISHOK, J., A. SHLEIFER, AND R. VISHNY. 1994. Contrarian investment, extrapolation and risk. *The Journal of Finance* 49: 1541-1578 .

LEHMANN, B. N. 1991. Asset pricing and intrinsic values: A review essay. *Working Paper*, NBER.

LIPE, R. 1990. The relation between stock returns and accounting earnings given alternative information. *The Accounting Review* 65 (January): 49-71.

LIPE, R., AND R. KORMENDI. 1994. Mean reversion in annual earnings and its implications for security valuation. *Review of Quantitative Finance and Accounting* 4: 27-46.

MISHKIN, F. S. 1983. *A Rational Expectations Approach to Macroeconometrics: Testing Policy Ineffectiveness and Efficient-Markets Models*. Chicago, IL: University of Chicago Press.

SARGENT, T. J. 1973. Rational expectations, the real rate of interest, and the natural rate of unemployment. *Brookings Paper on Economic Activity* 2: 429-480.

SCHIPPER, K., AND L. VINCENT. 2003. Earnings quality. *Accounting Horizons* 17 (Supplement): 97-110.

SHLEIFER, A. 2000. *Inefficient Markets: An Introduction to Behavioral Finance*. Oxford, UK: Oxford University Press.

SLOAN, R. G. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* 71 (July) : 289-318.

TEETS, W. R., AND C. E. WASLEY. 1996. Estimating earnings response coefficients: Pooled versus firm-specific models. *Journal of Accounting and Economics* 21 (June): 279-295.

XIE, H. 2001. The mispricing of abnormal accruals. *The Accounting Review* 76 (July): 357-373.