THE JAPANESE ACCOUNTING REVIEW
VOLUME 6
2016

Market-Wide Cost of Capital Impacts on the Aggregate Earnings-Returns Relation: Evidence from Japan*

YUTO YOSHINAGA†

Graduate School of Commerce and Management,
HITOTSUBASHI UNIVERSITY

ABSTRACT

This study aims to clarify the mechanism of the surprising earnings-returns relation observed at the aggregate level by offering evidence from Japan. Unlike firm-level evidence, recent Macro-Accounting research reports that when earnings changes and stock returns of individual firms are cross-sectionally aggregated, a significantly positive relation cannot be observed in the U.S. market. To explain this puzzling finding, Kothari et al. (2006) propose a hypothesis that negative effects of changes in the market-wide cost of capital cancel out positive effects of aggregate earnings changes on aggregate stock returns. Although this hypothesis is empirically supported in the U.S market, the validity of this hypothesis has not been sufficiently investigated in the Japanese market. Thus, we test the hypothesis and find it robustly supported in Japan. Our results show that positive effects of aggregate earnings changes on aggregate stock returns are canceled out by the effects of the market-wide cost of capital. We also find

* Acknowledgements: I would like to convey my gratitude to Hidetoshi Yamaji, the editor in chief of The Japanese Accounting Review and two anonymous reviewers for providing insightful comments. I am grateful for helpful advice from Toyohiko Hachiya, Makoto Nakano, and my colleagues at Hitotsubashi University. I also thank Souhei Ishida, Tetsuyuki Kagaya, Tomohiro Suzuki, Yusuke Takasu at the 12th Youth Academic Seminar, Konari Uchida at Japan Finance Association Finance Camp 2015, Hiroyuki Ishikawa, Takuma Kochiyama, Shoichi Tsumuraya, Tatsushi Yamamoto at the 74th Japan Accounting Association Annual Conference, Simone Kelly, Yoshinori Shimada at the 27th Asian-Pacific Conference on International Accounting Issues, Keishi Fujiyama, Akinobu Shuto at the 5th International Conference of The Japanese Accounting Review, Masato Hirota, Hyonok Kim, Kiichiro Kojima, Akira Mizobuchi, Katsuhiko Muramiya, Noriyoshi Yanase, Yukihiro Yasuda, Yasushi Yoshida at the 31st TKU Finance Research Center Research Workshop, and all the participants at these conferences for beneficial comments. These names are written in alphabetical order of family names and in chronological order of the conferences' dates. I appreciate Grant-in-Aid for Research Fellows of the Japan Society for the Promotion of Science (JSPS KAKENHI Grant number 15J00015) and financial supports by the Graduate School of Commerce and Management, Hitotsubashi University. All possible errors in this paper are my own.
† Corresponding Author. *Address* Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8601, JAPAN. *Telephone* +81-42-580-8000 *E-mail* cd151004@g.hit-u.ac.jp

Received October 31, 2015; accepted November, 9, 2016; available online December 27, 2016 (Advance publications by J-STAGE)
DOI: 10.11640/tjar.6.2016.04

that these canceling effects stem from the market risk premium in Japan. An additional test we conduct shows that expected aggregate earnings changes and changes in the market risk premium are not negatively related. This result indirectly supports the hypothesis proposed by Kothari et al. (2006), because it undermines the competing hypothesis proposed by Sadka and Sadka (2009). These results should contribute to the related research areas, Macro-Accounting and accounting research on the cost of capital.

JEL Classification: E44, G12, G14, M41
Keywords: aggregate earnings, earnings-returns relation, cost of capital, market risk premium

1. Introduction

This study aims to clarify the mechanism of the surprising earnings-returns relation observed at the aggregate level by offering evidence from Japan. In the traditional accounting and finance research, many researchers have studied the relation between accounting earnings and stock returns, beginning with Ball and Brown (1968). In this stream of research, a robust positive relation between earnings changes and contemporaneous stock returns is observed at the firm level[1] (Ball and Sadka 2015). Earnings changes are often regarded as earnings surprises.[2] Positive (negative) earnings surprises indicate that reported earnings are higher (lower) than expected and earnings are financial resources for payout. Thus, investors will increase (decrease) the expected cash flows from stocks of the firm and trade them based on their modified expectations. This results in a positive earnings-returns relation at the firm level.[3]

Turning our attention to recent studies, there is a new and growing research area called Macro-Accounting. According to Konchitchki (2016a), there are two typical Macro-Accounting areas, "Macro-to-Micro" and "Micro-to-Macro." The former research area, "Macro-to-Micro," tackles how various types of macroeconomic information affect or improve the firm-level prediction of future performance or stock valuation (e.g., Konchitchki 2011, 2013; Li et al. 2014; Williams 2015; Konchitchki et al. 2016). "Micro-to-Macro," the latter research area, focuses on how accounting contributes to informing and predicting various macroeconomic aspects (e.g., Shivakumar 2007; Arif and Lee 2014; Shivakumar and Urcan 2014; Konchitchki and Patatoukas 2014a, b, 2016a, b; Gallo et al. 2016; Konchitchki 2016b).

"Micro-to-Macro" research often investigates information contents of cross-sectionally aggregated earnings of listed firms. Following this research stream, we focus on the informational role of these "aggregate earnings" in the capital market. Let us consider the following question: when earnings changes and stock returns of individual firms are cross-sectionally aggregated, what relation would be observed between aggregate earnings changes and aggregate stock returns? These aggregate-level variables represent general trends of all listed firms in the market.

---

1 We describe "contemporaneous" variables as variables at the earnings announcement period in this paper.

2 Assuming that expected earnings at the current period are equal to realized earnings at the previous period ($E_{t-1}[earn_t] = earn_{t-1}$), earnings surprises at the current period become equal to the earnings changes at the current period ($UE_{t-1}[earn_t] = \Delta earn_t \because UE_{t-1}[earn_t] = earn_t - E_{t-1}[earn_t], \Delta earn_t = earn_t - earn_{t-1}$).

3 We use the description "earnings-returns relation" as the relation between earnings changes and corresponding stock returns at earnings announcement periods.

When positive (negative) aggregate earnings changes are observed, listed firms will generally experience a rise (drop) in performance. Subsequently, the economic impacts of positive (negative) firm-level earnings surprises should be dominant in the market, resulting in higher (lower) stock prices. According to this logic, a positive earnings-returns relation should also be observed at the aggregate level.

However, recent U.S. Macro-Accounting studies, such as Kothari et al. (2006) (referenced as KLW henceforth), present evidence contrary to this prediction. By running a simple regression, they report that a significantly positive earnings-returns relation cannot be detected at the aggregate level.[4] Furthermore, they indicate that even a significantly negative relation can be observed. Several other U.S. studies report that the observed aggregate earnings-returns relation is not significantly positive in a simple regression or in a pairwise correlation[5] (KLW; Anilowski et al. 2007; Bali et al. 2008; Hirshleifer et al. 2009; Sadka and Sadka 2009; Uysal 2010; Patatoukas 2014; Gallo et al. 2016; Konchitchki 2016a).

To clarify this puzzling earnings-returns relation, KLW develop a hypothesis based on omitted variable bias. KLW suppose that investors generally increase (decrease) the discount rate when aggregate earnings changes are positive (negative). If this hypothesis is correct, positive effects of aggregate earnings changes on contemporaneous aggregate stock returns will be concealed by negative effects of changes in the contemporaneous discount rate. The discount rate is the cost of capital (Brealey et al. 2014), so KLW assume that negative effects of changes in the market-wide cost of capital cause the negative aggregate earnings-returns relation.

Although several prior U.S. studies empirically support this hypothesis (e.g., Patatoukas 2014), the validity of this hypothesis in the Japanese market has not been sufficiently investigated. He and Hu (2014) is the only study that investigates whether some components of the market-wide cost of capital affect the aggregate earnings-returns relation outside the U.S. market. They reveal that the aggregate earnings-returns relation does not change after controlling for contemporaneous changes in interest rates and inflation in non-U.S. markets, which differs from the U.S. evidence (Uysal 2010; Gallo et al. 2016). However, it is still not clear whether the market-wide cost of capital cancels out the positive aggregate earnings-returns relation in the Japanese stock market for three reasons. First, He and Hu (2014) do not consider the market risk premium in their analysis. In other words, they do not control for all the necessary variables in their regression model. Second, their evidence is for the average non-U.S. market, and not for a specific stock market. This is because He and Hu (2014) use a pooled regression of country/year observations. Third, He and Hu (2014) use only annual data, although quarterly data provide more precise results because of the shorter window of returns. Accounting for these points, we test the KLW hypothesis using Japanese quarterly data based on the research design of Patatoukas (2014), whose regression models contain all components of the market-wide cost of capital. This research design also clarifies whether and which components bias the aggregate earnings-returns relation in the Japanese market.

Our results fulfill three requirements for the KLW hypothesis. First, aggregate earnings

---

[4] We also observe an insignificant and negative aggregate earnings-returns relation in the Japanese stock market by running a simple regression, as shown in Table 3.

[5] Despite a robust positive earnings-returns relation at the firm level (the micro level), a positive earnings-returns relation cannot be detected at the aggregate level (the macro level) when running a simple regression. This puzzling earnings-returns relation is referred to as the "Micro-Macro-Puzzle" in Japan (Nakano 2012, 2014; Yoshinaga 2016).

changes are significantly positively related to contemporaneous changes in the market-wide cost of capital. Second, the latter have a significantly negative relation with aggregate stock returns. Third, a significantly positive aggregate earnings-returns relation appears only after controlling for contemporaneous changes in the market-wide cost of capital. These results show that contemporaneous changes in the market-wide cost of capital cause a puzzling aggregate earnings-returns relation in the Japanese market. In addition, when we decompose the market-wide cost of capital, we find that only contemporaneous changes in the market risk premium affect the relation, while those in the other components do not.

Sadka and Sadka (2009) (referenced as SS henceforth) develop a competing hypothesis regarding the aggregate earnings-returns relation. To confirm the validity of the KLW hypothesis in Japan, we also investigate the SS hypothesis. The SS hypothesis is composed of two arguments. One is an argument relating to the high predictability of aggregate earnings and the other relates to investors' attitudes toward risk. Our main results undermine the former argument, because they show that aggregate earnings changes convey positive cash-flow news to investors during earnings announcement periods. On the other hand, we do not obtain implications on the latter argument from our main tests. Thus, we investigate the latter argument with an additional test and show results inconsistent with the argument. Consequently, our main and additional results indirectly support the validity of the KLW hypothesis, because they are not consistent with both arguments of the competing hypothesis proposed by SS.

This study makes two contributions to a related research area called Macro-Accounting, and specifically to the research area of the aggregate earnings-returns relation. This study is the first that supports KLW hypothesis outside the U.S. market, as far as we know. "Studies of aggregate earnings tend to be U.S. centric in their focus (Shivakumar 2010, p.339)" and the external validity of the KLW hypothesis is not proven yet. We show that the KLW hypothesis explains the aggregate earnings-returns relation in the Japanese market. Thus, this study contributes to expanding the external validity of the hypothesis. As the second contribution, our results suggest the importance of focusing on an argument regarding investors' risk-avoidance in the SS hypothesis, although prior studies supporting the SS hypothesis mainly focus on the other argument regarding the higher predictability of aggregate earnings (Ball et al. 2009; He and Hu 2014). Our results suggest that showing predictability is insufficient to support the SS hypothesis.

Our study also contributes to the stream of accounting research regarding the cost of capital in two ways. First, we confirm that accounting information is related to the cost of capital at the aggregate level. Recent studies on the cost of capital show that accounting information is useful to investors' decision making, and is therefore related to the firm-level cost of capital (e.g., Francis et al. 2004; Barth et al. 2013; Konchitchki et al. 2016). We confirm that the relation between accounting information and cost of capital in the Japanese market exists, even at the aggregate level. Second, our results indicate the strength of the market-wide cost of capital's impacts and identify the component that produces the impacts in the Japanese market. Our results show that these impacts are so strong that the positive effects of aggregate earnings changes on aggregate stock returns are canceled out. We also find that these impacts stem from the market risk premium, not risk-free rates or expected inflation. These findings improve our understanding of the economic impacts of the market-wide cost of capital in the Japanese capital market.

Additionally, our results have an implication for future international research. He and Hu (2014) report that interest rates and inflation do not affect the aggregate earnings-returns relation outside the U.S. market. However, they do not consider the market risk premium. To reveal the mechanism of the aggregate earnings-returns relation, this study suggests that future international research should consider the effects of the market risk premium.

This study proceeds as follows. Section 2 summarizes related studies and introduces the KLW hypothesis. Our research design is provided in Section 3. Sample selection, correlation matrix, and descriptive statistics are described in Section 4. Section 5 details our empirical results and interpretations. Finally, Section 6 concludes this study.

2. Prior studies and research question

2.1. Macro-Accounting, the related research area

In this subsection, we present information on a research area called Macro-Accounting and explain how this study is related to this area. Recently, Konchitchki (2016a) introduced a new and growing research area called Macro-Accounting. Konchitchki (2016a, p.27) stated, "This new research area focuses on addressing real-life world problems using the value added that accounting can bring to various macro-level topics that are at the forefront of the academic and professional discussions." To understand this area deeply, he proposes two types of Macro-Accounting research:[6] "Macro-to-Micro" and "Micro-to-Macro." We first summarize prior Macro-Accounting studies in line with his classification.

The first research area, described as "Macro-to-Micro," investigates how various types of macroeconomic information affect or improve the firm-level prediction of future performance or stock valuation. For example, Konchitchki (2011, 2013) shows that considering the effects of inflation on the accounting figures of individual firms helps to predict their future cash flows and improves their stock valuations. Li et al. (2014) reveal that combining firm-level exposures with countries and their forecasted economic performance is useful to predict the profitability of individual firms. Williams (2015) indicates that investors respond more strongly to bad earnings news than good earnings news when the recent macro economy is more uncertain. He also finds that this asymmetric response becomes stronger when stocks have higher sensitivity to macro-uncertainty. Konchitchki et al. (2016) report that earnings downside risk, which is related to sensitivity to macroeconomic shock, captures incremental risk information that other risk variables do not contain. They show that earnings downside risk has an incremental ability to explain subsequent stock returns.

On the other hand, the latter research stream called "Micro-to-Macro" focuses on how accounting contributes to informing and predicting various macroeconomic aspects. For example, Shivakumar (2007), Shivakumar and Urcan (2014), Konchitchki and Patatoukas (2014a), and Gallo et al. (2016) propose evidence that aggregate earnings contain various aspects of the future macro economy (e.g., real and nominal GDP growth, inflation, and monetary policy). Some recent research aggregates firm-level earnings in unique ways. Konchitchki (2016b) aggregates earnings changes at the regional level. He finds that regional-level profitability conveys timely information on the valuation of real estate and stock returns of Real Estate Investment Trusts (REIT). Konchitchki and Patatoukas (2014b, 2016a, b) aggregate earnings information of only the largest firms to propose a cost-effective aggregating method. They show that their cost-

[6] Konchitchki (2016a) recognizes that there are other Macro-Accounting studies that do not belong to the two types of research. He calls such research "other Macro-Accounting."

effective aggregate earnings are useful to nowcast and forecast GDP growth. In addition to earnings information, Arif and Lee (2014) report that higher aggregate investment predicts lower corporate profitability and economic growth.

We investigate the earnings-returns relation at the aggregate-level. We believe that this kind of research is related to the latter stream, because the issues of whether aggregate earnings are informative and what they inform are discussed by investigating the relation. Prior studies report that a significantly positive earnings-returns relation cannot be observed at the aggregate level. As an interpretation of this result, KLW argue that aggregate earnings changes convey two kinds of news (i.e., cash-flow news and discount-rate news), although SS argue that they are not informative due to their high predictability. In addition, the discount rate in this context is closely related to the macro economy, because it affects all stock prices in the market. Thus, our study belongs to the latter stream of Macro-Accounting research.

2.2. The explanation of the KLW hypothesis on the aggregate earnings-returns relation

Unlike firm-level evidence, the aggregate earnings-returns relation is not significantly positive. Some existing studies report that even a negative earnings-returns relation can be observed at the aggregate level. To explain why such a surprising relation can be observed, KLW propose a hypothesis based on omitted variable bias. In this subsection, we explain the KLW hypothesis. Hecht and Vuolteenaho (2006) present a formula in which three components explain realized returns, based on Campbell (1991) who decomposes unexpected returns into two components.

$$r_t \approx E_{t-1}[r_t] + (E_t - E_{t-1})\left[\sum_{i=0}^{\infty} \rho^i \Delta d_{t+i}\right] - (E_t - E_{t-1})\left[\sum_{j=1}^{\infty} \rho^j r_{t+j}\right]$$

$$= E_{t-1}[r_t] + N_{CF,t} - N_{DR,t} \quad (1)$$

r_t is the realized log return at period t. E_{t-1} is the expectation operator with expectations conditional on the information available at the end of period t-1 (the beginning of period t). Thus, $E_{t-1}[r_t]$ denotes stock return at period t expected at the end of period t-1. $(E_t - E_{t-1})[X]$ represents the modified expectation for X based on the news released at period t. Δd_t is the log dividend growth at period t. ρ is the inverse of 1 plus the dividend yield ($\rho < 1$). Consequently, $(E_t - E_{t-1})\left[\sum_{i=0}^{\infty} \rho^i \Delta d_{t+i}\right](= N_{CF,t})$ means the modified expectation for subsequent dividend growth, which is caused by "cash-flow news." Further, $(E_t - E_{t-1})\left[\sum_{j=1}^{\infty} \rho^j r_{t+j}\right]\left(= N_{DR,t}\right)$ is the modified expectation for the subsequent cost of capital, which is caused by "discount-rate news."[7] Next, we split earnings changes into expected earnings changes ($E_{t-1}[\Delta earn_t]$) and unexpected earnings changes (earnings surprises: $UE_{t-1}[\Delta earn_t]$).

$$\Delta earn_t = E_{t-1}[\Delta earn_t] + UE_{t-1}[\Delta earn_t] \quad (2)$$

[7] Though Hecht and Vuolteenaho (2006) denote $(E_t - E_{t-1})\left[\sum_{j=1}^{\infty} \rho^j r_{t+j}\right]$ as "expected-return news," we describe it as news on "cost of capital," because expected return is normally equal to cost of capital in the efficient market. If the expected return of a security is higher (lower) than its cost of capital, investors will be eager to buy (sell) the security. Then the security price will move upward (downward) until the expected return becomes equal to the cost of capital.

Substituting $\Delta earn_t$ into $E_{t-1}[\Delta earn_t] + UE_{t-1}[\Delta earn_t]$ in Equation 1 and deleting uncorrelated terms in the definition, [8] we can rewrite the earnings-returns relation ($cov(r_t, \Delta earn_t)$) in the following way.

$$cov(r_t, \Delta earn_t) \approx cov(E_{t-1}[r_t], E_{t-1}[\Delta earn_t]) \\ + cov\big(N_{CF,t}, UE_{t-1}[\Delta earn_t]\big) - cov\big(N_{DR,t}, UE_{t-1}[\Delta earn_t]\big) \tag{3}$$

In Equation 3, the earnings-returns relation is decomposed into three components: (1) the relation between expected earnings changes and expected returns ($cov(E_{t-1}[r_t], E_{t-1}[\Delta earn_t])$), (2) the relation between earnings surprises and contemporaneous modified expectation for subsequent dividend growth ($cov\big(N_{CF,t}, UE_{t-1}[\Delta earn_t]\big)$), and (3) the relation between earnings surprises and contemporaneous modified expectation for the subsequent cost of capital ($cov\big(N_{DR,t}, UE_{t-1}[\Delta earn_t]\big)$).

In an economic boom (economic recession), when aggregate earnings changes are positive (negative), positive (negative) firm-level earnings surprises should be dominant in the market, yielding higher (lower) stock prices. Thus, earnings changes should have positive effects on contemporaneous stock returns at the aggregate level, comparable to the firm level ($cov\big(N_{CF,t}, UE_{t-1}[\Delta earn_t]\big) > 0$). However, what if aggregate earnings changes are positively related to changes in the market-wide cost of capital[9] ($cov\big(N_{DR,t}, UE_{t-1}[\Delta earn_t]\big) > 0$)? Changes in the market-wide cost of capital are generally negatively related to the movement of stock prices.[10] Additionally, KLW (p.542) argue that "discount rates should be strongly correlated across stocks, largely driven by business conditions, while cash flows are likely to have a larger idiosyncratic component." Based on their argument that idiosyncratic components will be offset through aggregation, the negative effects of changes in the cost of capital on the contemporaneous stock returns will be stronger than the positive effects of earnings surprises at the aggregate level ($cov\big(N_{CF,t}, UE_{t-1}[\Delta earn_t]\big) \leq cov\big(N_{DR,t}, UE_{t-1}[\Delta earn_t]\big)$). Therefore, in a simple regression model that does not control for changes in the market-wide cost of capital, omitted variable bias will make the earnings-returns relation insignificant or negative ($cov(r_t, \Delta earn_t) \leq 0$).[11]

---

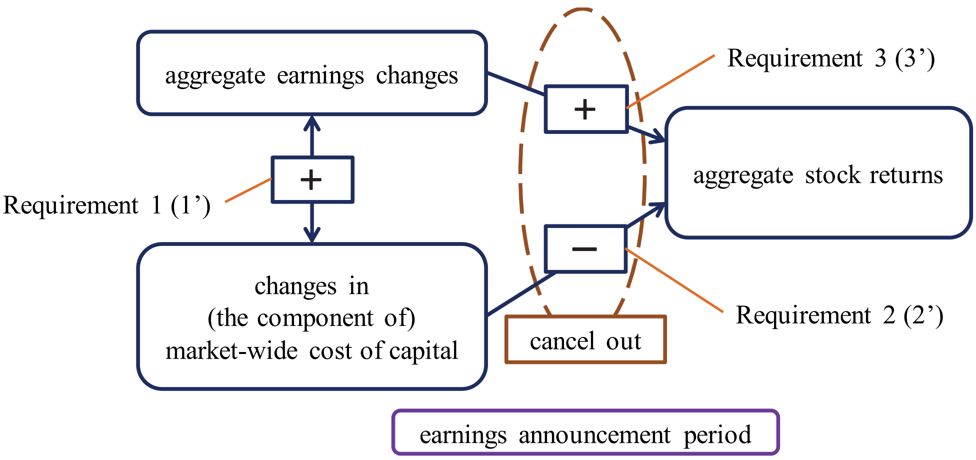
[8] We delete uncorrelated terms in the following way. Earnings changes expected at period t-1 are not related to news released at period t ($cov\big(N_{CF,t}, E_{t-1}[\Delta earn_t]\big) \approx 0, cov\big(N_{DR,t}, E_{t-1}[\Delta earn_t]\big) \approx 0$). Earnings surprises occur at period t. Thus, they are not correlated to stock returns expected at period t-1 ($cov(E_{t-1}[r_t], UE_{t-1}[\Delta earn_t]) \approx 0$).

[9] To understand the KLW hypothesis more deeply, we propose a possible economic story behind the positive relation between aggregate earnings changes and changes in the risk-free rate or expected inflation. In an economic boom (economic recession) when positive (negative) aggregate earnings changes are observed, the demands for money, goods, and services will increase (decrease), causing higher (lower) interest rates and inflation.

[10] Based on valuation models such as the Dividend Discount Model, the increase (decrease) of the discount rate (the cost of capital) drives the stock prices downward (upward). Therefore, changes in the market-wide cost of capital have a negative effect on aggregate stock returns.

[11] Additionally, the relation between expected earnings changes and expected returns should not affect the aggregate earnings-returns relation ($E_{t-1}[\Delta earn_t] \approx 0, \therefore cov(E_{t-1}[r_t], E_{t-1}[\Delta earn_t]) \approx 0$), because this hypothesis assumes that aggregate earnings changes are largely unpredictable.

FIGURE 1 CONCEPTUAL DIAGRAM OF KLW HYPOTHESIS



2.3. Empirical evidence on the aggregate earnings-returns relation

There are three requirements for the KLW hypothesis, as follows.

Requirement 1 (1'): aggregate earnings changes are significantly positively related to contemporaneous changes in (components of) the market-wide cost of capital.
Requirement 2 (2'): contemporaneous changes in (components of) the market-wide cost of capital have a significantly negative relation with aggregate stock returns.
Requirement 3 (3'): a significantly positive aggregate earnings-returns relation appears only after controlling for contemporaneous changes in (components of) the market-wide cost of capital.

Figure 1 illustrates the KLW hypothesis and its requirements. Prior U.S. studies mainly investigate whether these requirements are supported by two regression tests. In the first regression, they focus on the relation between aggregate earnings changes and contemporaneous changes in (components of) the market-wide cost of capital to check Requirement 1 (1'). In the second regression, they regress aggregate stock returns on aggregate earnings changes and contemporaneous changes in (components of) the market-wide cost of capital used in the first regression to detect whether Requirement 2 (2') is achieved. They also concentrate on the coefficient of aggregate earnings changes in the second regression to investigate Requirement 3 (3').

KLW show that aggregate earnings changes are positively related to contemporaneous changes in the one-year T-bill rate. Uysal (2010) reports that, although the aggregate earnings-returns relation is insignificant in a simple regression, a significantly positive aggregate earnings-returns relation occurs after controlling for two or more discount-rate proxies. Patatoukas (2014) observes that aggregate earnings changes are positively related to changes in the market-wide cost of capital. In addition, he shows that a significantly positive aggregate earnings-returns relation appears after controlling for changes in the market-wide cost of capital, although this significant relation does not appear in a simple regression. Gallo et al. (2016) find that aggregate earnings changes convey news regarding the federal fund rate. They show that when they control for federal fund rate news, the aggregate earnings-returns relation changes from significantly negative to insignificant. To the contrary, He and Hu (2014) report that, though aggregate earnings changes are positively correlated with contemporaneous changes in interest rates and inflation, the aggregate earnings-returns relation does not change even after controlling for these variables outside the U.S. market. In summary, these studies support the validity of the KLW hypothesis in the U.S. market, while it is not proven outside of the U.S. market.

In addition to the KLW hypothesis, SS present the other hypothesis regarding the aggregate earnings-returns relation. Their hypothesis is composed of two arguments. One is an argument regarding the high predictability of aggregate earnings and the other is regarding investors' risk-avoidance. It is assumed that aggregate earnings changes do not modify investors' expectations at earnings announcement periods, because they are almost completely predicted and priced in before earnings announcement periods ($cov\left(N_{CF,t}, UE_{t-1}[\Delta earn_t]\right) \approx 0,\ cov\left(N_{DR,t}, UE_{t-1}[\Delta earn_t]\right) \approx 0 \because UE_{t-1}[\Delta earn_t] \approx 0,\ \Delta X_t \approx E_{t-1}[\Delta earn_t]$). In addition, SS explain that aggregate earnings changes can be negatively related with ex ante expected returns due to the negative relation between expected aggregate earnings changes and the market risk premium ($cov(E_{t-1}[r_t], E_{t-1}[\Delta earn_t]) \leq 0$).

Prior evidence that supports the SS hypothesis focuses mainly on the former argument: high predictability of aggregate earnings (changes). SS and Ball et al. (2009) show that aggregate earnings (changes) are significantly related to past aggregate returns.[12] He and Hu (2014) study 28 non-U.S. stock markets and show that the aggregate earnings-returns relation is weaker (from positive to negative) in countries with more transparent financial disclosure, because such disclosure helps investors forecast future earnings more precisely. These results suggest that aggregate earnings changes are at least partially reflected in past aggregate returns. Therefore, our empirical tests use surprising information in aggregate earnings changes (aggregate earnings surprises) in addition to "raw" aggregate earnings changes.

2.4. Motivation and research question

As far as we know, the He and Hu (2014) study is the only non-U.S. study that investigates whether several components of the market-wide cost of capital affect the aggregate earnings-returns relation. However, it is not clear whether their evidence explains the aggregate earnings-returns relation in the Japanese market for three reasons. First, He and Hu (2014) do not include all components of the market-wide cost of capital in their regression model. As Patatoukas (2014) states, the market-wide cost of capital has three components: the real risk-free rate, expected inflation, and market risk premium. He and Hu (2014) control for only inflation and changes in nominal interest rates, and do not consider the market risk premium.

Second, though He and Hu (2014) propose evidence regarding the effects of inflation and interest rates on the aggregate earnings-returns relation, the evidence is for the average non-U.S. market and not for a specific stock market. He and Hu (2014) cover 28 non-U.S. stock markets and run a pooled regression of their country/year observations. Consequently, their results show the average effects of inflation and interest rates on the aggregate earnings-returns relation in these countries. They do not sufficiently investigate whether the aggregate earnings-returns

---

[12] In existing studies supporting the SS hypothesis, it is argued that aggregate earnings changes contain positive cash-flow news, but such news is priced in before earnings announcement periods.

relation in the Japanese market is affected by these components of the market-wide cost of capital.

Third, He and Hu (2014) use only annual data while U.S. studies that test the KLW hypothesis also often use quarterly data to investigate the aggregate earnings-returns relation (e.g., KLW). Quarterly earnings constitute more timely information. Quarterly returns are calculated by a shorter window, which is useful in excluding more of the effects of uninterested events. Thus, quarterly analyses will capture the aggregate earnings-returns relation in the Japanese market more precisely.

Based on these three reasons, we set our research question as whether the KLW hypothesis explains the quarterly aggregate earnings-returns relation in the Japanese market. To answer this question, we use the research design of Patatoukas (2014), whose regression model contains all components of the market-wide cost of capital.

If the KLW hypothesis explains the aggregate earnings-returns relation in the Japanese market, Requirements 1, 2, and 3 will all be fulfilled. Thus, we investigate whether these requirements are achieved in our empirical tests. Additionally, we decompose the market-wide cost of capital into three components to clarify which components bias the aggregate earnings-returns relation in the Japanese market. If a component of the market-wide cost of capital makes the aggregate earnings-returns relation not significantly positive, the component will satisfy all three Requirements 1', 2', and 3'.

3. Research design

3.1. Model description

We adopt two main tests to investigate whether changes in the market-wide cost of capital and changes in its components bias the aggregate earnings-returns relation in the Japanese stock market. In the first test, we check Requirement 1 (1'). We use the regression models shown in Equations 4 through 6.

$$\Delta AggE_q = \alpha + \beta_1 \Delta ICC_{q+1} + \varepsilon \tag{4}$$

$$\Delta AggE_q = \alpha + \beta_1 \Delta IRP_{q+1} + \beta_2 \Delta RF_{q+1} + \varepsilon \tag{5}$$

$$\Delta AggE_q = \alpha + \beta_1 \Delta IRP_{q+1} + \beta_2 \Delta RRF_{q+1} + \beta_3 \Delta INF_{q+1} + \varepsilon \tag{6}$$

$\Delta AggE_q$ is a variable of aggregate earnings changes. ΔICC_{q+1} represents changes in the market-wide cost of capital. ΔIRP_{q+1} represents changes in the implied market risk premium. ΔRF_{q+1} represents changes in the nominal risk-free rate. ΔRRF_{q+1} represents changes in the real risk-free rate. ΔINF_{q+1} represents changes in expected inflation. In Equation 4, we investigate the relation between aggregate earnings changes and contemporaneous changes in the market-wide cost of capital. If the KLW hypothesis reflects the reality of the Japanese stock market, β_1 in Equation 4 should be significantly positive (Requirement 1).

Equations 5 and 6 are used to investigate whether and which components of changes in the market-wide cost of capital fulfill Requirement 1'. We split ΔICC_{q+1} into ΔIRP_{q+1} and ΔRF_{q+1} in Equation 5. We divide ΔRF_{q+1} into ΔRRF_{q+1} and ΔINF_{q+1} in Equation 6. If these components bias the aggregate earnings-returns relation, their coefficients should be significantly positive.

In the second test, we focus on Requirements 2 and 3 (2' and 3'). We use the regression models described in Equations 7 through 10.

$$R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \varepsilon \tag{7}$$

$$R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta ICC_{q+1} + \varepsilon \tag{8}$$

$$R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta IRP_{q+1} + \gamma_3 \Delta RF_{q+1} + \varepsilon \tag{9}$$

$$R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta IRP_{q+1} + \gamma_3 \Delta RRF_{q+1} + \gamma_4 \Delta INF_{q+1} + \varepsilon \tag{10}$$

R_{q+1} represents aggregate stock returns during earnings announcement periods. According to prior studies, the quarterly aggregate earnings-returns relation is observed to be insignificant or significantly negative with a simple regression model both in Japan (Yoshinaga 2016) and in the U.S. (e.g., KLW; SS; Patatoukas 2014). Therefore, we expect that γ_1 in Equation 7 is not significantly positive. As an interpretation of this earnings-returns relation, KLW argue that the positive effects of aggregate earnings changes are canceled out by the negative effects of contemporaneous changes in the market-wide cost of capital (ΔICC_{q+1}). We control for ΔICC_{q+1} in Equation 8 to test this argument. If the KLW hypothesis reflects reality in Japan, γ_1 should be significantly positive (Requirement 3) and γ_2 should be significantly negative (Requirement 2).

In Equations 9 and 10, we decompose ΔICC_{q+1} into its components and investigate whether and which components satisfy Requirements 2' and 3'. If the components fulfill the Requirements, coefficients of the components should be significantly negative (Requirement 2') and coefficients of $\Delta AggE_q$ should be significantly positive (Requirement 3').

3.2. Variable definition

We use quarterly data. As a proxy for aggregate stock returns, we use equally-weighted averages of firm-level quarterly buy-and-hold returns (R_q). Before calculating the firm-level returns, we adjust stock prices for price movements due to ex-rights and ex-dividends. The measurement window of the stock returns is from the beginning to the end of the quarter.

Though cumulative total net incomes during the fiscal year are typically announced on a quarterly basis in Japan, we define firm-level quarterly earnings as net income of firm i achieved during quarter q ($EARN_{i,q}$). If quarter q is the first quarter of each fiscal year for firm i, we use its net income as $EARN_{i,q}$. If quarter q is not the first quarter, we treat the quarter-on-quarter change in its net income as $EARN_{i,q}$. We use two variables of aggregate earnings changes in our empirical tests.[13] The first is the "raw" aggregate earnings changes ($\Delta EARN_q$), which are equally-weighted averages of the year-on-year change in firm-level quarterly earnings deflated by the previous-year book value of equity ($\frac{EARN_{i,q} - EARN_{i,q-4}}{BV_{i,q-4}}$).

The second is the estimated aggregate earnings surprises (SUR_q). We define SUR_q as

[13] We estimate the aggregate earnings surprises (SUR_q) and use the estimate in our tests, because prior studies suggest that aggregate earnings changes are predicted before earnings announcement periods. We use $\Delta EARN_q$ in addition to SUR_q because our results may depend on our specific estimation model of aggregate earnings surprises.

residuals of the following Equation 11.[14] [15] Untabulated results of Equation 11 indicate that the estimated β_1 and β_2 in Equation 11 are all significantly positive (β_1= 0.655 [t=7.031], β_2= 0.028 [t= 2.673]) and the adjusted R-square is 0.464 using adjusted standard errors presented by Newey and West (1987). We confirm that SUR_q does not contain information reflected in stock prices before earnings announcement periods in Appendix (A).

$$\Delta EARN_q = \alpha + \beta_1 \Delta EARN_{q-1} + \beta_2 R_q + \varepsilon \tag{11}$$

ΔICC_{q+1} represents changes in the market-wide implied cost of capital ($\Delta ICC_q = ICC_q - ICC_{q-1}$). We apply the estimating method offered by Easton and Sommers (2007) to calculate the market-wide cost of capital (ICC_q). Our estimation method for this variable is detailed in Appendix (B). ΔRF_q represents changes in the nominal risk-free rate, which is the quarter-on-quarter change in yield of the 10-year Japanese government bond at the end of each quarter ($\Delta RF_q = RF_q - RF_{q-1}$). ΔIRP_q represents changes in the market risk premium and is defined as the difference between ΔICC_q and ΔRF_q, following Patatoukas (2014) ($\Delta IRP_q = \Delta ICC_q - \Delta RF_q$). ΔINF_q represents changes in expected inflation in Japan. This variable is measured as the averages of expected year-on-year growth of the core Consumer Price Index (CPI) released in the ESP forecast[16] issued at the end of each quarter as expected inflation[17] ($\Delta INF_q = INF_q - INF_{q-1}$). Following Patatoukas (2014), ΔRRF_q represents the difference between ΔRF_q and ΔINF_q ($\Delta RRF_q = \Delta RF_q - \Delta INF_q$). Figure 2 is the timeline of our main variables.

---

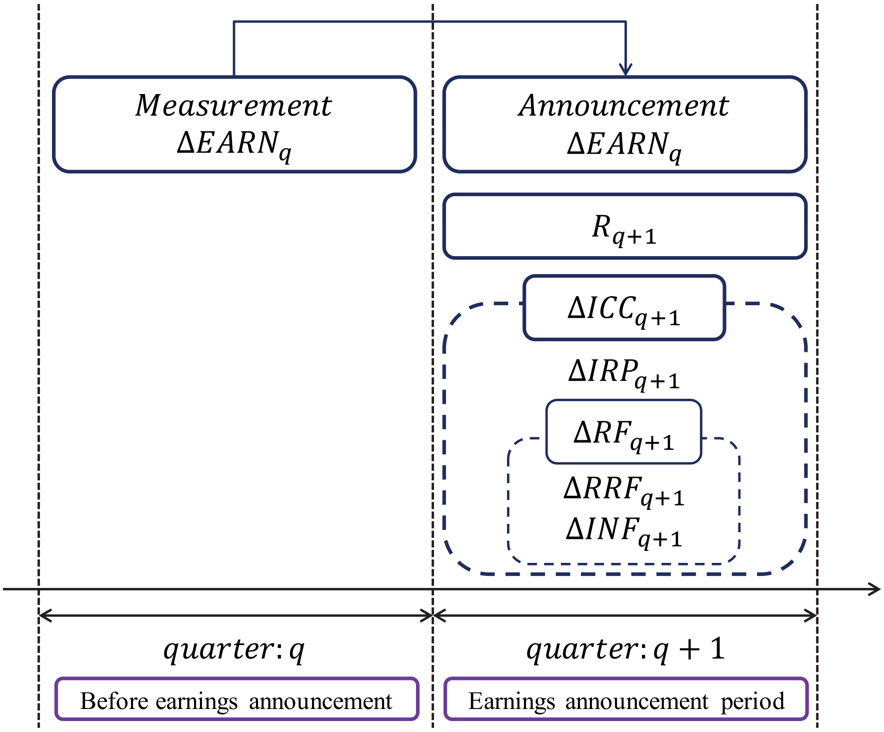
[14] Yoshinaga (2016) shows that aggregate earnings changes have a significantly positive relation with aggregate stock returns just before earnings announcement periods in the Japanese stock market. KLW report positive autocorrelation of aggregate earnings changes (earnings persistence), and our untabulated results confirm that the first-order autocorrelation is observed in Japanese aggregate earnings changes. These results can be interpreted as evidence that aggregate earnings changes are somehow predictable. To exclude the effects of expected aggregate earnings changes on expected returns as SS assume, we extract surprising information in aggregate earnings changes using Equation 11.

[15] According to KLW, aggregate earnings changes have the first to the third order significantly positive autocorrelation, and this autocorrelation is mainly caused by the first order partial autocorrelation. In our untabulated tests, we confirm that $\Delta EARN_q$ also has the first to the second order significantly positive autocorrelation, and this autocorrelation is mainly caused by the first order partial autocorrelation. (The relation between $\Delta EARN_q$ and $\Delta EARN_{q-2}$ becomes insignificant after controlling for $\Delta EARN_{q-1}$.) Thus, we adjust aggregate earnings changes for only the first order autocorrelation in calculating SUR_q.

[16] ESP forecast is the survey issued by the Economic Planning Association since its origin in 2004, and it was taken over by the Japan Center for Economic Research in April 2012. These authorities send approximately 40 private economists a questionnaire about their expectations of important economic indicators, such as stock prices and yen exchange rates, each month. They publish their answers monthly to clarify the consensus on future economic trends and the persistence of business conditions (http://www.jcer.or.jp/esp/index.html).

[17] In April 2014, the consumption tax rate was increased from 5% to 8% in Japan. To exclude the effects of the tax increase on expected inflation, we use the average core CPI after adjusting for the rise in the consumption tax rate (the adjusted average core CPI) starting at Q2:2013. However, at Q2:2013 and at Q3:2013, the ESP forecast has not announced the adjusted average core CPI. Consequently, we subtract 0.02 from the non-adjusted average year-on-year growth of the core CPI in these quarters to rule out the effect of the consumption tax rate increase, because Bank of Japan (2013) estimates the effects of the rise in the consumption tax on the CPI in 2014 to be 2.0%. The Japanese central bank states: "The effects of the two scheduled consumption tax hikes on prices can be mechanically estimated by assuming that the rise in consumption taxes will be fully passed on for all currently taxable items. On this basis, the CPI will be pushed up by 2.0 percentage points in fiscal 2014."

FIGURE 2 THE TIMELINE OF OUR MAIN VARIABLES



R_q is aggregate stock returns. $\Delta EARN_q$ is aggregate earnings changes. ΔICC_q is changes in the market-wide cost of capital. ΔIRP_q is changes in the market risk premium. ΔRRF_q is changes in real risk-free rate. ΔINF_q is changes in expected inflation.

3.3. Statistical issues: heteroskedasticity and serial correlation

Many empirical studies in accounting and finance adjust for heteroskedasticity. Researchers often calculate standard errors with the method of White (1980) to reduce statistical problems due to heteroskedasticity. Additionally, considering Durbin-Watson statistics, serial correlation may bias some of our results.[18] Therefore, we use heteroskedasticity- and autocorrelation-consistent standard errors proposed by Newey and West (1987). We set the maximum lag length for calculating Newey-West standard errors as two, which is an integer part of 0.25 power of the sample size, based on related studies (Konchitchki and Patatoukas 2014a) and practical convention (Ota 2012).

---

[18] Stanford University releases "Critical Values for the Durbin-Watson Test" based on the method presented by Savin and White (1977) (http://web.stanford.edu/~clint/bench/dwcrit.htm). We use the critical values presented on this webpage to judge whether and how strongly the serial correlation biases our results.

4. Sample selection, correlation matrix, and descriptive statistics

4.1. Sample selection

Our data source is primarily "Nikkei NEEDS Financial Quest 2.0," which contains financial data of listed firms and macroeconomic data in Japan. We obtain all the required data except expected inflation from Nikkei NEEDS. Expected inflation is manually collected from the ESP forecast.

We define Q1 as the quarter from January to March, Q2 as April to June, Q3 as July to September, and Q4 as October to December. Using this description, we collect financial data and stock price data from Q1:2003 to Q1:2015.[19] We impose the following six data requirements on firm/quarter observations for these periods:

I. Firm/quarter observations that have non-missing data to construct all the firm-level and aggregate-level variables required in our empirical tests.
II. Firm/quarter observations of industrial firms (not financial firms: banks, insurance, brokerage, and asset management firms)
III. Firm/quarter observations that use positive book values to construct the variables
IV. Firm/quarter observations whose stock price at the beginning of the quarter is 100JPY or higher
V. Firm/quarter observations whose fiscal year-ends are March, June, September, or December
VI. Firm/quarter observations that release a quarterly Summary of Financial Statements by 60 days after the beginning of the earnings announcement periods

Data requirement I is required to remove observations that have missing variables or that cannot be used to construct aggregate-level variables. We establish Data requirement II because some accounting items of financial firms are different from those of industrial firms. Data requirement III is set to avoid variables whose deflators are zero or negative. Data requirement IV is imposed to exclude outliers of stock returns. If stock prices are near the minimum monetary unit (1JPY), the stock returns tend to be highly volatile. Thus, it is supposed that KLW and SS exclude observations with stock prices below 1USD to reduce the effects of outliers of stock returns. Our sample covers listed firms adopting March as the fiscal year-end, because March is the most popular fiscal year-end in Japan. As stated in data requirement V, we add firms with fiscal year-ends of June, September, or December to our sample to increase the generality of our results. Data requirement VI is set for reported earnings changes to be priced in during earnings announcement periods.

In addition to imposing these data requirements, we regard the top and bottom 1% of our firm/quarter observations as ranked by $\Delta EARN_{i,q}$, $\frac{SUMEARN_{i,q-1}}{BV_{i,q-5}}$, and $\frac{MV_{i,q}-BV_{i,q-1}}{BV_{i,q-5}}$ each quarter as

[19] The first quarter in which Nikkei NEEDS includes quarterly financial data from the Summary of Financial Statements (*Kessan-Tanshin* in Japanese) is Q2:2002. We do not, however, use data before Q1:2003, because the numbers of firms whose quarterly (3-months) earnings can be calculated are less than 500 before Q2:2003 and some data at Q1:2003 is required to calculate firm-level variables after Q1:2003.

TABLE 1 CORRELATION MATRIX AND DESCRIPTIVE STATISTICS

R_q is aggregate stock returns. $\Delta EARN_q$ is aggregate earnings changes. SUR_q is surprising information in aggregate earnings changes. ΔICC_q is changes in the market-wide cost of capital. ΔIRP_q is changes in the market risk premium. ΔRF_q is changes in nominal risk-free rate. ΔRRF_q is changes in real risk-free rate. ΔINF_q is changes in expected inflation. In Panel A, Pearson (Spearman) correlations are below (above) diagonal. Significant correlation at 5% level is bold.

Panel A Correlation matrix (N=42)

	R_{q+1}	$\Delta EARN_q$	SUR_q	ΔICC_q	ΔIRP_q	ΔRF_q	ΔRRF_q	ΔINF_q
R_{q+1}		0.082	-0.169	**-0.341**	**-0.360**	**0.369**	0.041	0.225
$\Delta EARN_q$	-0.057		**0.575**	**0.792**	**0.760**	-0.168	-0.283	0.227
SUR_q	-0.021	**0.714**		**0.656**	**0.683**	**-0.415**	-0.082	-0.167
ΔICC_{q+1}	**-0.348**	**0.889**	**0.664**		**0.977**	**-0.357**	**-0.322**	0.105
ΔIRP_{q+1}	**-0.370**	**0.866**	**0.670**	**0.988**		**-0.517**	**-0.399**	0.066
ΔRF_{q+1}	0.290	-0.232	**-0.317**	**-0.368**	**-0.508**		**0.572**	0.146
ΔRRF_{q+1}	-0.081	**-0.487**	-0.296	**-0.396**	**-0.436**	**0.410**		**-0.594**
ΔINF_{q+1}	0.276	**0.368**	0.113	0.186	0.137	0.210	**-0.806**	

Panel B Descriptive statistics

	Mean	S.D.	Min	25%	Median	75%	Max	N
R_q	0.023	0.101	-0.169	-0.049	0.012	0.085	0.266	43
$\Delta EARN_q$	0.002	0.010	-0.027	-0.002	0.002	0.007	0.035	43
SUR_q	0.000	0.007	-0.019	-0.003	0.000	0.003	0.025	43
ΔICC_q	0.000	0.010	-0.024	-0.006	0.000	0.007	0.028	43
ΔIRP_q	0.001	0.010	-0.024	-0.005	0.001	0.008	0.031	43
ΔRF_q	0.000	0.002	-0.003	-0.002	0.000	0.001	0.003	43
ΔRRF_q	-0.001	0.003	-0.008	-0.002	-0.001	0.001	0.009	43
ΔINF_q	0.000	0.003	-0.012	0.000	0.001	0.001	0.005	43

outliers, and exclude them from our sample.[20] After deleting outliers, we obtain 104,971 firm/quarter observations from Q2:2004 to Q1:2015 to calculate aggregate-level variables. We exclude a quarter observation at Q2:2004, because we cannot calculate some aggregate-level variables in Q2:2004 (SUR_q, ΔICC_q, ΔIRP_q, ΔRRF_q, and ΔINF_q).[21] Our final sample consists of 43 quarter from Q3:2004 to Q1:2015.

4.2. Correlation matrix and descriptive statistics

Table 1 shows the correlation matrix and descriptive statistics. The correlation between

[20] $\frac{SUMEARN_{i,q-1}}{BV_{i,q-5}}$ and $\frac{MV_{i,q}-BV_{i,q-1}}{BV_{i,q-5}}$ are used to estimate the market-wide cost of capital. Please see Appendix (B) for more information.

[21] SUR_q requires $\Delta EARN_{q-1}$; ΔICC_q and ΔIRP_q require ICC_{q-1}; and ΔRRF_q and ΔINF_q require INF_{q-1} for the calculation. Our sample covers firm/quarter observations from Q2:2004 and expected inflation written in the ESP forecast (INF_q) is available from Q2:2004. Therefore, SUR_q, ΔICC_q, ΔIRP_q, ΔRRF_q, and ΔINF_q are available from Q3:2004.

ΔICC_{q+1} and ΔIRP_{q+1} is almost one, probably because movements of both the risk-free rate and expected inflation in Japan do not change drastically.[22] Consistent with this supposition, the standard deviations of ΔRF_{q+1} and ΔINF_{q+1} are less than one third of those of ΔIRP_{q+1}. Some explanatory variables have strong correlations with one another. Therefore, we judge whether our empirical results are biased by multicollinearity based on the Variance Inflation Factor (VIF). We confirm that the VIF of each variable in all regression models is lower than 10 in the following Tables. Thus, we conclude that statistical problems due to multicollinearity do not affect our results severely.

We conduct the unit root tests proposed by Phillips and Perron (1988) for all variables described in Table 1. According to Okimoto (2010), when we regress an explained variable that has a unit root on an explanatory variable that also has a unit root, a significant relation between them can be observed, even though they have no rational relation.[23] All results of the Phillips-Perron type unit root tests reject the null hypothesis that variables contain a unit root at the 1% level (untabulated). Therefore, our regressions in Section 5 should not be "spurious regressions."

5. Empirical results

5.1. Main results

Table 2 shows the results of the first main test, and Table 3 of the second main test. First, we focus on Requirements 1, 2, and 3 to reveal whether the KLW hypothesis explains the aggregate earnings-returns relation in Japan. In Table 2, the coefficients of ΔICC_{q+1} are significantly positive, which means that aggregate earnings changes have a significantly positive relation with contemporaneous changes in the market-wide cost of capital. Thus, Requirement 1 is fulfilled in the Japanese market. In Table 3, the coefficients of $\Delta EARN_q$ and SUR_q are insignificant and negative in a simple regression, which means that a significantly positive earnings-returns relation is not observed at the aggregate level when running a simple regression. On the other hand, when controlling for ΔICC_{q+1}, the coefficients of $\Delta EARN_q$ and SUR_q become significantly positive. Table 3 also describes the negative coefficients of ΔICC_{q+1}, which means that changes in the market-wide cost of capital have a significantly negative relation with aggregate returns (R_{q+1}). These results prove that Requirements 2 and 3 are satisfied in the Japanese market. In summary, our results indicate that the KLW hypothesis is valid in the Japanese market, because Requirements 1 through 3 are all fulfilled. In other words, negative effects of contemporaneous changes in the market-wide cost of capital cancel out positive effects of aggregate earnings changes in Japan.

Next, we target results for components of the market-wide cost of capital to reveal which components bias the aggregate earnings-returns relation in Japan. In Tables 2 and 3, the signs and significance of coefficients of ΔIRP_{q+1} are the same as those of ΔICC_{q+1}. $\Delta EARN_q$ and

[22] The average absolute value of the quarterly yield changes in the 10-year government bond from Q2:2003 to Q1:2015 is 0.153% in Japan, while it is 0.397% in the U.S. In addition, the average absolute value of year-on-year changes in the quarterly Consumer Price Index for all items less food and energy from Q2:2003 to Q1:2014 is 0.590% in Japan, while it is 1.920% in the U.S. This slight change in risk-free rates and expected inflation may be caused by the "zero interest rate policy" in Japan. The yield of 10-year government bonds in the U.S. is collected from the website of the U.S. Department of the Treasury and the Consumer Price Index in the U.S. is from the website of the U.S. Bureau of Labor Statistics. The Japanese data is collected from Nikkei NEEDS.

[23] Granger and Newbold (1974) caution about this kind of nonsense and spurious regression.

TABLE 2 THE RELATION BETWEEN AGGREGATE EARNINGS CHANGES AND CHANGES IN THE MARKET-WIDE COST OF CAPITAL AND THOSE IN ITS COMPONENTS

The table shows the results obtained by $\Delta AggE_q = \alpha + \beta_1 \Delta ICC_{q+1} + \varepsilon$ (Equation 4), $\Delta AggE_q = \alpha + \beta_1 \Delta IRP_{q+1} + \beta_2 \Delta RF_{q+1} + \varepsilon$ (Equation 5), $\Delta AggE_q = \alpha + \beta_1 \Delta IRP_{q+1} + \beta_2 \Delta RRF_{q+1} + \beta_3 \Delta INF_{q+1} + \varepsilon$ (Equation 6). $\Delta AggE_q$ is replaced by $\Delta EARN_q$ or SUR_q. $\Delta EARN_q$ is aggregate earnings changes. SUR_q is aggregate earnings surprises. ΔICC_q is changes in the market-wide cost of capital. ΔIRP_q is changes in the market risk premium. ΔRF_q is changes in nominal risk-free rate. ΔRRF_q is changes in real risk-free rate. ΔINF_q is changes in expected inflation. The left three columns indicate the results by the regression whose explained variable is $\Delta EARN_q$. The right three columns indicate the results by the regression whose explained variable is SUR_q. We report t-statistics using heteroskedasticity- and autocorrelation-consistent standard errors proposed by Newey and West (1987) in the brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively, using two-tailed tests.

	$\Delta EARN_q$			SUR_q		
$Intercept$	0.002**	0.002**	0.002**	0.000	0.000	0.000
	[2.250]	[2.707]	[2.654]	[0.095]	[-0.030]	[-0.054]
ΔICC_{q+1}	0.888***			0.472***		
	[8.207]			[4.627]		
ΔIRP_{q+1}		0.920***	0.858***		0.448***	0.443***
		[8.177]	[10.465]		[3.687]	[3.485]
ΔRF_{q+1}		1.432***			0.054	
		[3.157]			[0.083]	
ΔRRF_{q+1}			0.980**			0.019
			[2.557]			[0.026]
ΔINF_{q+1}			1.714***			0.076
			[4.828]			[0.120]
$Adj. R^2$	0.785	0.787	0.821	0.426	0.420	0.405
$F\ stats$	67.363***	33.891***	39.250***	21.406***	15.737***	10.432***
$D.W. stats$	1.607	1.739	1.923	2.174	2.136	2.145
$max\ VIF$	1.000	1.314	4.200	1.000	1.314	4.200
N	42	42	42	42	42	42

SUR_q have a significantly positive relation with ΔIRP_{q+1} in Table 2 (Requirement 1'). Coefficients of ΔIRP_{q+1} are significantly negative in Table 3 (Requirement 2'). Coefficients of $\Delta EARN_q$ and SUR_q become significantly positive after controlling for ΔIRP_{q+1} in Table 3 (Requirement 3'). These results show that changes in the market risk premium meet Requirements 1', 2', and 3'. To the contrary, though some coefficients of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} are significantly positive in Table 2, coefficients of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} are not significantly negative in Table 3. These results mean that changes in the risk-free rate and expected inflation do not meet Requirement 2', at least. In untabulated results, when we exclude ΔIRP_{q+1} from Equations 9 and 10, the coefficients of $\Delta EARN_q$ and SUR_q are insignificant and those of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} are not significantly negative. These untabulated results show that changes in risk-free rates and expected inflation do not meet Requirements 2' and 3'. On the other hand, when we regress R_{q+1} on $\Delta EARN_q$ or SUR_q controlling for only ΔIRP_{q+1}, the coefficients of $\Delta EARN_q$ and SUR_q become significantly positive and those of

TABLE 3 EFFECTS OF CONTROLLING FOR CHANGES IN THE MARKET-WIDE COST OF CAPITAL ON AGGREGATE EARNINGS-RETURNS RELATION

The table shows the results obtained by $R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \varepsilon$ (Equation 7), $R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta ICC_{q+1} + \varepsilon$ (Equation 8), $R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta IRP_{q+1} + \gamma_3 \Delta RF_{q+1} + \varepsilon$ (Equation 9), $R_{q+1} = \alpha + \gamma_1 \Delta AggE_q + \gamma_2 \Delta IRP_{q+1} + \gamma_3 \Delta RRF_{q+1} + \gamma_4 \Delta INF_{q+1} + \varepsilon$ (Equation 10). $\Delta AggE_q$ is replaced by $\Delta EARN_q$ or SUR_q. R_q is aggregate stock returns. $\Delta EARN_q$ is aggregate earnings changes. SUR_q is aggregate earnings surprises. ΔICC_q is changes in the market-wide cost of capital. ΔIRP_q is changes in the market risk premium. ΔRF_q is changes in nominal risk-free rate. ΔRRF_q is changes in real risk-free rate. ΔINF_q is changes in expected inflation. We report t-statistics using heteroskedasticity- and autocorrelation-consistent standard errors proposed by Newey and West (1987) in the brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively, using two-tailed tests.

$Intercept$	0.026	0.002	0.004	0.005	0.025	0.024	0.027	0.023
	[1.400]	[0.184]	[0.285]	[0.320]	[1.444]	[1.340]	[1.627]	[1.470]
$\Delta EARN_q$	-0.586	11.903***	11.647***	10.437***				
	[-0.392]	[4.241]	[3.808]	[2.994]				
SUR_q					-0.307	5.229**	5.682**	5.511***
					[-0.202]	[2.636]	[2.536]	[3.009]
ΔICC_{q+1}		-14.039***				-5.935***		
		[-4.795]				[-3.279]		
ΔIRP_{q+1}			-13.574***	-12.871***			-5.409**	-6.358***
			[-3.840]	[-3.625]			[-2.652]	[-3.012]
ΔRF_{q+1}			-9.679				6.689	
			[-0.784]				[0.688]	
ΔRRF_{q+1}				-10.963				-0.839
				[-0.851]				[-0.083]
ΔINF_{q+1}				-6.062				11.406
				[-0.502]				[1.510]
$Adj. R^2$	-0.022	0.359	0.346	0.343	-0.025	0.143	0.160	0.243
$F\ stats$	0.154	11.504***	11.797***	11.805***	0.041	5.382***	5.373***	6.885***
$D.W. stats$	1.606	2.185	2.191	2.197	1.636	1.248	1.314	1.430
$max\ VIF$	1.000	4.764	6.127	6.553	1.000	1.787	2.142	4.200
N	42	42	42	42	42	42	42	42

ΔIRP_{q+1} are significantly negative. These untabulated results support the conclusion that ΔIRP_{q+1} meets Requirements 2' and 3'.

In summary, we find that the KLW hypothesis explains the aggregate earnings-returns relation in the Japanese market. In other words, contemporaneous changes in the market-wide cost of capital cause omitted variable bias against the aggregate earnings-returns relation. Additionally, decomposing the market-wide cost of capital, we find that only changes in the market risk premium cause such bias in Japan.

5.2. Robustness checks

In this subsection, we check the robustness of our main results by using different standard errors, a different regression method, a different aggregating method, and different periods. We do not tabulate the results of these robustness checks due to space considerations. Briefly speaking of the conclusion of these tests, we confirm the robustness of the interpretation of our main results.

5.2.1. Robustness checks on serial correlation and heteroskedasticity

We calculate the heteroskedasticity- and autocorrelation-consistent Newey-West standard errors in our main tests. In calculating these standard errors, we set the maximum lag length as two. Despite this treatment, we may not be able to reduce statistical problems due to serial correlation, because this lag length is based only on academic and practical conventions. Therefore, we check the robustness of our main results in two ways. First, we vary the maximum lag length from zero to four and check the sensitivity of our results. Second, we adopt the generalized least-squares method presented by Prais and Winsten (1954) and use the heteroskedasticity-consistent standard errors presented by White (1980). All results of these robustness checks are similar to our main results.

5.2.2. Robustness checks on the other aggregating method: value-weighted averages

Existing studies on the aggregate earnings-returns relation use value-weighted cross-sectional averages as aggregate-level variables, in addition to equally-weighted cross-sectional averages. Therefore, we employ value-weighted averages based on market values as our aggregation method and run the same regressions as in the main analysis. In this robustness check, we estimate the average cost of capital separately for each industry and calculate the value-weighted average of the cost of capital based on the total market value of each industry. We regard it as ICC_q in this test. Untabulated results using these value-weighted averages demonstrate that almost all signs and statistical significance of coefficients are similar to those of our main results, with one differing result. When we check the relation between SUR_q and R_{q+1}, controlling for ΔICC_{q+1} (Equation 8) or its components (Equations 9 and 10) with Newey-West standard errors, the coefficients of SUR_q are insignificant. To the contrary, when we adopt the generalized least-squares method presented by Prais and Winsten (1954) and the heteroskedasticity-consistent standard errors proposed by White (1980), significantly positive coefficients of SUR_q are observed, consistent with our main analysis. Therefore, we comprehensively judge that positive effects of value-weighted aggregate earnings surprises on the contemporaneous aggregate stock returns exist, but they are somewhat weaker.[24]

5.2.3. Robustness checks on the sample period

Aggregating fewer firms can cause inadequate diversification of firm-specific information. Due to data restriction, our sample size is limited to roughly 1,000 firm/quarter observations before Q2:2005, although over 2,000 firm/quarter observations are available starting at Q2:2005. Thus, we limit the sample periods to those beginning with Q2:2005 and run the regressions. The

[24] One of the reasons why positive effects of value-weighted aggregate earnings surprises are weaker is that the impacts of large firms become stronger when we use value-weighted averages. Collins et al. (1987) suggest that earnings changes in larger firms are more predictable. Therefore, the value-weighted averages of earnings changes will be predicted more easily than equally-weighted averages. By running Equation 11 to calculate SUR_q using equally-weighted averages, the adjusted R-Square is 0.464 (untabulated). On the other hand, when we use value-weighted averages, the adjusted R-Square is 0.568 (untabulated). This difference suggests that value-weighted aggregate earnings changes are more predictable than equally-weighted aggregate earnings changes.

results are not largely different from the main results in signs and significance of the coefficients.

The bankruptcy of Lehman Brothers and the subsequent financial crisis occurred during our sample period. Since this financial crisis seriously damaged the Japanese economy, some observations can be outliers. Therefore, we exclude quarter observations from Q3:2008 (the period in which Lehman Brothers declared bankruptcy) to Q1:2010 (the first trough of the business cycle following the bankruptcy of Lehman Brothers according to the Cabinet Office of Japan) to reduce the effect of the financial crisis on our results. In this skipped sample period, we run the same regressions as in our main tests using the generalized least-squares method of Prais and Winsten (1954) and the heteroskedasticity-consistent standard errors proposed by White (1980). As a result, two points are largely different from our main results.

First, when we regress $\Delta EARN_q$ on ΔIRP_{q+1} and ΔRF_{q+1} in Equation 5 or regress it on ΔIRP_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} in Equation 6, the coefficients of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} become insignificant. These results mean that changes in risk-free rates (ΔRF_{q+1}, ΔRRF_{q+1}) and expected inflation (ΔINF_{q+1}) do not fulfill all Requirement 1'. These results are consistent with our interpretation that these variables do not fulfill all Requirements 1' through 3'.

Second, when we regress R_{q+1} on $\Delta EARN_q$, ΔIRP_{q+1}, and ΔRF_{q+1} in Equation 9 and when we regress R_{q+1} on $\Delta EARN_q$, ΔIRP_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} in Equation 10, the coefficients of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} become significantly negative and the coefficients of $\Delta EARN_q$ become significantly positive. These results may mean that changes in risk-free rates and expected inflation meet Requirements 2' and 3'. However, three other results indicate that changes in risk-free rates and expected inflation do not meet all three Requirements 1', 2', and 3'. First, as we state in the previous paragraph, the risk-free rates and expected inflation do not satisfy Requirement 1'. Second, the coefficients of $\Delta EARN_q$, SUR_q, ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} become insignificant when we do not control for ΔIRP_{q+1} in Equations 9 and 10, which is inconsistent with the interpretation that changes in risk-free rates and expected inflation fulfill Requirement 2' and 3'. Third, when we replace $\Delta EARN_q$ with SUR_q in Equations 9 and 10, the coefficients of ΔRF_{q+1}, ΔRRF_{q+1}, and ΔINF_{q+1} become insignificant and negative. These results also suggest that changes in risk-free rates and expected inflation do not satisfy Requirement 2'. Therefore, we conclude that changes in risk-free rates and expected inflation do not satisfy all the requirements. Consequently, our main results are robust when we reduce the effects of the financial crisis.

5.3. Discussion of SS hypothesis

As noted in Section 2, SS propose the other hypothesis regarding the earnings-returns relation at the aggregate level. In this subsection, we discuss how our findings are related to their hypothesis. Furthermore, we make an additional test to investigate the validity of the SS hypothesis in the Japanese market.

The SS hypothesis is composed of two arguments. One is an argument regarding the high predictability of aggregate earnings and the other addresses investors' attitudes toward risk. They argue that aggregate earnings changes are almost completely predictable and investors will become less (more) risk-averse when they predict future positive (negative) aggregate earnings changes.

At first, our main results undermine the former argument. We extract surprising information in aggregate earnings changes (SUR_q) using Equation 11 and check whether SUR_q has significantly positive effects on aggregate stock returns at earnings announcement periods (R_{q+1})

after controlling for changes in the market-wide cost of capital (ΔICC_{q+1}) in Equation 8. If the former argument of the SS hypothesis is valid in the Japanese market, the observed relation will not be significant, because the SS hypothesis argues that aggregate earnings changes do not convey any news to investors during earnings announcement periods. However, Table 3 indicates that SUR_q is significantly positively related with R_{q+1} in Equation 8. This result suggests that aggregate earnings changes convey positive cash-flow news to investors during earnings announcement periods, inconsistent with the SS hypothesis.

On the other hand, we do not obtain implications on the latter argument from our main tests. Thus, we investigate the latter argument with an additional test. We focus on how the market risk premium changes when aggregate earnings changes are predicted. In Japan, quarterly aggregate earnings changes have a significantly positive relation with aggregate returns just before earnings announcement periods (Yoshinaga 2016). We confirm this with regression results using Equation 11. We obtain a significantly positive relation between aggregate earnings changes ($\Delta EARN_q$) and aggregate returns just before earnings announcement periods (R_q). Interpreting this significant relation as quarterly aggregate earnings changes are predicted just before earnings announcement periods, we can investigate the latter argument of the SS hypothesis by focusing on the relation between expected aggregate earnings changes and changes in the market risk premium during the periods (ΔIRP_q). If this argument is right, we will observe a significantly negative relation between them.

To clarify the validity of the latter argument of SS hypothesis, we regress ΔIRP_q on $\Delta \widehat{EARN}_q$ using a simple regression model. $\Delta \widehat{EARN}_q$ is a fitted value of Equation 11. We regard it as a proxy for expected aggregate earnings changes. In addition, we regress ΔIRP_q on $\Delta EARN_q$ to address the concern that results using $\Delta \widehat{EARN}_q$ may depend on the specific estimation model of expected aggregate earnings changes.

As a result, the estimated coefficient of $\Delta \widehat{EARN}_q$ and that of $\Delta EARN_q$ are both significantly positive using Newey-West standard errors (1.029 [t=5.153] and 0.459 [t=3.176]). When we do the robustness checks provided in Subsection 5.2, significantly negative coefficients are not observed. Therefore, our results suggest that investors do not become less (more) risk-averse when expected aggregate earnings changes are positive (negative). Though this additional test is simple, the results suggest that the latter argument of the SS hypothesis will not be valid, at least in the Japanese market.

In summary, our main and additional results oppose two arguments of the SS hypothesis. The discussion in this subsection supports the KLW hypothesis indirectly, because the SS hypothesis competes with the KLW hypothesis.

6. Conclusion

There is a new and growing research area called Macro-Accounting. Konchitchki (2016a) explains that there are two research areas in Macro-Accounting research. One, called "Macro-to-Micro," tackles how various types of macroeconomic information affect or improve the firm-level prediction of future performance or stock valuation (e.g., Konchitchki et al. 2016). The other, described as "Micro-to-Macro," focuses on how accounting contributes to informing and predicting various macroeconomic aspects (e.g., Gallo et al. 2016).

Prior studies in the "Micro-to-Macro" stream frequently use cross-sectionally aggregated earnings in empirical tests. Some of them analyze the earnings-returns relation with aggregate earnings and obtain interesting results. They report that a significantly positive earnings-returns relation cannot be observed at the aggregate level. As a response to this finding, KLW propose a hypothesis. They assume that negative effects of changes in the market-wide cost of capital conceal positive effects of aggregate earnings changes. After KLW, several studies empirically support this hypothesis in the U.S. market. However, the validity of the KLW hypothesis in the Japanese market has not been investigated. Therefore, we test the KLW hypothesis using Japanese quarterly data based on the research design of Patatoukas (2014), whose regression models contain all components of the market-wide cost of capital.

Our results robustly support the validity of the KLW hypothesis in Japan. We find that positive effects of aggregate earnings changes on aggregate stock returns are concealed by negative effects of changes in the market-wide cost of capital. Of the components of the market-wide cost of capital, we find that only the market risk premium makes the aggregate earnings-returns relation not significantly positive. Including additional results, our results are inconsistent with the competing hypothesis proposed by SS. Our results indicate that aggregate earnings changes are not completely priced in before earnings announcement periods. Our additional results suggest that investors do not change their attitudes toward risks as SS assume. These results support the KLW hypothesis indirectly, through rejecting the competing hypothesis constructed by SS.

This study contributes to Macro-Accounting research, especially on aggregate earnings. At first, our results support the external validity of the KLW hypothesis. It is not sufficiently clear whether the KLW hypothesis is valid outside the U.S. market. To the best of our knowledge, this is the first study that supports the hypothesis outside the U.S. market. We show the validity of the KLW hypothesis in the Japanese market. There are many differences in economic situations between Japan and the U.S. Thus, our results contribute to expanding the external validity of the hypothesis. As the second contribution, our results suggest the importance of focusing on an argument regarding investors' risk-avoidance in the SS hypothesis, although prior studies supporting the SS hypothesis mainly focus on the other argument regarding the higher predictability of aggregate earnings (Ball et al. 2009; He and Hu 2014). Our results suggest that, even if the former argument is partially supported, the latter can be unsupported.

We contribute to the accounting research on the cost of capital in two ways. The first contribution is indicating the significant relation between accounting and cost of capital using aggregate-level variables. Prior studies show the significant relation at the firm level (e.g., Francis et al. 2004; Barth et al. 2013; Konchitchki et al. 2016). On the other hand, we focus on the aggregate-level relation between accounting information and cost of capital. After our empirical tests, the relation is shown to exist in the Japanese market, even at the aggregate level. Second, we clarify the strength of the market-wide cost of capital's impacts and identify the component that produces the impacts. Our results show that the powerful impacts of the market-wide cost of capital cancel out the positive effects of aggregate earnings changes on aggregate stock returns. We also reveal that the impacts of the market-wide cost of capital are derived from the market risk premium in the Japanese capital market. These results will be helpful in understanding the impacts of the market-wide cost of capital in the Japanese market.

Additionally, these results have an implication for future international research. He and Hu (2014) report that changes in interest rates and inflation do not affect the aggregate earnings-returns relation outside the U.S. market. They do not, however, consider the role of the market risk premium. We find that the market risk premium has important impacts on the aggregate

TABLE 4 THE RELATION BETWEEN AGGREGATE EARNINGS SURPRISES AND THE PAST AGGREGATE STOCK RETURNS

The table shows the results obtained by $SUR_q = \alpha + \sum_{k=0}^{3} \beta_k R_{q-k} + \varepsilon$ (Equation 12). R_q is aggregate stock returns. SUR_q is aggregate earnings surprises. We report t-statistics using heteroskedasticity-consistent standard errors proposed by White (1980) in the brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% level respectively, using two-tailed tests.

$Intercept$	0.000	0.000	-0.001	0.000	-0.001
	[-0.000]	[-0.068]	[-0.537]	[-0.225]	[-0.582]
R_q	0.000				0.000
	[0.000]				[-0.007]
R_{q-1}		0.004			0.002
		[0.349]			[0.165]
R_{q-2}			0.023*		0.020
			[1.782]		[1.127]
R_{q-3}				0.018	0.015
				[1.534]	[1.053]
$Adj.R^2$	-0.024	-0.022	0.093	0.048	0.059
$F\ stats$	0.000	0.122	3.177*	2.352	1.594
$D.W.stats$	1.863	1.897	2.031	1.859	1.887
$max\ VIF$	1.000	1.000	1.000	1.000	1.124
N	43	42	41	40	40

earnings-returns relation, even if both the risk-free rates and inflation do not. Considering the effects of the market risk premium can yield results different from those of He and Hu (2014).

Before concluding this paper, we discuss its limitation. Existing studies including this study have not sufficiently clarified the mechanism of the positive relation between aggregate earnings changes and changes in the market risk premium. In our next study, we would like to investigate this mechanism to understand the aggregate earnings-returns relation more deeply.

Appendix

(A) The validity of SUR_q as a proxy for aggregate earnings surprises

We use the residuals of Equation 11 as a proxy for aggregate earnings surprises (SUR_q). We test whether this variable is appropriate to represent aggregate earnings surprises using Equation 12. If the slope parameters of Equation 12 are significant, SUR_q can contain information priced in before the earnings announcement period and this variable may not be appropriate for aggregate earnings "surprises."

$$SUR_q = \alpha + \sum_{k=0}^{3} \beta_k R_{q-k} + \varepsilon \tag{12}$$

Table 4 indicates the results of the regression using Equation 12. In this table, aggregate earnings surprises are not significantly related to past aggregate stock returns. Thus, we can conclude that SUR_q is not priced in before the earnings announcement period and is appropriate as a proxy for aggregate earnings surprises.

(B) Our estimating method of the market-wide cost of capital

We estimate the market-wide cost of capital by applying the method proposed by Easton and Sommers (2007). Easton and Sommers (2007) run a cross-sectional regression to determine the implied cost of capital for a portfolio. We estimate the implied cost of capital for a market portfolio which is composed of the stocks of all sample firms based on their method, and use it as the market-wide cost of capital in our analysis (ICC_q). Their method is derived from the following residual income model (Equation 13).

$$v_{i,t} = bps_{i,t} + \sum_{\tau=1}^{\infty} \frac{eps_{i,t+\tau} - icc_{i,t} \times bps_{i,t+\tau-1}}{(1 + icc_{i,t})^{\tau}} \tag{13}$$

$v_{i,t}$ is the intrinsic value per share of firm i at period t. $bps_{i,t}$ is the book value per share of firm i at period t. $eps_{i,t}$ is the earnings per share of firm i at period t. $icc_{i,t}$ is the cost of capital of firm i at period t. We can transform Equation 13 into Equation 14 by applying the following three arguments: (1) the perpetual growth rate of the residual earnings starting at period t+1 ($g_{i,t+1}$) is constant, (2) the intrinsic value is equal to the contemporaneous stock price ($v_{i,t} = p_{i,t}$), and (3) firm i has a positive book value of equity at period t ($bps_{i,t} > 0$).

$$p_{i,t} = bps_{i,t} + \sum_{\tau=1}^{\infty} \frac{(eps_{i,t+1} - icc_{i,t} \times bps_{i,t})(1 + g_{i,t+1})^{\tau-1}}{(1 + icc_{i,t})^{\tau}}$$

$$p_{i,t} = bps_{i,t} + \frac{eps_{i,t+1} - icc_{i,t} \times bps_{i,t}}{(icc_{i,t} - g_{i,t+1})}$$

$$\frac{eps_{i,t+1}}{bps_{i,t}} = g_{i,t+1} + \left(icc_{i,t} - g_{i,t+1}\right) \times \frac{p_{i,t}}{bps_{i,t}} \tag{14}$$

Investors at period t cannot know the realized earnings per share of firm i at period t+1. Therefore, $eps_{i,t+1}$ can be regarded as the expected earnings per share of firm i at period t+1 that are expected at period t ($E_t[eps_{i,t+1}]$). We obtain the following Equation 15.

$$\frac{E_t[eps_{i,t+1}]}{bps_{i,t}} = g_{i,t+1} + \left(icc_{i,t} - g_{i,t+1}\right) \times \frac{p_{i,t}}{bps_{i,t}} \tag{15}$$

Assuming that analysts' forecast of future earnings per share is a proxy for the expected earnings per share ($E_t[eps_{i,t+1}]$), we can substitute all items for the specific values in Equation 15 except $g_{i,t+1}$ and $\left(icc_{i,t} - g_{i,t+1}\right)$. Replacing these two with the intercept parameter and the slope parameter, respectively ($\alpha_t = g_{i,t+1}, \beta_t = \left(icc_{i,t} - g_{i,t+1}\right)$) and containing error term in Equation 15, we can simultaneously estimate the average cost of capital and the average perpetual growth rate for the listed firms in the portfolio each period with a cross-sectional regression ($\overline{icc_{i,t}} = \widehat{\alpha_t} + \widehat{\beta_t}$, $\overline{g_{i,t+1}} = \widehat{\alpha_t}$). This method is often used to estimate the portfolio-level cost of capital (e.g., Easton et al. 2002).

Nonetheless, it is known that the estimated cost of capital based on analysts' forecast is biased upward, because analysts tend to forecast future earnings optimistically (Easton and Sommers 2007). To handle this upward bias, Easton and Sommers (2007) propose a method that estimates the implied cost of capital using realized current earnings instead of forecasted future earnings. Assuming (1) the perpetual growth rate of residual earnings starting from period t ($g'_{i,t}$) is stable, (2) the intrinsic value is equal to the contemporaneous stock price ($v_{i,t} = p_{i,t}$), and (3) firm i has positive book value of equity at period t-1 ($bps_{i,t-1} > 0$), we can transform Equation 13 into Equation 16. Further, Equation 16 can be reduced to Equation 17.

$$p_{i,t} = bps_{i,t} + \sum_{\tau=1}^{\infty} \frac{(eps_{i,t} - icc_{i,t} \times bps_{i,t-1})(1 + g'_{i,t})^{\tau}}{(1 + icc_{i,t})^{\tau}}$$

$$p_{i,t} = bps_{i,t} + \frac{(eps_{i,t} - icc_{i,t} \times bps_{i,t-1})(1 + g'_{i,t})}{(icc_{i,t} - g'_{i,t})} \tag{16}$$

$$\Leftrightarrow \frac{eps_{i,t}}{bps_{i,t-1}} = icc_{i,t} + \frac{icc_{i,t} - g'_{i,t}}{1 + g'_{i,t}} \times \frac{p_{i,t} - bps_{i,t}}{bps_{i,t-1}} \tag{17}$$

Replacing $icc_{i,t}$ and $\frac{icc_{i,t} - g'_{i,t}}{1+g'_{i,t}}$ with the intercept parameter and the slope parameter, respectively $\left(\alpha_t = icc_{i,t},\ \beta_t = \frac{icc_{i,t} - g'_{i,t}}{1+g'_{i,t}}\right)$ and containing error term, we can simultaneously estimate the average cost of capital and the average perpetual growth rates of the listed firms whose stocks are in the portfolio each period ($\overline{icc_{i,t}} = \widehat{\alpha_t}$, $\overline{g'_{i,t}} = \frac{\widehat{\alpha_t} - \widehat{\beta_t}}{1+\widehat{\beta_t}}$).

Although Easton and Sommers (2007) estimate the implied cost of capital each year using annual earnings, we must estimate it each quarter because our analysis is on a quarterly basis. Thus, we sum up the recent four quarterly earnings of each firm and regard such total earnings as the quasi-annual earnings of the firm. Using these quasi-annual earnings, we estimate the implied market-wide cost of capital each quarter. Considering the timing of the quarterly earnings announcement[25] and multiplying per share items by the number of outstanding shares, we transform Equations 16 and 17 into Equations 18 and 19, respectively.

$$MV_{i,q} = BV_{i,q-1} + \frac{(SUMEARN_{i,q-1} - ICC_{i,q} \times BV_{i,q-5})(1 + G'_{i,q})}{(ICC_{i,q} - G'_{i,q})} \tag{18}$$

---

[25] In Japan, quarterly earnings are normally released at the next quarter.

$$\frac{SUMEARN_{i,q-1}}{BV_{i,q-5}} = ICC_{i,q} + \frac{ICC_{i,q} - G'_{i,q}}{1 + G'_{i,q}} \times \frac{MV_{i,q} - BV_{i,q-1}}{BV_{i,q-5}} \tag{19}$$

$MV_{i,q}$ is the market value of firm i at the end of quarter q. $BV_{i,q-1}$ is the book value of firm i stated in the earnings briefing at quarter q-1 (released at quarter q). $SUMEARN_{i,q-1}$ is the quasi-annual earnings of firm i at quarter q-1. $ICC_{i,q}$ is the implied cost of capital of firm i estimated at the end of quarter q. $G'_{i,q}$ is the perpetual growth rate of residual quasi-annual earnings starting from quarter q.

Replacing $ICC_{i,q}$ and $\frac{ICC_{i,q}-G'_{i,q}}{1+G'_{i,q}}$ with the intercept parameter and the slope parameter, respectively $\left(\alpha_q = ICC_{i,q},\ \beta_q = \frac{ICC_{i,q}-G'_{i,q}}{1+G'_{i,q}}\right)$ and the containing error term, we obtain Equation 20 from Equation 19. We run the cross-sectional regression using Equation 20 and estimate the implied cost of capital for the market portfolio each quarter ($ICC_q = \overline{ICC_{i,q}} = \widehat{\alpha_t}$). We regard ICC_q as the market-wide cost of capital in this study.

$$\frac{SUMEARN_{i,q-1}}{BV_{i,q-5}} = \alpha_q + \beta_q \times \frac{MV_{i,q} - BV_{i,q-1}}{BV_{i,q-5}} + \varepsilon \tag{20}$$

REFERENCES

ANILOWSKI, C., M. FENG, AND D. J. SKINNER. 2007. Does earnings guidance affect market returns? The nature and information content of aggregate earnings guidance. *Journal of Accounting and Economics* 44 (1): 36-63.

ARIF, S., AND C. M. LEE. 2014. Aggregate investment and investor sentiment. *Review of Financial Studies* 27 (11): 3241-3279.

BALI, T. G., K. O. DEMIRTAS, AND H. TEHRANIAN. 2008. Aggregate earnings, firm-level earnings, and expected stock returns. *Journal of Financial and Quantitative Analysis* 43 (3): 657-684.

BALL, R., AND P. BROWN. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6 (2): 159-178.

BALL, R., AND G. SADKA. 2015. Aggregate earnings and why they matter. *Journal of Accounting Literature* 34: 39-57.

BALL, R., G. SADKA, AND R. SADKA. 2009. Aggregate earnings and asset prices. *Journal of Accounting Research* 47 (5): 1097-1133.

BANK OF JAPAN. 2013. Outlook for economic activity and prices. *April 2013.*

BARTH, M. E., Y. KONCHITCHKI, AND W. R. LANDSMAN. 2013. Cost of capital and earnings transparency. *Journal of Accounting and Economics* 55 (2): 206-224.

BREALEY, R., S. MYERS, AND F. ALLEN. 2014. *Principles of Corporate Finance. 11th Global Edition.* New York, NY: Mcgraw-Hill/Irwin.

CAMPBELL, J. Y. 1991. A variance decomposition for stock returns. *Economic Journal* 101 (405): 157-179.

COLLINS, D. W., S. P. KOTHARI, AND J. D. RAYBURN. 1987. Firm size and the information content of prices with respect to earnings. *Journal of Accounting and Economics* 9 (2): 111-138.

EASTON, P., G. TAYLOR, P. SHROFF, AND T. SOUGIANNIS. 2002. Using forecasts of earnings to simultaneously estimate growth and the rate of return on equity investment. *Journal of Accounting Research*, 40 (3): 657-676.

EASTON, P. D., AND G. A. SOMMERS. 2007. Effect of analysts' optimism on estimates of the expected rate of return implied by earnings forecasts. *Journal of Accounting Research* 45 (5): 983-1015.

FRANCIS, J., R. LAFOND, P. M. OLSSON, AND K. SCHIPPER. 2004. Costs of equity and earnings attributes. *The Accounting Review* 79 (4): 967-1010.

GALLO, L. A., R. N. HANN, AND C. LI. 2016. Aggregate earnings surprises, monetary policy, and stock returns. *Journal of Accounting and Economics* 62 (1): 103-120.

GRANGER, C. W., AND P. NEWBOLD. 1974. Spurious regressions in econometrics. *Journal of econometrics* 2 (2): 111-120.

HE, W., AND M. R. HU. 2014. Aggregate earnings and market returns: International evidence. *Journal of Financial and Quantitative Analysis* 49 (4): 879-901.

HECHT, P., AND T. VUOLTEENAHO. 2006. Explaining returns with cash-flow proxies. *Review of Financial Studies* 19 (1): 159-194.

HIRSHLEIFER, D., K. HOU, AND S. H. TEOH. 2009. Accruals, cash flows, and aggregate stock returns. *Journal of Financial Economics* 91 (3): 389-406.

KONCHITCHKI, Y. 2011. Inflation and nominal financial reporting: implications for performance and stock prices. *The Accounting Review* 86 (3): 1045-1085.

KONCHITCHKI, Y. 2013. Accounting and the macroeconomy: The case of aggregate price-level effects on individual stocks. *Financial Analysts Journal* 69 (6): 40-54.

KONCHITCHKI, Y. 2016a. Accounting valuation and cost of capital dynamics: Theoretical and empirical macroeconomic aspects. Discussion of Callen. *Abacus* 52 (1): 26-34.

KONCHITCHKI, Y. 2016b. Regional accounting performance, local real estate markets, and stock prices. *Working paper* University of California at Berkeley.

KONCHITCHKI, Y., Y. LUO, M. L. MA, AND F. WU. 2016. Accounting-based downside risk, cost of capital, and the macroeconomy. *Review of Accounting Studies* 21 (1): 1-36.

KONCHITCHKI, Y., AND P. N. PATATOUKAS. 2014a. Accounting earnings and gross domestic product. *Journal of Accounting and Economics* 57 (1): 76-88.

KONCHITCHKI, Y., AND P. N. PATATOUKAS. 2014b. Taking the pulse of the real economy using financial statement analysis: Implications for macro forecasting and stock valuation. *The Accounting Review* 89 (2): 669-694.

KONCHITCHKI, Y., AND P. N. PATATOUKAS. 2016a. From forecasting to nowcasting the macroeconomy: a granular-origins approach using financial accounting data. *Working Paper* Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2832991.

KONCHITCHKI, Y., AND P. N. PATATOUKAS. 2016b. Accounting information and turning points in the business cycle. *Working Paper* University of California at Berkeley.

KOTHARI, S. P., J. LEWELLEN, AND J. B. WARNER. 2006. Stock returns, aggregate earnings surprises, and behavioral finance. *Journal of Financial Economics* 79 (3): 537-568.

LI, N., S. RICHARDSON, AND İ. TUNA. 2014. Macro to micro: Country exposures, firm fundamentals and stock returns. *Journal of Accounting and Economics* 58 (1): 1-20.

NAKANO, M. 2012. Challenge to Macro Empirical Accounting Research. *Accounting* 182 (1): 28-38. (in Japanese)

NAKANO, M. 2014. Innovation in accounting research. *Accounting* 185 (3): 334-344. (in Japanese)

NEWEY, W. K., AND K. D. WEST. 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica* 55 (3): 703-708.

OKIMOTO, T. 2010. *Econometric Analysis of Time-Series with Economic and Financial data.* Tokyo: Asakura Publishing. (in Japanese)

OTA, K. 2012. The theory and practice of White, Newey-West, Cluster-robust and Fama-Macbeth standard error. *Proceeding of the 71st Annual Conference of Japanese Accounting Association.* (in Japanese)

PATATOUKAS, P. N. 2014. Detecting news in aggregate accounting earnings: implications for stock market valuation. *Review of Accounting Studies* 19 (1): 134-160.

PHILLIPS, P. C., AND P. PERRON. 1988. Testing for a unit root in time series regression. *Biometrika* 75 (2): 335-346.

PRAIS, S. J., AND C. B. WINSTEN. 1954. Trend estimators and serial correlation. *Cowles Commission Discussion Paper* Statistics No.383.

SADKA, G., AND R. SADKA. 2009. Predictability and the earnings–returns relation. *Journal of Financial Economics* 94 (1): 87-106.

SAVIN, N. E., AND K. J. WHITE. 1977. The Durbin-Watson test for serial correlation with extreme sample sizes or many regressors. *Econometrica* 45 (8): 1989-1996.

SHIVAKUMAR, L. 2007. Aggregate earnings, stock market returns and macroeconomic activity: A discussion of 'Does earnings guidance affect market returns? The nature and information content of aggregate earnings guidance'. *Journal of Accounting and Economics* 44 (1): 64-73.

SHIVAKUMAR, L. 2010. Discussion of aggregate market reaction to earnings announcements. *Journal of Accounting Research* 48 (2): 335-342.

SHIVAKUMAR, L., AND O. URCAN. 2014. Why do aggregate earnings shocks predict future inflation shocks?. *Working Paper.* Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2194122.

UYSAL, A. 2010. Aggregate earnings, cash flows, accruals surprises, and expected equity premiums. *Working Paper* University of California at Berkeley.

WHITE, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (4): 817-838.

WILLIAMS, C. D. 2015. Asymmetric responses to earnings news: A case for ambiguity. *The Accounting Review* 90 (2): 785-817.

YOSHINAGA, Y. 2016. "Micro-Macro-Puzzle" on earnings-returns relation in Japan. *Hitotsubashi Review of Commerce and Management*, forthcoming. (in Japanese)