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Voluntary monthly earnings disclosures and analyst behavior ☆

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ABSTRACT

We examine how voluntary monthly earnings disclosures relate to monthly analyst behavior. We focus on the number of analysts following a firm and several properties that characterize analysts' earnings forecasts for the upcoming annual earnings. We find firms that disclose monthly earnings attract more analysts, have more accurate and less dispersed analyst earnings forecasts, and have lower overall uncertainty and less commonality of information in analysts' earnings forecasts. In addition, the effect of monthly earnings disclosure on analyst behavior is more pronounced for the firms that regularly disclose monthly earnings. Our results are consistent with the notion that an important role played by a voluntary increase in reporting frequency is to trigger the generation of idiosyncratic information by financial analysts. In other words, analysts tend to complement rather than substitute for firm-provided voluntary disclosures.

1. Introduction

Advocates of more frequent reporting argue that increased reporting improves corporate transparency and governance and thus improves the efficiency of capital markets. Opponents counter that more frequent reporting may lead to more errors in accounting estimates, creates a disproportionate burden on firms and can induce managers to make myopic operating and investment decisions. Because substantial disagreement exists with regard to the desirability of different disclosure regimes, the discussion on whether to introduce mandatory more frequent reporting regimes has been at the center of a heated debate between politicians and practitioners around the world. For example, in the early 2000s, regulators in Europe attempted to increase disclosure frequency by requiring quarterly reporting. However, after strong opposition from several member states and after two consultant rounds with auditors, this proposal was rejected. The commission decided to propose only the introduction of an Interim Management Statement. In the United States, companies have been required to file quarterly reports since 1970. However, the AICPA and the SEC have repeatedly advocated for increased reporting frequency and real-time reporting.

The controversy over optimal reporting frequency calls for further evidence on its effects. Taiwan provides an interesting setting to examine the market effects of increased reporting frequency for three reasons. First, U.S. studies (e.g., Leftwich et al., 1981; McNichols and Manegold, 1983; Butler et al., 2007) and international studies (e.g., Alford et al., 1993; Mensah and Werner, 2008) focus only on the differences in capital market effects between firms reporting quarterly and those reporting semiannually. Taiwan offers a unique setting for examining disclosure frequency because many listed firms voluntarily disclose monthly earnings information. This reporting practice provides a unique opportunity around the world to study the market effects of monthly disclosure. Second, previous U.S. and international studies have generally compared the effects of disclosure frequency across different periods. These effects may be attributed to the passage of time or increased market attention over time rather than higher reporting frequency. International studies relying on cross-country variation in disclosure frequency are also confounded by other cross-country differences, such as legal origin and shareholders rights, which are difficult to be explicitly controlled. This study exploits a setting with a variation in reporting frequency but with

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relative homogeneity across other dimensions.[1] Taiwan's unique monthly disclosure practice provides an opportunity to study the effects of disclosure frequency while holding disclosure quantity, or content, relatively constant. Third, the literature provides mixed results on the capital market effects of reporting frequency. As suggested by Gigler and Hemmer (1998) and Butler et al. (2007), increases in mandatory reporting frequency do not necessarily lead to capital market effects because a cross-sectional variation in reporting frequency is an equilibrium response to differences in the market's demand for accounting information. This demand is shaped by firm characteristics and the availability of lower-cost information alternatives. Thus, regulation that forces firms to adopt more frequent financial reporting policies may not result in an increase in earnings informativeness and leads to the mixed evidence reported in the literature. Whereas prior studies mainly focus on mandatory increases in reporting frequency, this study investigates the market consequences of voluntary increases in reporting frequency. We shed light on whether such voluntary increases in reporting frequency lead to an increase in the market's demand for information provided by financial analysts.

We focus on a major class of users of accounting information, financial analysts, to draw inferences about the potential benefits of more frequent reporting. Our results are based on 14,323 firm-month observations across 1009 unique firms over the period from 2000 to 2010. We begin our analysis by examining the impact of monthly earnings disclosure on analyst following. Consistent with an increasing demand and supply for analyst services for firms providing monthly earnings, we find that the provision of monthly earnings increase analyst following.

We find that monthly earnings disclosures increase forecast accuracy and decrease forecast dispersion. Monthly earnings disclosures provide elements of quarter/annual earnings more quickly and release additional information beyond what market participants can learn from quarter/annual information. In addition, monthly earnings disclosures reduce analysts' cost to interpret information disclosed by firms.

Barron et al. (1998) (hereafter "BKLS") indicate that the traditional measures for the properties of analysts' forecasts (i.e., analyst earnings forecast dispersion and accuracy) do not directly capture the theoretical properties of analysts' information environment, such as the consensus of information contained in analysts' earnings forecasts. We find that the provision of monthly earnings increases the precision of both public and idiosyncratic information of individual analysts' forecasts. Because the increases in the precision of individual analysts' idiosyncratic information are greater than those of common information, monthly earnings disclosure decreases the consensus of analyst information environment. Such effects are stronger for firms that regularly disclose monthly earnings.

Because the firms could choose how much voluntary monthly earnings disclosure to provide, one may argue that endogeneity is a confounding issue. To alleviate this concern, we use the following three approaches: 1. controlling for the endogeneity of the decision to disclose monthly earnings using the Heckman model; 2. controlling for the endogeneity of analyst following using the Heckman model; and 3. controlling for unobservable firm characteristics and potential self-selection bias using within-firm analyses. Our main results are robust to potential selection bias; it is the act of disclosure *per se* that accounts for our results.

This study contributes to the literature in several ways. First, we provide direct evidence of the effect of voluntary earnings disclosures in a jurisdiction with opaque information and weak investor protection. Prior studies show that weak investor protection may limit the usefulness of earnings.[2] Our results suggest that managers may mitigate the adverse effects of country-level institutional factors on earnings' usefulness by providing more frequent voluntary disclosure to improve the information environment.

Second, whereas most studies generally focus on the effect of a firm's disclosure quantity on analyst behavior (e.g., Lang and Lundholm, 1996; Barron et al., 1998, 2002b; Bowen et al., 2002; Hope, 2003; Vanstraelen et al., 2003; Bhat et al., 2006), few studies have examined the impact of reporting frequency on analyst behavior. Because an increase in reporting frequency is different from an increase in the quantity or the precision of reporting information, this study examines another dimension of increased disclosure. We provide direct evidence of how disclosure frequency influences analysts' behavior and the analysts' information environment. Our results corroborate the findings of Francis et al. (2002) in favor of a complementary role rather than a substitutional role of financial analysts in the financial reporting environment.

Finally, to the extent that analysts' information mirrors the beliefs and activities of investors, we shed light on the market consequences of more frequent, and potentially more costly, interim reporting requirements. We provide evidence that more frequent reporting may lead to more efficient capital allocations and investment decisions, at least when firms can choose to report more frequently.

The reminder of this study is organized as follows. Section 2 presents a literature review. Section 3 presents the hypothesis formulated in this study. Section 4 describes the sample and research design. Section 5 presents the empirical results. Section 6 discusses the robustness checks, and Section 7 concludes.

2. Literature review

The literature investigates the effect of increased disclosure frequency on earnings timeliness (Butler et al., 2007), information asymmetry (van Buskirk, 2012), the return-earnings relation (Alford et al., 1993), stock price volatility (Mensah and Werner, 2008), management earnings forecasts, and overall disclosure (Gigler and Hemmer, 1998). These studies provide conflicting evidence on whether more frequent disclosure is desirable. For example, Butler et al. (2007) and van Buskirk (2012) provide mixed evidence on the relation between increased reporting frequency and earnings timeliness.[3] Botosan and Plumlee (2002) find that

[1] One possible reason for this practice is that Article 36 of Securities and Exchange Act in Taiwan requires that within the first ten days of each calendar month, firms must publicly announce and register with the Taiwan Stock Exchange (TWSE) the operating status for the preceding month. Because of this requirement, many companies in Taiwan choose to disclosure monthly earnings together with monthly revenue. Firms usually disclose operating income and income before tax on a monthly and year-to-date basis. Nevertheless, a full income statement is not provided.

[2] For example, the accounting income of firms in code law countries is less timely (Ball et al., 2000). Moreover, managers are more likely to manipulate earnings in countries with weak investor protection (Hung, 2000). Institutions with weak investor protection provide managers with incentives to mask true firm performance by distorting reported earnings and thus reduce the usefulness of earnings (Leuz et al., 2003).

[3] Butler et al. (2007) find little evidence of differences in timeliness between firms reporting quarterly and those reporting semiannually. They find that firms that voluntarily increase reporting frequency from semiannual to quarterly experienced increased timeliness, whereas firms whose increase was mandated by the U.S. SEC did not experience any increase. This finding does not support the claim that regulation mandating more frequent reporting improves earnings timeliness. Van Buskirk (2012) shows that more frequent disclosure is associated with lower price and volume reactions surrounding quarterly earnings announcement. This finding indicates that these disclosures result in more efficient stock prices in the sense that those prices impound information more quickly. In contrast to the conjecture that increased reporting frequency reduces information asymmetry, van Buskirk (2012) finds no evidence that information asymmetry is lower for firms that provide more frequent disclosure. Instead, he documents an increase in information asymmetry in the days prior to the interim announcements.

the cost of equity capital decreases at the annual report disclosure level but *increases* at the level of timely disclosure. Some of these results are consistent with managers' claims that more timely disclosures may *increase* information asymmetry through increased stock price volatility.

Disclosure frequency has also been studied in settings outside of the United States. Alford et al. (1993) investigate the effect of disclosure frequency on the return-earnings relation and return timeliness across 17 countries with cross-sectional variation in disclosure frequency. Their results reveal significant differences in the timeliness and information content of accounting earnings. Although these 17 countries exhibit cross-sectional variation in reporting frequency, the effect of reporting frequency is difficult to isolate from other critical variables, such as the countries' regulatory environment and market structures. Mensah and Werner (2008) empirically examine the extent to which the frequency of interim financial reporting affects stock price volatility over the course of the fiscal year in four countries: two with a quarterly reporting regime (the United States and Canada) and two with a semiannual interim reporting regime (Great Britain and Australia). Although they find greater volatility for firms reporting on a quarterly basis, they note that this result does not account for the relative efficiency of the capital market involved.

Whether mandating more frequent interim reporting actually increases more frequent *overall* disclosure by the firm is unclear. McNichols and Manegold (1983) find evidence that interim reports simply preempt information that would otherwise be disclosed in subsequent annual reports, which thus reduce the informativeness of annual reports. Interim reporting may not improve the overall disclosure of a firm. Gigler and Hemmer (1998) suggest that a mandated increase in interim reporting is likely to result in a reduction in voluntary disclosures by firms because these disclosures are now less valuable. To the extent that voluntary disclosures are more precise indicators of firm value, interim reporting may reduce the timeliness of overall disclosure.

In sum, prior studies in this stream of research offer mixed results on the benefits of increased reporting frequency. We extend this stream of research by examining the effect of voluntary monthly earnings disclosures on analysts' behavior. To the extent that analysts' forecasts mirror that of investors, analyzing the behaviors of analysts provides more direct evidence about how analysts and investors use the disclosed information.

Furthermore, the analyst forecast literature mainly examines the relation between the quantity of firms' financial disclosures and the behavior of security analysts. The quantity of disclosure and the frequency of disclosure are two different measures. Because quarterly and monthly EPS are additive in constituting annual EPS, an increase in reporting frequency is not exactly the same as an increase in reporting quantity. Prior studies establish that the quantity of firms' financial disclosure is informative to analysts' forecasts. However, it is unclear whether a firm's disclosure frequency affects analysts' behavior. We extend the literature on the quantity of a firm's disclosure and analysts' behaviors by examining how a firm's disclosure frequency (i.e., the frequency of a firm's monthly earnings disclosure) influences analysts' behavior.

3. Hypotheses

3.1. Monthly earnings disclosure and analyst following

Monthly earnings disclosure may affect both the supply and demand of analyst forecast. On the supply side, monthly earnings disclosure makes it less costly to receive information from the firm than acquire it from independent sources. All else being equal, this effect increases the equilibrium number of analysts (Bhushan, 1989; Lang and Lundholm, 1996). On the demand side, the effect of monthly earnings disclosure on analyst following depends on whether more frequent reporting by firms substitutes for or complements the analyses performed by financial analysts. Financial analysts may act as information providers who compete with firm-provided disclosure and preempt disclosures made directly to investors by the firms. If that is the case, more frequent disclosure reduces the information gap between the market's expectation of earnings and the expectation conditional on full information (Butler et al., 2007). Because of the reduction in rents to forecasting, monthly earnings disclosure may substitute for analyst services and thus decrease analyst following (hereafter the "substitute effect").

On the other hand, analysts may act as intermediaries who interpret the information disclosed by the firms and transmit this processed information to the capital markets. To the extent that analyst reports complement monthly earnings disclosures, there is a demand for analysts' interpretation of the information. The additional information conveyed by monthly earnings disclosures increases the aggregate demand for analyst services and increases the number of analysts producing earnings forecasts for the firm (hereafter the "complement effect").[4]

In sum, the net effect of monthly earnings disclosures on analyst following depends on the relative importance of these competing supply and demand forces. Because the direction of the effect of monthly earnings disclosure on analyst following is an empirical issue, our hypothesis is nondirectional:

H1. The number of analysts following a firm is related to monthly earnings disclosures.

3.2. Monthly earnings disclosure and characteristics of analysts' earnings forecasts

3.2.1. Analyst forecast accuracy

We argue that voluntary monthly earnings disclosure is positively associated with the analyst accuracy. First, to the extent that more frequent reporting through monthly earnings disclosures provides more up-to-date information on upcoming quarters or years, analysts' forecast accuracy for the current forecasts will increase. Second, monthly earnings disclosures can highlight trends and seasonal patterns that are not obvious based on when earnings are aggregated at the quarter or the annual levels. Accordingly, we formulate the following hypothesis:

H2. Monthly earnings disclosures increase monthly forecast accuracy for upcoming annual earnings.

3.2.2. Analyst dispersion

The effect of increased disclosure on the dispersion of analyst forecasts depends on whether differences in individual forecasts are caused by differences in information or differences in forecasting models (Lang and Lundholm, 1996).[5] If analysts have a common forecasting model and possess different private information, they would place less weight on their private information because they observe the release of publicly available monthly earnings disclosures, which in turn increases the consensus among their forecasts.

[4] For example, Stickel (1989) finds that analysts' revision activity increases following an interim announcement. An increase in reporting frequency, such as monthly earnings disclosure, might attract analyst following or forecast revisions by reducing analysts' costs of production.

[5] In the language of BKLS, analysts attach different weights to private and public information. Therefore, even analysts observe identical public and private information signals, they may come up with different forecasts.

Alternatively, if analysts have different forecasting models or differ in the weights they place on the public information disclosed by the firm, additional disclosure may increase the dispersion of analyst forecasts. We thus formulate the following hypothesis:

H3. Monthly earnings disclosures are related to monthly forecast dispersion for upcoming annual earnings.

3.2.3. The precision and consensus of the information contained in individual analysts' forecasts

We continue to examine how disclosure frequency affects analyst forecast error and forecast dispersion. We explore the BKLS model to examine whether more frequent reporting increases the precision of the information contained in individual analysts' forecasts. Barron et al. (2002b) (hereafter "BBK") document that both the precision of the common and the idiosyncratic information contained in individual analysts' forecasts of future annual earnings increase after the announcement of prior earnings. Based on the findings of BBK, we conjecture that the disclosure of monthly earnings would increase the precision of the common and the idiosyncratic information contained in individual monthly analysts' forecasts.

H4A. Monthly earnings disclosure increases the precision of the common and the idiosyncratic information contained in individual monthly analysts' forecasts.

The effect of monthly earnings disclosures on the consensus of the information contained in individual analysts' forecasts per month is unclear because it depends on the increase in the precision of common information relative to that in idiosyncratic information contained in analysts' forecasts after monthly earnings releases. If the percentage increases in the precision of analysts' common information after monthly earnings disclosures are greater than those in idiosyncratic information, the proportion of individual analysts' total information that is common (i.e., the commonality of analysts' information environment) will decline after the provision of monthly earnings, and *vice versa*. We thus formulate the following hypothesis:

H4B. Monthly earnings disclosures are related to the consensus of information contained in analysts' monthly forecasts for upcoming annual earnings.

4. Research design

4.1. Measurement of the main variables

4.1.1. Analyst following

For months with monthly earnings disclosures, we define a firm's monthly analyst following (*FOLLOWING*) as the number of analysts over the 30-day period starting the day after the announcement of the firm's monthly earnings. For a month without monthly earnings disclosure, we define monthly analyst following as the number of analyst for that month.

4.1.2. Analyst accuracy and analyst dispersion

We define analyst forecast accuracy (*ACCURACY*) for month m of year t as the squared difference between actual annual earnings for year $t+1$ and the consensus analyst earnings forecast for year $t+1$ in month m of year t, scaled by stock price at the beginning of month 1 of year t, where $m = 1, 2, \ldots, 12$. Accordingly, we define analyst forecast dispersion (*DISPERSION*) as the standard deviation of the outstanding individual analysts' earnings forecasts for year $t+1$ in month m of year t, scaled by stock price at beginning of month 1 of year t, where $m = 1, 2, \ldots, 12$.

4.1.3. The precision and consensus of the information contained in individual analysts' forecasts

According to BKLS, analyst consensus (*CONSENSUS*) of the information contained in analysts' earnings forecasts can be expressed in terms of four forecast properties—analyst overall uncertainty (*UNCERTAINTY*), expected dispersion (*DISPERSION*), expected squared error in the mean of forecast (*ACCURACY*), and analyst following (*FOLLOWING*)—as follows:

$$UNCERTAINTY = \left(1 - \frac{1}{FOLLOWING}\right) \times DISPERSION + ACCURACY \quad (1)$$

$$CONSENSUS = \frac{ACCURACY - \frac{DISPERSION}{FOLLOWING}}{UNCERTAINTY} \quad (2)$$

Following BKLS, *CONSENSUS* can be interpreted as the across-analyst correlation in forecast errors. The measure can also be interpreted as the ratio of common uncertainty to overall uncertainty, which represents how much the average analyst's belief reflects common versus private information.

The estimations of the precision of private information (h) and the public information (s) are based on observable features of analysts' forecasts (BKLS, p. 428)[6]:

$$h = \rho \times \frac{1}{UNCERTAINTY} = \frac{\left(ACCURACY - \frac{DISPERSION}{FOLLOWING}\right)}{\left[\left(ACCURACY - \frac{DISPERSION}{FOLLOWING}\right) + DISPERSION\right]^2} \quad (3)$$

$$s = (1-\rho) \times \frac{1}{UNCERTAINTY} = \frac{DISPERSION}{\left[\left(ACCURACY - \frac{DISPERSION}{FOLLOWING}\right) + DISPERSION\right]^2} \quad (4)$$

4.1.4. Monthly earnings disclosure variables

We use a dummy variable, *ME*, that equals 1 when a firm in month m discloses monthly earnings following the announcement of year t earnings and 0 otherwise, where $m = 1, 2, \ldots, 12$. We also use a dummy variable, *MEFIRM*, that equals 1 when a firm discloses monthly earnings frequently and 0 otherwise. A firm is classified as frequent provider of monthly earnings disclosure if the firm discloses monthly earnings in at least 50% of the total number of months in our sample period. Because our sample period ranges from 2000 to 2010 (i.e., 11 years/132 months), such a firm would have provided at least 66 monthly earnings disclosures over the period.[7]

4.2. Control variables

We control for a set of variables that the literature shows to be associated with analyst behavior. In particular, for both regressions of analyst following and the properties of analyst forecasts, we control for a firm's information environment, as proxied by firm size

[6] Specifically, BKLS (p. 427) show that $CONSENSUS = h \times V = h/(h+s)$. V is overall uncertainty computed as in Eq. (1) of our paper.

[7] Our primary results remain qualitatively unchanged when we redefine regular providers of monthly earnings disclosure as those that have disclosed monthly earnings in at least 6 months out of the previous 12 months (trailing 12 months). When a firm initiates monthly earnings disclosures, most of them would commit to providing the same level of disclosures in the future. It is unlikely that a firm would provide monthly earnings disclosures in the earlier years of the sample period but would no longer do so in the later years of the sample period.

(*SIZE*) and institutional ownership (*INSTOWN*). Prior studies find that firm size (*SIZE*) is the most important determinant of analyst following (Barth et al., 2001; Bhushan, 1989; Brennan and Hughes, 1991). Institutional ownership is positively associated with analyst following (Bhushan, 1989; Brennan and Subrahmanyam, 1995; Frankel et al., 2006). Firm size and institutional ownership may also be associated with higher analyst forecast accuracy and lower dispersion because firms with high levels of institutional holdings tend to have better information environments.

We also control for a firm's investment in intangible assets. Barth et al. (2001) find that analysts have increased incentives to follow firms with greater intangibles due to increased demand from investors. Gu and Wang (2005) find that analyst forecast errors increase with a firm's intangible intensity. Barron et al. (2002a) argue that intangible assets are associated with the properties of the information contained in analysts' earnings forecasts. They find that analyst uncertainty increases and analyst commonality decreases with the level of a firm's intangible assets. We use research and development expenditures (*RD*), defined as the ratio of research and development expense to operating expense, and advertising expenditures (*ADV*), defined as the ratio of advertising expense to operating expense, to proxy for intangible intensity.[8]

Bhushan (1989) suggests that private information is more valuable for firms with higher return volatility and is thus positively related to the demand for analyst services. In addition, higher return volatility likely increases information uncertainty and influences the accuracy and dispersion of analyst forecasts. We include the standard deviation of a firm's daily stock returns from the prior quarter (*STD*) as a measure of information uncertainty. We define *STD* as the standard deviation of stock returns, which we calculate using daily returns for the latest quarter proceeding month *m*. Following Barth et al. (2001), we control for growth (*GROWTH*). High-growth firms tend to attract greater analyst following because of investor interest and the potential for future investment banking deals. Furthermore, analysts likely find accurately forecasting earnings for high-growth firms more difficult, leading to greater disagreement among analysts and less accurate forecasts. We define the variable *GROWTH* as compound average growth rate of firm sales over the previous three years.

In addition, we include additional control variables of earnings surprise and the average age of the consensus of the analysts' forecasts in our forecast characteristic regressions. We control for recent earnings surprises because forecast characteristics are likely to be affected by the magnitude of the earnings information to be disclosed. We measure earnings surprise (*ES*) as the absolute value of the reported earnings for year $t+1$ minus the average of analyst forecasts for year $t+1$ in month m, scaled by the stock price 30 days before the earnings announcement date. We control for the average age of the consensus forecasts (*AGE*) because prior work (Brown, 2001; Bowen et al., 2002) finds that forecast age is an important determinant for forecast accuracy and forecast dispersion. We define the average age of the mean forecast as the difference between the announcement date of actual earnings for year $t+1$ and the release date of the analyst's forecast for year $t+1$ in month m.

4.3. Empirical specification

We use the following model to test our hypotheses:

$$\begin{aligned} FOLLOWING_{i,t}\ (Forecast\ properties_{i,t}) &= \beta_0 + \beta_1 ME_{i,t} + \beta_2 MEFIRM_{i,t} + \beta_3 ME_{i,t} \times MEFIRM_{i,t} \\ &\quad + Control\ \ variables + \varepsilon_{i,t} \end{aligned} \tag{5}$$

where *Forecast properties* include forecast accuracy (*ACCURACY*), forecast dispersion (*DISPERSION*), analyst consensus (*CONSENSUS*), and the precision of analyst information (h and s); and the subscripts i and t represent firm i in year t.

The coefficients on *ME* (β_1) capture the impact of monthly earnings disclosure on analyst following (the properties of analyst forecasts) for the non-regular disclosers. The coefficients on *MEFIRM* (β_2) capture the difference in analyst following (the properties of analyst forecasts) between regular and non-regular disclosers. The coefficients on the interaction, $ME \times MEFIRM$ (β_3), are of interest. They indicate the incremental impact of monthly earnings disclosure on analyst following (properties of analyst forecasts) for regular disclosers.

5. Sample and descriptive statistics

5.1. Sample

The sample is based on publicly listed firms on the Taiwan Stock Exchange. Our empirical tests employ data from *Taiwan Economic Journal* (TEJ). The Expert Financial Forecast Application Systems of the TEJ database enables us to identify when individual analysts issue their earnings forecasts (similarly to the I/B/E/S detail file). Because analysts' earnings forecasts from the Expert Financial Forecast Application Systems of the TEJ database are available only from 2000, our sample period spans from 2000 to 2010. We exclude financial services firms from the sample because these firms operate in a different business environment than those in other industries.

We use monthly data to examine the effect of monthly earnings disclosure on analysts' earnings forecasts. We delete firm-month observations lacking at least two individual forecasts of upcoming annual earnings for the corresponding month. For the firms with monthly earnings disclosure, we require that at least two individual forecasts be issued over the 30-day period after a monthly earnings disclosure.[9] This 30-day period is selected to make sure that analysts incorporate the information contained in monthly earnings disclosures into their upcoming annual earnings forecasts.

Panel A of Table 1 summarizes the sample selection criteria. Our sample comprises 515 unique firms with monthly earnings disclosure and 934 firms without them. In Panel B, we find that the monthly earnings observations per firm for one or more than one forecast subsamples with monthly earnings disclosure grow more than for subsamples without monthly earnings disclosure over time. The phenomenon is consistent with hypothesis 1, which suggests that the number of analysts following a firm is related to monthly earnings disclosures. The final sample consists of 2940 firm-months by 515 firms for the subsample disclosing monthly earnings and 11,383 firms-months by 934 firms for the subsample not disclosing monthly earnings.

5.2. Descriptive statistics

Table 2 provides univariate statistics that compare the firm-month observations from firms that disclose monthly earnings with those from firms that do not. Detailed variable definitions are provided in the footnotes to Table 2. Panel A of Table 2 shows that the average number of analysts that follow a firm

[8] Barth et al. (2001) find that analysts have increased incentives to follow firms with greater intangibles because of increased demand from investors. Gu and Wang (2005) find that analyst forecast errors increase with a firm's intangible intensity. Barron et al. (2002a) argue that intangible assets are associated with the properties of the information contained in analysts' earnings forecasts. They find that analyst uncertainty increases and analyst commonality decreases with the level of a firm's intangible assets.

[9] Two individual forecasts are necessary to compute our variables, such as forecast dispersion. Most papers using the BKLS measures feature a similar data requirement.

Table 1
Sample selection.

Panel A: Selection criteria

	Sample with Monthly Earnings Disclosure	Sample without Monthly Earnings Disclosure
Full sample	24,430	140,770
Delete firm-months with no forecast.	(16,297)	(113,862)
Delete firm-months with only one forecast.	(4050)	(14,098)
Delete firm-months with insufficient data to compute necessary variables.	(1143)	(1427)
Final sample	2940	11,383

	Years											Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Panel B: Descriptive data on the sample with zero, one, or more than one forecast before imposing additional data requirements												
Sample with monthly earnings disclosure												
Sample with zero forecast												
Firm-months	1214	1250	1327	1436	1748	1732	1625	1442	1630	1458	1435	16,297
Unique firms	266	284	255	429	494	451	411	497	448	441	382	4358
Firm-months/Firm	4.56	4.40	5.20	3.35	3.54	3.84	3.95	2.90	3.64	3.31	3.76	3.74
Sample with one forecast												
Firm-months	79	90	113	284	285	262	378	584	546	705	724	4050
Unique Firms	54	56	66	161	159	157	203	268	271	334	338	2067
Firm-months/Firm	1.46	1.61	1.71	1.76	1.79	1.67	1.86	2.18	2.01	2.11	2.14	1.96
Sample with more than one forecast												
Firm-months	69	89	97	232	295	354	476	524	596	623	728	4083
Unique firms	38	48	51	109	129	150	182	192	221	230	266	1616
Firm-months/Firm	1.82	1.85	1.90	2.13	2.29	2.36	2.62	2.73	2.70	2.71	2.74	2.53
Sample without monthly earnings disclosure												
Sample with zero forecast												
Firm-months	6943	8040	8963	10,473	11,583	11,815	11,433	11,268	11,198	11,309	10,837	113,862
Unique firms	1013	1114	1251	1299	1351	1347	1323	1350	1383	1379	1369	14,179
Firm-months/Firm	6.85	7.22	7.16	8.06	8.57	8.77	8.64	8.35	8.10	8.20	7.92	8.03
Sample with one forecast												
Firm-months	451	814	1043	1186	1484	1456	1581	1441	1452	1513	1677	14,098
Unique firms	261	467	517	586	602	561	601	602	638	715	733	6283
Firm-months/Firm	1.73	1.74	2.02	2.02	2.47	2.60	2.63	2.39	2.28	2.12	2.29	2.24
Sample with more than one forecast												
Firm-months	866	886	907	1063	1042	1111	1208	1366	1414	1467	1480	12,810
Unique firms	299	304	308	343	329	356	383	419	419	423	421	4004
Firm-months/Firm	2.90	2.91	2.94	3.10	3.17	3.12	3.15	3.26	3.37	3.47	3.52	3.20

	Years											Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Panel C: Descriptive data on final sample used in our tests												
Firm-months with monthly earnings disclosure	48	63	73	170	221	251	361	394	412	458	489	2940
Firm-months without monthly earnings disclosure	740	770	790	966	972	1016	1053	1184	1277	1298	1317	11,383
Proportion of firm-months with monthly earnings disclosure (%)	6.09	7.56	8.46	14.96	18.52	19.81	25.53	24.97	24.39	26.08	27.08	20.53
Panel D: Distribution of forecasts for final sample used in our tests												
Sample with monthly earnings disclosure												
Number of forecasts	161	214	248	590	786	916	1346	1504	1546	1679	1766	10,756
Number of forecasts/ Firm-months	3.35	3.40	3.40	3.47	3.56	3.65	3.73	3.82	3.75	3.67	3.61	3.66
Sample without monthly earnings disclosure												
Number of forecasts	2458	2586	2665	3330	3431	3675	3900	4496	4763	4721	4712	40,737
Number of forecasts/firm-months	3.32	3.36	3.37	3.45	3.53	3.62	3.70	3.80	3.73	3.64	3.58	3.58

(*FOLLOWING*) for the subsample that disclose monthly earnings is larger than that for the subsample that does not disclose monthly earnings. Specifically, the mean (median) *FOLLOWING* is 3.659 (3.000) for the firm-months with voluntary earnings disclosures, compared with 3.579 (3.000) for those without such disclosures.[10]

The mean (median) *ACCURACY* is 0.055 (0.059) for the firm-months with voluntary earnings disclosures and 0.068 (0.063) for the firm-months without voluntary earnings disclosures. The mean (median) *DISPERSION* is 0.015 (0.013) for the firm-months with voluntary earnings disclosures and 0.017 (0.015) for the firm-months without voluntary earnings disclosures. Consistent with Hypotheses 2 and 3, these results suggest that the disclosure of monthly earnings increases the *total* information available about a firm and improves analysts' earnings forecasts.

CONSENSUS is smaller for the firm-months with voluntary earnings disclosures. We further find that the mean and median of *h* and *s* for the firm-months with voluntary earnings disclosures are larger than those without voluntary earnings disclosures. In addition, the percentage increase in the mean (median) of *s* for the disclosing sample relative to the nondisclosing sample is 21.50% (22.63%), whereas the percentage increase in the mean

[10] The average number of individual forecasts in a firm-month is 3.66. This number is comparable to the criteria reported by BBK (they require a similar number of forecasts for at least two analysts for each of the four prior earnings announcements, p.829). We thus believe that our measures are reliable.

(median) of *h* is 14.78% (18.13%).[11] These results suggest that the percentage increase in the precision of individual analysts' idiosyncratic information arising from the disclosure of monthly earnings is greater than that in the precision of individual analysts' common information arising from the disclosure of monthly earnings. As a result, the disclosure of monthly earnings decreases the proportion of individual analysts' total information that is common (i.e., *CONSENSUS*). Firm-months with voluntary earnings disclosure exhibit lower earnings surprises (*ES*) and a larger age of forecasts (*AGE*) relative to those without monthly earnings disclosure.

Panel B of Table 2 presents the correlations among the variables used in our tests. We report the Spearman correlations in the upper diagonal and the Pearson correlations in the lower diagonal. Consistent with our hypotheses, we find that both monthly earnings variables (*ME* and *MEFIRM*), which indicate whether a firm in month *m* discloses monthly earnings and whether it is a regular discloser of monthly earnings, are negatively related to *ACCURACY* and *DISPERSION* but positively related to *FOLLOWING*, *h* and *s*. In addition, both monthly earnings variables are negatively related to *CONSENSUS*.

6. Empirical results

6.1. Analyst following and monthly earnings disclosure

Panel A of Table 3 reports the results of Eq. (5). The coefficient on *ME* (β_1) is 0.095 (p-value < 0.05). For non-regular disclosers of monthly earnings, the number of analysts following for the months with monthly earnings disclosure is 25.89% greater than that for the months without monthly earnings disclosure (i.e., $0.095/0.367 \times 100\%$), which is economically significant. The coefficient on *MEFIRM* (β_2) is 0.700 (p-value < 0.01). Even for the months without monthly earnings disclosure, the number of analysts following is greater for regular disclosers than for non-regular disclosers. The coefficient on the interaction of *ME* and *MEFIRM* (β_3) is 0.373 (p-value < 0.01). This result further suggests that the impact of monthly earnings disclosure on analyst following is greater for regular disclosers than for non-regular disclosers. In particular, the addition of *ME* and *ME* × *MEFIRM* ($\beta_1 + \beta_3$) is 0.468 (0.095 + 0.373), which suggests that for regular disclosers, the number of analysts following for the months with monthly earnings disclosure is 43.86% above those without monthly earnings disclosure (i.e., $(0.095 + 0.373)/(0.367 + 0.700) \times 100\%$). Therefore, the implication of monthly earnings disclosure for analyst following of regular disclosers is 1.69 times (i.e., $(43.86/25.89) \times 100\%$) that of non-regular disclosers.[12] The coefficients on the control variables are largely consistent with those reported in the literature.

Overall, our results are consistent with the notion that monthly earnings disclosure complement rather than substitute for analyst activities. Financial analysts are primarily information intermediaries. Even if the analysts are information providers, the effect of reduced information production costs outweighs the effect of reduced demand because of increased voluntary disclosures.[13]

6.2. The accuracy and dispersion of analyst forecasts and monthly earnings disclosure

Table 4 presents results obtained from the regressions of forecast accuracy and forecast dispersion on the monthly earnings disclosure variables. For both regressions, the coefficients on *ME* are −0.004 for the forecast accuracy equation and −0.001 for the forecast accuracy dispersion equation (significant at the 5% and 10% levels, respectively). Initiation of monthly earnings disclosure is associated with less dispersed and more accurate analyst earnings forecasts. In addition, for non-regular disclosers, the forecast accuracy of monthly observations with monthly earnings disclosure is 6.45% ($(0.004/0.062) \times 100\%$) higher than that of firms without monthly earnings disclosure, whereas the forecast dispersion of monthly observations with monthly earnings disclosure is 4.76% ($(0.001/0.021) \times 100\%$) lower than that of firms without monthly earnings disclosure.

The coefficients on *MEFIRM* are −0.016 for the forecast accuracy equation and −0.004 for the forecast dispersion equation (both significant at the 1% level). Even in the months without monthly earnings disclosure, regular disclosers exhibit more accurate and less dispersed analyst forecast relative to non-regular disclosers. The coefficients on the interactions of *ME* and *ME* × *MEFIRM* are significantly negative for both the accuracy and the dispersion equations (both at the 1% level). The effects of monthly earnings disclosures on analyst accuracy and analyst dispersion are more pronounced for regular disclosers than for non-regular disclosers. In particular, the coefficients on *ME* and *ME* × *MEFIRM* are −0.020 for the forecast accuracy equation and −0.005 for the forecast dispersion equation (significant at the 1% level). For regular disclosers, the accuracy of analyst earnings forecasts for the months with earnings disclosure is 43.48% $((0.004 + 0.016)/(0.062–0.016) \times 100\%)$ higher and the dispersion of analyst earnings forecasts for the months with earnings disclosure is 29.41% $((0.001 + 0.004)/(0.021–0.004) \times 100\%)$ lower than those for firms without earnings disclosure. These results suggest that the implication of monthly earnings disclosure for forecast accuracy and forecast dispersion is more pronounced for regular disclosers relative to non-regular disclosers. The coefficients on the control variables are consistent with those reported in the literature.

Overall, the results suggest that firms with monthly earnings disclosure experience an increase in analyst accuracy and a decrease in forecast dispersion. In addition, regular disclosers have higher forecast accuracy and lower forecast dispersion than non-regular disclosers do, even for the months without earnings disclosure. The implications of monthly earnings disclosure for both forecast accuracy and forecast dispersion are more pronounced for regular disclosers relative than for non-regular disclosers.

6.3. The properties of analysts' information environment and monthly earnings disclosure

We further examine the impact of monthly earnings disclosure on *the precision and consensus of analysts' information*, as derived

[11] The percentage increase in the mean for *s* is 21.50%, which equals ((321.656–264.744)/264.744) × 100%; the percentage increase in the median for *s* is 22.63%, which equals ((35.346–28.823)/28.823) × 100%; the percentage increase in the mean for *h* is 14.78%, which equals ((228.250–198.858)/198.858) × 100%; and the percentage increase in the median for *h* is 18.13%, which equals ((6.789–5.747)/5.747) × 100%.

[12] These figures are computed based on the regression coefficients. The regression coefficient from OLS is the *partial* effect, which measures the effect on the conditional mean of y caused by a change in one of the regressors. Therefore, it is implicitly assumed that other conditioning variables are controlled for (i.e., kept at the same level). We are not trying to rule out the possibility that other variables, for example, size, may have a stronger economic impact on voluntary disclosure decisions.

[13] In unreported analyses, we split the full sample into three subgroups: 1. firm-months before quarterly earnings announcements; 2. firm-months after quarterly earnings announcements; and 3. firm-months in the month of quarterly earnings announcements. We find the effects of voluntary monthly forecasts on forecast accuracy (*ACCURACY*) and dispersion (*DISPERSION*) much stronger in the months before quarterly earnings announcements. However, we find the opposite results for the precision of idiosyncratic information (*s*). These results corroborate that analysts serve as interpreters of financial disclosures ("complementary" role) (Schipper, 1991; Barron et al., 2002b) when they revise their revisions after earnings announcements.

Table 2
Descriptive statistics.

	Mean values			Median values		
	Sample with monthly earnings disclosure	Sample without monthly earnings disclosure	Differences in means	Sample with monthly earnings disclosure	Sample without monthly earnings disclosure	Differences in distributions
Panel A: Comparisons of the samples with and without monthly earning disclosure						
FOLLOWING	3.659	3.579	0.081 (0.043)	3.000	3.000	0.000 (0.340)
ACCURACY	0.055	0.068	−0.014 (0.000)	0.059	0.063	−0.004 (0.000)
DISPERSION	0.015	0.017	−0.002 (0.000)	0.013	0.015	−0.001 (0.000)
CONSENSUS	0.214	0.260	−0.046 (0.000)	0.248	0.337	−0.089 (0.000)
h	228.250	198.858	29.392 (0.000)	6.789	5.747	1.042 (0.000)
s	321.656	264.744	56.912 (0.000)	35.346	28.823	6.523 (0.000)
SIZE	3.737	4.156	−0.419 (0.000)	3.668	4.066	−0.398 (0.000)
INSTOWN	0.455	0.378	0.078 (0.000)	0.447	0.345	0.103 (0.000)
RD	0.223	0.279	−0.055 (0.000)	0.199	0.261	−0.062 (0.000)
ADV	0.431	0.367	0.064 (0.000)	0.414	0.347	0.067 (0.000)
STD	0.029	0.031	−0.001 (0.005)	0.029	0.029	0.000 (0.754)
GROWTH	0.164	0.173	−0.009 (0.151)	0.128	0.126	0.002 (0.987)
ES	0.028	0.041	−0.013 (0.000)	0.014	0.015	−0.001 (0.000)
AGE	225.836	219.967	5.869 (0.001)	229.805	227.000	2.805 (0.004)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Panel B: Correlation matrix																
ME		0.442	0.034	−0.199	−0.145	−0.041	0.066	0.069	−0.270	0.144	−0.090	0.118	−0.004	0.003	0.228	0.024
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.620)	(0.754)	(0.000)	(0.004)
MEFIRM	0.442		0.221	−0.418	−0.311	−0.063	0.109	0.067	−0.070	0.052	−0.120	0.158	−0.141	−0.043	0.147	−0.007
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.408)
FOLLOWING	0.024	0.100		−0.034	−0.108	0.142	0.261	−0.022	0.231	0.147	0.146	0.037	0.042	0.171	0.054	0.062
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ACCURACY	−0.053	−0.098	−0.018		0.456	0.062	−0.452	−0.161	−0.016	−0.069	0.540	0.077	0.139	0.183	0.084	0.262
	(0.000)	(0.000)	(0.031)		(0.000)	(0.000)	(0.000)	(0.000)	(0.060)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DISPERSION	−0.056	−0.127	−0.031	0.511		−0.529	−0.509	−0.488	−0.079	−0.125	0.240	0.073	0.144	0.090	0.050	0.207
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CONSENSUS	−0.090	−0.137	0.057	0.071	−0.459		0.578	−0.679	0.053	0.021	−0.134	−0.011	0.016	0.035	−0.018	0.139
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.010)	(0.000)	(0.175)	(0.060)	(0.000)	(0.035)	(0.000)
h	0.067	0.120	0.138	−0.201	−0.443	0.418		−0.069	0.053	0.035	−0.121	0.053	0.054	−0.091	−0.019	−0.358
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.023)	(0.000)
s	0.070	0.117	−0.049	−0.167	−0.250	−0.257	−0.146		0.069	−0.022	0.115	0.017	0.011	−0.016	0.027	−0.068
	(0.000)	(0.000)	(0.267)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.010)	(0.000)	(0.045)	(0.171)	(0.059)	(0.001)	(0.000)
SIZE	−0.254	−0.058	0.227	−0.021	−0.077	0.032	0.006	0.001		0.511	0.178	−0.092	−0.129	0.076	−0.447	0.000
	(0.000)	(0.000)	(0.000)	(0.010)	(0.000)	(0.000)	(0.473)	(0.865)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.997)
INSTOWN	0.140	0.047	0.137	−0.034	−0.066	0.048	0.019	−0.010	0.512		0.018	−0.069	−0.188	0.013	−0.186	0.007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	(0.241)	(0.000)		(0.031)	(0.000)	(0.000)	(0.133)	(0.000)	(0.394)
RD	−0.104	−0.126	0.164	0.035	0.027	−0.025	−0.047	0.011	0.197	0.026		−0.483	0.115	0.222	0.080	0.011
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)	(0.000)	(0.181)	(0.000)	(0.002)		(0.000)	(0.000)	(0.000)	(0.000)	(0.198)
ADV	0.111	0.155	0.054	0.015	0.015	−0.021	0.039	0.011	−0.078	−0.042	−0.502		−0.132	−0.020	−0.028	−0.01
	(0.000)	(0.000)	(0.000)	(0.073)	(0.068)	(0.014)	(0.000)	(0.185)	(0.000)	(0.000)	(0.000)		(0.000)	(0.017)	(0.001)	(0.242)
STD	−0.023	−0.060	0.011	0.016	0.026	0.028	0.005	0.003	−0.047	−0.034	0.053	−0.047		0.124	−0.098	−0.019
	(0.005)	(0.000)	(0.193)	(0.049)	(0.002)	(0.001)	(0.538)	(0.694)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.022)
GROWTH	−0.01	−0.043	0.096	0.011	0.009	0.010	−0.013	−0.008	0.059	0.044	0.126	−0.029	0.073		0.100	−0.005
	(0.219)	(0.000)	(0.000)	(0.197)	(0.284)	(0.243)	(0.119)	(0.326)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.586)
ES	0.053	0.053	0.099	0.066	0.034	−0.049	−0.016	0.030	0.066	−0.025	0.194	−0.120	−0.024	0.030		0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.004)	(0.000)		(0.617)
AGE	0.028	−0.007	0.080	0.051	0.059	0.082	−0.272	−0.068	−0.005	0.010	0.008	−0.008	0.002	−0.012	0.006	
	(0.001)	(0.423)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.579)	(0.253)	(0.326)	(0.365)	(0.849)	(0.155)	(0.485)	

Table 3
Regressions of analyst following on monthly earnings disclosure variables and control variables.

Variables	Coefficient	*p*-Value
(Constant)	0.367	0.030
ME	0.095	0.044
MEFIRM	0.700	0.000
ME × *MEFIRM*	0.373	0.005
SIZE	0.589	0.000
INSTOWN	0.426	0.010
RD	1.391	0.000
ADV	0.140	0.048
STD	1.545	0.084
GROWTH	0.444	0.003
F-statistics	128.71	
Adj. R^2	0.090	

Notes: Dependent variable is a firm's monthly analyst following (*FOLLOWING*), defined as the number of forecasting analysts who have revised their earnings forecasts for the upcoming earnings in month *m* following the announcement of year *t* earnings. Two-tailed *p*-values are computed using heteroskedasticity robust standard errors clustered by firms. See Table 2 for variable definitions.

Table 4
Regressions of the accuracy and dispersion of analysts' forecasts on monthly earnings disclosure variables and control variables.

Variables	Model 1 Dependent Variable: *ACCURACY*		Model 2 Dependent Variable: *DISPERSION*	
	Coefficient	*p*-Value	Coefficient	*p*-Value
(Constant)	0.062	0.000	0.021	0.000
ME	−0.004	0.035	−0.001	0.058
MEFIRM	−0.016	0.007	−0.004	0.000
ME × *MEFIRM*	−0.016	0.000	−0.004	0.000
SIZE	−0.003	0.003	−0.002	0.000
INSTOWN	−0.009	0.004	−0.002	0.000
RD	0.008	0.024	0.002	0.053
ADV	0.007	0.086	0.001	0.070
STD	0.032	0.133	0.008	0.231
GROWTH	0.001	0.327	0.000	0.363
ES	0.213	0.023	0.024	0.003
AGE	0.000	0.000	0.000	0.000
F-statistics	41.31		42.57	
Adj. R^2	0.030		0.031	

Notes: Two-tailed *p*-values are computed using heteroskedasticity robust standard errors clustered by firms. See Table 2 for variable definitions.

by BKLS. In both the *h* and *s* equations of Table 5, we find that the coefficients on *ME* are 0.076 and 0.166 (significant at the 10% and 5% levels, respectively). These positive coefficients suggest that for non-regular disclosers, the initiation of monthly earnings increases the precision of individual analysts' common and idiosyncratic information. In particular, for non-regular disclosers, the precision of the individual analyst's common information for the disclosing sample is 2.81% ((0.076/2.709) × 100%) higher than that of the non-disclosing firms. The precision of the individual analyst's idiosyncratic information for disclosing firms is 5.95% ((0.166/2.790) × 100%) higher than that of the non-disclosing firms.

We next compare the implications of monthly earnings disclosure for the precision of individual analysts' common information relative to that of idiosyncratic information for regular disclosers. The coefficients on the interactions of *ME* and *MEFIRM* are positively significant for both models, suggesting that the influence of monthly earnings disclosure on the precision of individual analysts' common and idiosyncratic information is more pronounced for regular disclosers relative than for non-regular disclosers. In addition, for regular disclosers, the precision of individual analysts' common information for the months with earnings disclosure is 13.48% (0.076 + 0.317)/(2.709 + 0.206) × 100%) higher than that

Notes: Panel A provides the univariate tests comparing the samples with and without monthly earning disclosure. Corresponding *p*-values (two-tailed) from *t*-tests and Wilcoxon rank-sum tests are reported. Panel B presents the correlation analyses for the variables used in our tests. The Spearman rank correlation coefficients are reported in the upper right portion of the Panel B, and the Pearson linear coefficients are reported in the lower left portion. Two-tailed *p*-values are reported in parentheses. Variables are defined as follows.
ME = 1 if the firm releases a monthly earning in month *m* following the announcement of year *t* earnings and 0 otherwise.
MEFIRM = 1 for all firm-months (both monthly earning and non-monthly earning) for firms that we identify as regular monthly earning disclosures and 0 otherwise. We classify regular monthly earning disclosures as firms that disclose monthly earnings in greater than 50% of our sample period (i.e., greater than or equal to 66 monthly earnings disclosures over the period from 2000 to 2010).
FOLLOWING = The number of forecasting analysts who have revised their earnings forecasts for the upcoming earnings in month *m* following the announcement of year *t* earnings, where *m* = 1, 2, …, 12.
ACCURACY = Future earnings forecast error in month *m* following the announcement of year *t* earnings (i.e., prior year). Future earnings forecast error in month *m* is the squared difference between actual earnings for year *t* + 1 and the outstanding consensus analyst earnings forecast for year *t* + 1 in month *m*, scaled by stock price at beginning of month 1, where *m* = 1, 2, …, 12. For example, month *m* = 1 is the first month following the prior year's earnings announcement, month *m* = 2 is the second month following the prior year's earnings announcement, and month *m* = 12 is the twelfth month following the prior year's earnings announcement.
DISPERSION = future earnings forecast dispersion in month *m* following the announcement of year *t* (prior year's) earnings. Future earnings forecast dispersion in month *m* is the standard deviation of the outstanding individual analysts' forecasts for year *t* + 1 in month *m*, scaled by stock price at beginning of month 1.
CONSENSUS = The ratio of common uncertainty to total uncertainty among analysts computed following Barron et al. (1998, Eq. (16)), using the measures of accuracy, dispersion, and analyst following as previously defined in this table.
h = Precision of common information computed following Barron et al. (1998, Eq. (21)).
s = Precision of idiosyncratic information computed following Barron et al. (1998, Eq. (22)).
SIZE = Log of the market value at the end of the latest quarter proceeding month *m*.
INSTOWN = The ownership held by institutional investors at the end of each fiscal year.
RD = Research and development expense as a percentage of operating expense at the end of the latest quarter's proceeding quarter.
ADV = Advertising expense as a percentage of operating expense at the end of the latest quarter's proceeding month *m*.
GROWTH = Compound average growth rate of firm sales over the prior three years.
STD = The standard deviation of stock returns calculated using daily returns for the latest quarter's proceeding month *m*.
ES = Earnings surprise, calculated as absolute value of the reported earnings for year *t* + 1 minus the average of analyst forecasts for year *t* + 1 in month *m*, scaled by the stock price 30 days before the earnings announcement date, where *m* = 1, 2, …, and 12.
AGE = Average age of forecasts of year *t* + 1 earnings in month *m* following the announcement of year *t* earnings (i.e., prior year). Average age of forecasts in month *m* is the difference between the announce date of actual earnings for year *t* + 1 and the release date of analyst forecast for year *t* + 1 in month *m*.

Table 5
Regressions of precision of common and idiosyncratic information contained in individual analysts' forecasts on monthly earnings disclosure variables and control variables.

Variables	Model 1 Dependent Variable: *h*		Model 2 Dependent Variable: *s*		Model 3 Dependent Variable: *CONSENSUS*	
	Coefficient	*p*-Value	Coefficient	*p*-Value	Coefficient	*p*-Value
(Constant)	2.709	0.000	2.790	0.000	0.238	0.000
ME	0.076	0.073	0.166	0.025	−0.009	0.032
MEFIRM	0.206	0.025	0.635	0.035	−0.033	0.003
ME × *MEFIRM*	0.317	0.072	0.879	0.080	−0.052	0.002
SIZE	0.022	0.256	0.057	0.284	0.002	0.476
INSTOWN	0.129	0.033	−0.097	0.497	0.025	0.048
RD	−0.134	0.023	0.403	0.056	−0.016	0.067
ADV	0.028	0.618	0.108	0.377	−0.008	0.397
STD	0.278	0.284	0.588	0.379	0.142	0.005
GROWTH	−0.036	0.216	−0.087	0.252	0.003	0.402
ES	−0.695	0.084	2.231	0.047	−0.231	0.002
AGE	−0.004	0.000	−0.003	0.000	0.000	0.000
F-statistics	30.30		27.42		41.76	
Adj. R^2	0.021		0.020		0.030	

Notes: In Models 1 and 2, the regression coefficients are multiplied by 100 for convenience. Two-tailed *p*-values computed using heteroskedasticity robust standard errors clustered by firms are reported. See Table 2 for variable definitions.

Table 6
Controlling for potential endogeneity in firm's decision to disclose monthly earnings.

Variables	Model 1 Dependent Variable: *ACCURACY*		Model 2 Dependent Variable: *DISPERSION*		Model 3 Dependent Variable: *CONSENSUS*		Model 4 Dependent Variable: *h*		Model 5 Dependent Variable: *s*	
	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value
(Constant)	0.048	0.008	0.027	0.000	0.203	0.000	3.124	0.000	3.887	0.000
ME	−0.005	0.022	−0.001	0.014	−0.010	0.019	0.085	0.041	0.185	0.004
MEFIRM	−0.016	0.006	−0.004	0.000	−0.033	0.003	0.211	0.022	0.645	0.031
ME × *MEFIRM*	−0.016	0.000	−0.004	0.000	−0.052	0.002	0.316	0.071	0.876	0.079
SIZE	−0.003	0.023	−0.002	0.000	0.005	0.159	0.030	0.142	0.053	0.299
INSTOWN	−0.008	0.007	−0.002	0.007	0.026	0.043	0.123	0.047	−0.110	0.256
RD	0.009	0.021	0.002	0.018	−0.015	0.094	−0.141	0.016	0.388	0.175
ADV	0.006	0.097	0.001	0.084	−0.008	0.374	0.033	0.490	0.117	0.351
STD	0.045	0.068	0.014	0.036	0.151	0.001	0.186	0.541	0.394	0.523
GROWTH	0.000	0.696	0.000	0.454	0.002	0.590	−0.030	0.290	−0.073	0.310
ES	0.189	0.105	0.013	0.220	−0.247	0.001	−0.533	0.212	2.571	0.020
AGE	0.000	0.000	0.000	0.000	0.000	0.000	−0.004	0.000	−0.003	0.000
MILLS	−0.140	0.468	−0.063	0.244	−0.098	0.331	0.939	0.240	1.977	0.374
F-statistics	42.46		42.93		42.64		31.06		27.49	
Adj. R^2	0.031		0.031		0.031		0.021		0.020	

Notes: In Models 4 and 5, the regression coefficients are multiplied by 100 for convenience. Two-tailed *p*-values computed using heteroskedasticity robust standard errors clustered by firms are reported. See Table 2 for variable definitions.

for the months without earnings disclosure, whereas the precision of individual analysts' idiosyncratic information for the months with earnings disclosure is 30.51% ((0.166 + 0.879)/(2.790 + 0.635) × 100%) higher than that for the months without earnings disclosure.

In Model (3) of Table 5, the coefficient on *ME* is −0.009, which is significantly negative (at the 5% level). Even for non-regular disclosers, the initiation of monthly earnings reduces the consensus of analysts' forecasts. In particular, for non-regular disclosers, the consensus of monthly observations with monthly earnings disclosure is 3.78% (0.009/0.238 × 100%) lower than that of observations without monthly earnings disclosure.

The coefficients on *MEFIRM* are negatively significant, suggesting that for the months without monthly earnings disclosure, the consensus of the information contained in analysts' earnings forecasts is lower for regular disclosers. The coefficients on the interactions of *ME* and *MEFIRM* are negatively significant, suggesting that the effect of monthly earnings disclosure on the consensus of the analyst information environment is more pronounced for regular disclosers than for non-regular disclosers. In particular, in Model (3) for regular firms, analyst consensus for the months with earnings disclosure is 29.76% ((0.009 + 0.052)/(0.238–0.033) × 100%) lower than that for the months without earnings disclosure.

Overall, the results in Table 5 indicate that for both regular and non-regular disclosers, monthly earnings disclosure increases the precision of the information contained in individual analysts' forecasts. However, the effect of monthly earnings disclosure on the precision of individual analysts' idiosyncratic information is greater than the effect of common information. Therefore, the proportion of individual analysts' total information that is common (i.e., *CONSENSUS*) declines after the disclosure of monthly earnings.

7. Robustness tests

7.1. Controlling for potential self-selection in monthly earnings disclosure and endogeneity in analyst following using Heckman models

A firm's decision to disclose monthly earnings is endogenously determined by the information environment and capital market attention. Furthermore, analysts decide whether they want to follow a firm given the firm's characteristics. One may argue that part of our results may be caused by self-selection rather than the act of disclosing monthly earnings *per se*. We econometrically control for self-selection bias in two ways.

Table 7
Controlling for potential endogeneity in the number of analysts following.

Variables	Model 1 Dependent Variable: *ACCURACY*		Model 2 Dependent Variable: *DISPERSION*		Model 3 Dependent Variable: *CONSENSUS*		Model 4 Dependent Variable: *h*		Model 5 Dependent Variable: *s*	
	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value
(Constant)	0.057	0.193	0.029	0.023	0.219	0.637	2.726	0.273	3.741	0.007
ME	−0.005	0.043	−0.001	0.053	−0.009	0.018	0.078	0.066	0.159	0.040
MEFIRM	−0.016	0.000	−0.004	0.000	−0.033	0.003	0.207	0.022	0.631	0.040
ME × *MEFIRM*	−0.014	0.002	−0.003	0.000	−0.053	0.002	0.310	0.078	0.899	0.074
SIZE	0.007	0.262	−0.000	0.278	−0.004	0.382	−0.010	0.807	0.151	0.181
INSTOWN	−0.014	0.015	−0.003	0.000	0.028	0.026	0.145	0.180	−0.143	0.561
RD	0.033	0.010	0.005	0.004	−0.032	0.041	−0.214	0.106	0.635	0.043
ADV	0.021	0.007	0.003	0.052	−0.017	0.266	−0.019	0.880	0.246	0.367
STD	−0.364	0.251	−0.042	0.143	0.384	0.003	1.538	0.097	−3.064	0.187
GROWTH	0.002	0.126	0.000	0.174	0.002	0.696	−0.040	0.486	−0.077	0.595
ES	0.141	0.227	0.015	0.018	−0.186	0.017	−0.464	0.570	1.561	0.413
AGE	0.000	0.000	0.000	0.000	0.000	0.000	−0.004	0.000	−0.003	0.000
MALLS_AF	−0.397	0.236	−0.051	0.071	−0.243	0.038	1.265	0.098	3.665	0.085
F-statistics	46.280		52.180		43.860		33.743		28.860	
Adj. R^2	0.035		0.038		0.032		0.023		0.021	

Notes: In Models 4 and 5, the regression coefficients are multiplied by 100 for convenience. Two-tailed *p*-values computed using heteroskedasticity robust standard errors clustered by firms are reported. See Table 2 for variable definitions.

To address the first concern, we conduct Heckman's (1979) two-stage estimation to assess the severity of the potential self-selection bias.[14] In the first stage, we model a firm's decision to disclose monthly earnings as a function of the firm's information environment (market value, analyst following, and institutional ownership), past performance (past market-adjusted returns, growth rate, and ROA), investment opportunities (price-to-book ratio, firm age, and dummy for high-tech industry), volatility (leverage, standard deviation of past returns on equity and analysts' earnings forecast errors), and activities in the capital markets (security offerings in the current or following two years). These variables are motivated by past research (Lang and Lundholm, 1993; Tasker, 1998; Chen et al., 2002; Miller, 2002; Botosan and Stanford, 2005; and Francis et al., 2008). We choose those variables because they are known determinants of voluntary disclosure from those papers. The first-stage results (untabulated) show that most of the variables are significant at the conventional level. In the second stage, we include the inverse Mills ratio (*MILLS*) from the first-stage probit regressions as additional independent variables in our main tests. Table 6 shows that the coefficients on the inverse Mills ratios are not significant and that the main results are robust to potential selection bias.[15]

To address the second concern, we conduct Heckman's (1979) two-stage estimation in a different way. In the first stage, we run a probit regression in which the dependent variable is a binary analyst following variable. For firm-months with at last two forecasts, the binary variable is defined as 1 and defined as 0 otherwise. The independent variables include firm size, institutional ownership, R&D expenditures, advertising expenditures, standard deviation of stock returns, and sales growth rate. In the second stage, we include the inverse Mills ratios obtained from this first stage in our main tests. As shown in Table 7, we also find that the main results are robust to potential endogeneity in analyst following.

7.2. Within-firm analyses

We also perform a changes analysis to control for the potential selection bias problem. We consider those firms that initiated monthly earnings announcements over our sample period such that we could observe the changes in those firms associated with their analysts' behavior between the pre-period (when they did not supply monthly earnings reports) and the post-period when they did supply voluntary monthly earnings reports). One advantage of such a changes analysis is that the firm can serve as its own control. We find that during the sample period, 390 unique firms initiated monthly earnings announcements over our sample period, whereas 2222 firm-month observations belong to the pre-period and 1733 firm-year observations that disclose monthly earnings information in the corresponding months belong to the post-period. Specifically, we use the following equation to control for the potential sample selection bias:

$$\begin{aligned} Forecast\ properties_{i,t} = {} & \beta_0 + \beta_1 POST_{i,t} + \beta_2 MEFIRM_{i,t} \\ & + \beta_3 POST_{i,t} \times MEFIRM_{i,t} \\ & + Control\ variables + \varepsilon_{i,t} \end{aligned} \tag{6}$$

where POST indicates the post-period dummy variable, which equals 1 if the firm-month observations in the sub-sample belong to the post-period and 0 otherwise. Table 8 presents the results of Eq. (6). Consistent with the results of our cross-sectional tests, the results of the within-firm tests for each dependent variable still support our hypotheses. In Models 1–3 (4–5), the coefficients on *POST* × *MEFIRM* are negative (positive) and significant, suggesting that when firms start to regularly disclose monthly earnings, they have more accurate and less dispersed analyst earnings forecasts, have lower overall uncertainty and less commonality of information contained in analysts' earnings forecasts, and increase the precision of the common and the idiosyncratic information contained in individual monthly analysts' forecasts.

[14] Although endogeneity may exist, it is a question of econometrics whether its existence may or may not affect the test variables of interests. It is clear that managers decide whether to provide monthly earnings disclosure. However, this decision does not imply that the act of disclosure itself has no effect on analyst forecast properties.

[15] Two-stage estimates may have poor finite sample properties. If the instruments are weak or partially endogenous, two-stage instrumental variable estimation can produce estimates that are more biased than ordinary least squares estimations. Standard test statistics are misspecified when the correlation between the independent and the instrumental variables is low (Wooldridge, 2002). Larcker and Rusticus (2010, p. 187) make a similar point, suggesting that "[instrument variable (IV) methods] can produce highly biased estimates when the instrumental variable is even slightly endogenous. In those cases, it is likely that IV estimates are more biased and more likely to provide the wrong statistical inference than simple OLS estimates that make no correction for endogeneity." We caution the reader to keep this limitation in mind when interpreting our results.

Table 8
Within-firm analyses.

Variables	Model 1 Dependent Variable: *ACCURACY*		Model 2 Dependent Variable: *DISPERSION*		Model 3 Dependent Variable: *CONSENSUS*		Model 4 Dependent Variable: *h*		Model 5 Dependent Variable: *s*	
	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value
(Constant)	0.048	0.000	0.016	0.000	0.289	0.000	3.055	0.000	3.889	0.000
POST	0.001	0.571	0.000	0.266	−0.020	0.008	0.025	0.583	0.284	0.104
MEFIRM	−0.013	0.000	−0.006	0.000	−0.043	0.000	0.572	0.050	0.874	0.010
POST × *MEFIRM*	−0.009	0.000	−0.003	0.001	−0.082	0.000	0.578	0.047	0.911	0.070
SIZE	0.003	0.209	−0.001	0.002	0.001	0.894	0.064	0.426	0.123	0.663
INSTOWN	−0.011	0.129	−0.003	0.000	0.040	0.015	0.233	0.171	−0.499	0.196
RD	0.015	0.004	0.002	0.013	−0.024	0.222	−0.412	0.048	0.393	0.337
ADV	0.010	0.000	0.001	0.302	−0.007	0.725	−0.118	0.567	0.103	0.780
STD	−0.138	0.342	0.043	0.015	−0.859	0.024	−7.886	0.018	3.800	0.100
GROWTH	0.006	0.110	0.001	0.188	0.001	0.916	−0.176	0.142	−0.266	0.436
ES	−0.017	0.643	0.011	0.034	−0.242	0.043	0.138	0.895	4.089	0.000
AGE	0.000	0.000	0.000	0.000	0.000	0.000	−0.004	0.000	−0.002	0.023
F-statistics	72.620		52.060		14.330		19.410		9.800	
Adj. R^2	0.100		0.135		0.064		0.089		0.035	

Notes: The initial point for the sample used in the within-firm tests consists of firms that have first engaged in monthly earnings announcements for the period spanning from 2000 to 2010. Similarly to a cross-sectional sample, we then eliminated (1) financial services firms, (2) firm-months lacking necessary data to compute necessary variables, and (3) firm-months lacking at least two individual forecasts of upcoming annual earnings for the corresponding month. We identify firm-months with monthly earnings disclosure as the post-monthly earning sample and firm-months before the first monthly earnings announcement as the pre-monthly earning sample. Firm-months without monthly earnings disclosure after the first monthly earnings announcement are eliminated from the post-monthly earning sample. The final sample for within-firm tests consists of a sample of 390 firms and 3955 firm-months (post-monthly earning sample consists of 1733 observations, and pre-monthly earning sample consists of 2222 observations). In Models 4 and 5, the regression coefficients are multiplied by 100 for convenience. Two-tailed *p*-values computed using heteroskedasticity robust standard errors clustered by firms are reported. See Table 2 for variable definitions.

7.3. Propensity score matching

Finally, we control for self-selection by creating a matched sample based on the predicted probabilities from the first-stage probit regression using propensity score matching (PSM) (LaLonde, 1986). An advantage of PSM is that it is a largely nonparametric approach. The researcher is not required to identify instrumental variables (referred to as "Z variables" in Lennox et al., 2012). Untabulated results show that our main results are qualitatively the same and robust to potential selection bias. Overall, the three abovementioned tests suggest that controlling for sample selection bias has little effect on the estimated coefficients of interest. Thus, our results are robust to potential sample selection bias.

8. Conclusion

Regulators and researchers have long been interested in understanding the capital market effects of increased disclosure frequency. However, prior studies in both the U.S. and worldwide offer mixed results regarding the efficacy of market reactions to increased disclosure frequency. Given that an economically significant portion of Taiwan's listed firms voluntarily disclose monthly earnings, this Taiwanese setting provides a unique opportunity to study the effects of disclosure frequency.

Our analyses provide several empirical results. First, voluntary disclosure of monthly earnings attracts more analyst following. Second, the disclosure of monthly earnings affects the properties of analysts' earnings forecasts. Monthly analyst earnings forecasts following months with earnings disclosure are more accurate, less dispersed, and associated with greater precision and lower commonality in analysts' forecasts. Third, the effects of monthly earnings disclosure on analyst following and the properties of analysts' earnings forecasts are more pronounced for firms that regularly disclose monthly earnings. These results suggest that more frequent and regular voluntary disclosure complements analysts' private knowledge rather than substitutes for it. We contribute to the literature by providing direct evidence of the effect of voluntary earnings disclosures in a jurisdiction with opaque information and weak investor protection. Our results corroborate the findings of Francis et al. (2002) in favor of a complementary effect versus a substitution effect for earnings announcement on analyst reports. Further research could examine other capital market consequences of more frequent voluntary disclosures and add to the debate on more frequent, but potentially more costly, interim reporting requirements.

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