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The informational role of aggregate accounting earnings and their components in predicting GDP growth – evidence from Korea

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Abstract: Research on the information value of accounting data has been mainly conducted from the perspective of individual companies and the capital market. However, in recent years, the area has been expanding to an aggregate perspective and the analysis of the relationship with the macro economy. Among them, research on the relationship between aggregate accounting earnings and GDP is drawing special attention. Studies on this have also focused mainly on identifying the relationship between gross accounting net income and GDP growth rate itself. It is difficult to find an in-depth analysis of the source and path of aggregate accounting earnings exerting predictive power as a leading indicator of GDP growth. This study tries to contribute to deepen and expand an accounting research flow related to aggregate accounting earnings by investigating what information factors of aggregate accounting earnings and how the information factors of those act, for companies listed in the Korea Stock Exchange. To this end, this study divides the aggregate accounting earnings and GDP growth rate into sub-elements, and then checks the existence and working path of predictive power through regression analysis. As a result, we find that aggregate accounting earnings have predictive power over the future GDP growth rate, and it is confirmed that the combined effect between the future information of aggregate accruals and the historical information of aggregate operating cash flow is the source of predictive power. In addition, the predictive power for GDP growth rate of aggregate accounting earnings exert through both consumption and investment paths, and the investment path consistently shows higher predictive power for GDP growth rate than consumption path. Through these results, it is expected to increase interest and understanding in enhancing the connection between the national account system and corporate accounting, and to highlight the usefulness of accounting information as basic data for macroeconomic statistics and policy proposals.

Subjects: Economics; Microeconomics; Business, Management and Accounting; Accounting

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Keywords: Aggregate accounting earnings; GDP growth; accruals; non-discretionary accruals; Discretionary accruals

1. Introduction

Accounting researches have traditionally focused on analyzing accounting information at the corporate level, but recently, studies approaching from a macroeconomic perspective have been increasing. This is because the information value of aggregate corporate accounting data, which is aggregated to the level of the national economy, is newly recognized. For example, aggregate accounting earnings reflect the ability of all domestic companies to create added value, so they can be an important source of information about the country's macroeconomic situation and prospects (Ball et al., 2009; Kothari et al., 2006; Sadka & Sadka, 2009).

Researches on aggregate accounting information begin with the exploration of the relationship between aggregate accounting earnings and stock return, and develop into an analysis of the attributes of aggregate accounting information, and the relationship between aggregate accounting information and major macroeconomic variables. Among them, researches on the relationship between aggregate accounting earnings and gross domestic product (GDP) are drawing special attention (Kalay et al., 2018; Konchitchki & Patatoukas, 2014a, 2014b; Nallareddy & Ogneva, 2017; Shivakumar & Urcan, 2017). This is because GDP is a comprehensive indicator of the level of economic activity in a country and is widely used in decision-making by not only policy authorities but also economic players such as managers and investors.

However, research between aggregate accounting earnings and GDP is still only to the extent that it checks whether there is a significant relationship between aggregate accounting earnings and GDP growth rate and the factors affecting the relationship (Konchitchki & Patatoukas, 2014a; Shivakumar, 2007). Most of the prior studies rely on reasoning and do not actively attempt to verify which information element the significant relationship between aggregate accounting earnings and GDP is caused by and how the information element works.

Therefore, in this study, we focus on proving topics that previous studies have not attempted to actively demonstrate, that is, the source and working path of aggregate accounting earnings' predictive power for GDP growth through empirical analysis. Specifically, we divide the aggregate accounting earnings and GDP growth rate into the lower level, and then the presence or absence of predictive power and the working path are checked through regression analysis between them. Through this, it is intended to contribute to the deepening and expansion of the flow of accounting research related to aggregate accounting information.

The remainder of this paper consists of the following. In Section 2, prior studies about the relationship between accounting earnings and macroeconomic variables were reviewed, and research hypotheses were established based on this. Section 3 presents a research model necessary for verifying the research hypotheses and describes the results of data collection and sample selection for empirical analysis. In Section 4, the results of an empirical analysis for the research hypothesis were presented and whether or not the research hypothesis was supported was verified. Section 5 summarizes the research results and describes the implications and limitations.

2. Literature review and hypothesis

2.1. Accounting earnings and their sub-components

The introduction of an empirical study on the information value of accounting earnings is Ball and Brown (1968). They presented empirical evidence that accounting information reflects stock price movements and delivers new information at the time of disclosure of accounting information. Since Ball and Brown (1968), many accounting studies based on capital markets have focused on whether accounting information disclosed by companies brings new information to the capital

market. Among them, most studies on the relationship between accounting earnings and stock return at the corporate level prove that there is a positive relationship between the two variables (Choi et al., 2016; Sadka & Sadka, 2009; Teets & Wasley, 1996).

Accounting earnings calculated by accrual basis accounting consisting of operating cash flows and accruals. Operating cash flow is a measure of management performance calculated by applying the cash-based accounting principle. On the other hand, accruals are calculated by deducting operating cash flows from earnings as a collective estimate of revenue and expense items without cash outflows. Studies comparing the information value of cash flows and accruals report conflicting results.

Some previous studies have reported that operating cash flows have predictive power about the company's future cash flows or profitability. Furthermore, there are studies showing that operating cash flows are higher than accounting earnings in terms of future cash flow prediction capabilities (Bowen et al., 1987; Finger, 1994). This may be the result of accounting distortion caused by manager's earnings management or measurement error problem, rather than solving the lag and matching problem of cash flow. However, most of these studies also show that although accounting earning is lower than cash flow, it still has the ability to predict future cash flow.

Bowen et al. (1987) studied the information value of operating cash flows using the stock price model, focusing on the fact that it is widely recognized that the measurement that is highly related to corporate value is future cash flows. As a result of the analysis, it was confirmed that operating cash flows had less explanatory power for changes in stock prices than accounting earnings but had additional information value in addition to accounting earnings and working capital from operations. Furthermore, it was found that the accrual had additional information value in addition to the operating cash flow.

The accruals are divided again into discretionary accruals and non-discretionary accruals. Non-discretionary accruals are naturally generated as a result of business and investment activities, and are relatively persistent compared to discretionary accruals. On the other hand, the discretionary accrual is the part excluding the non-discretionary accrual from the accrual, and is relatively exposed to the estimation error and the arbitrary judgment of the manager.

Many previous studies have reported a significant relationship between discretionary accruals and future earnings and corporate value. This suggests that accruals, especially discretionary accruals, are an important factor in determining future earnings, and that these relationships can be used to predict future earnings (DeFond & Park, 1997; Feltham & Pae, 2000).

Warfield et al. (1995) confirmed a negative relationship between the incentive to accruals management and the information content of accounting earnings. This suggests that the greater the incentive to earnings management, the lower the information value of the accounting data. On the other hand, Hunt et al. (2000) reported a positive relationship between the stock price-earning multiplier and the degree of earnings smoothing. This suggests that earnings smoothing can increase the predictive power of accounting information.

Subramanyam (1996) confirmed that the stock market, on average, recognizes the information value of discretionary accruals at the corporate level and reflects them in the stock price in the analysis using annual data. As a result of simple regression analysis between stock returns, accounting earnings, non-discretionary earnings (sum of operating cash flows and non-discretionary accruals), and operating cash flows, accounting earnings were higher than non-discretionary earnings and operating cash flows in both regression coefficient size and explanatory power. In addition, a large part of the predictive power of accounting earnings for stock returns was attributed to the discretionary accrual factor. In multiple regression analysis, it was also found that discretionary accruals have additional information value in addition to non-discretionary

earnings. This study said that this is because discretionary accruals improve the ability to reflect the basic value of accounting earnings.

2.2. Aggregate accounting earnings

Since Ball and Brown (1968), many studies have been conducted on the information value of accounting earnings at the corporate level and the aggregate level. Some of these studies demonstrate that accounting earning is a leading indicator of a firm's future cash flow or economic performance, while others confirm a significant relationship between accounting earnings and stock returns, or between stock returns and GDP growth (Ball & Brown, 1968; Fama, 1981; Fischer & Merton, 1984; Teets & Wasley, 1996). From this, the logic is naturally derived that the aggregate accounting earning of all companies in the national economy is a leading indicator of future GDP growth. Aggregate accounting earnings mean the sum of each company's earnings for the entire market.

On the contrary, several studies have demonstrated a negative relationship between aggregate accounting earnings and stock market returns, opposite to existing corporate-level studies (Cready & Gurun, 2010; Kothari et al., 2006). Kothari et al. (2006) expanded the study of the relationship between accounting earnings and stock returns from the corporate level to the total market level. They confirmed that the change in aggregate earning had a negative relationship with the stock market return in the same period. It argued that the positive relationship between earnings and stock market returns at the corporate level is because earnings are dominated by cash flow news, and the negative relationship between aggregate accounting earnings and stock market returns is because the effect of discount rate is dominant. This means that the research results at the corporate level cannot be applied to the aggregate level. However, there may also be a difference in that the reflection of information implied by accounting earnings to the stock price ultimately depends on investors' judgment, while the reflection to GDP depends on the choice of managers and GDP estimators.

A number of subsequent studies have explored the relationship between aggregate accounting earnings and stock returns from various angles (Cready & Gurun, 2010; Gallo et al., 2016; Hirshleifer et al., 2009; Jorgensen et al., 2012; Sadka & Sadka, 2009; Shivakumar, 2007). These studies stimulated accounting studies on the relationship between aggregate accounting earnings and macroeconomic variables, including GDP.

In recent years, studies on the information value of aggregate accounting earnings have expanded to the relationships with various macroeconomic indicators (real and nominal GDP, inflation, unemployment, etc.; Kalay et al., 2018; Konchitchki & Patatoukas, 2014a, 2014b; Nallareddy & Ogneva, 2017; Shivakumar & Urcan, 2017). Konchitchki and Patatoukas (2014a, 2014b) analyzed the relationship between aggregate accounting earnings and future nominal and real GDP growth rates, respectively. They found a significant positive relationship between aggregate accounting earnings and future nominal and real GDP growth rates. It was also argued that aggregate accounting earnings could be a useful leading indicator for future GDP forecasts because it provides timely basic data on the "corporate profits" and other components of GDP. Since Konchitchki and Patatoukas (2014a), studies have continued to confirm that aggregate accounting earnings is a leading indicator of GDP growth, but it is difficult to find studies that have attempted to analyze which information elements of aggregate accounting earnings exert predictive power for GDP growth.

On the other hand, the factors that are often mentioned as sources of predictive power of aggregate accounting earnings for GDP growth rate in previous studies are as follows. First, aggregate accounting earning is one of the main components of GDP, so it has a certain relationship with future GDP as well as current GDP (Ball et al., 2019; Konchitchki & Patatoukas, 2014a). Second, aggregate accounting earning is an indicator of the performance and potential capabilities identified in the past activities of companies in the national economy, so it can be an indicator of

the future profit generation ability and future GDP of the national economy (Abdalla & Carabias, 2022; Ball & Sadka, 2015). Third, aggregate accounting earning is the result of corporate real activity accounting records and contains information on future economic conditions realized over time due to conservative accounting, etc.(Abdalla & Carabias, 2022; Gaertner et al., 2017).

2.3. Hypotheses

In this study, the sources of predictive power of these aggregate accounting earnings for GDP growth rate mentioned in previous studies is verified by dividing them into the following two factors from an information perspective.

The first is historical information contained in aggregate accounting earnings. Many prior studies have demonstrated that accounting earning is a historical record but contains information about the entity's future cash flow trends and profitability (Ball & Brown, 1968; Subramanyam, 1996; Teets & Wasley, 1996). For example, accounting earning reflects past return on investment and thus may contain information about the profitability of new investments. From a financial point of view, the increase in accounting earning also increases a firm's equity investment resources (Abdalla & Carabias, 2022; Ball & Sadka, 2015). Aggregate accounting earning is a comprehensive measure of the ability to create added value confirmed in the past activities of companies in the national economy and has predictive power for future GDP through characteristics such as earnings persistence. In this study, the aggregate operating cash flow, which is the result of cash-based accounting, is expected to hold only historical information.

The second is the future information implied by aggregate accounting earnings. Accounting earnings reflect real events in the market for the company and related products, so they contain some information about economic activities that will affect the future. In addition, in the process of accrual accounting or conservative accounting, accounting earnings at the corporate level reflect information and judgments about future business activities and economic conditions, whether intended or not by managers. The information on determining the future situation of individual companies changes to future macroeconomic situation information at aggregate accounting earnings level, and these macroeconomic information is reflected in the future consumption, investment, and GDP growth at a certain time lag (Konchitchki and Patoukas, 2014a). Previous studies also suggest that the persistence of accounting earnings alone does not fully explain the confirmed relationship between aggregate accounting earnings and future GDP growth, and that additional information elements exist in accounting earning(Barth et al., 2001; Ebaid, 2011). In this study, the aggregate total accruals and its sub-factors (aggregate non-discretionary accruals, aggregate discretionary accruals) are expected to have other information elements such as future macroeconomic information and profit adjustment.

Many previous studies have confirmed or suggested that accounting earning consists of cash flow and accrual but has more than a simple sum of these components (Barth et al., 2001). In this study, based on the assumption that the components of accounting earning have differentiated information values for GDP growth prediction, we attempt to verify the information factors and working paths that are the sources of GDP growth prediction power for each sub-component of aggregate accounting earning.

Recent accounting studies provide more direct evidence on the ability of aggregate accounting earnings to predict future GDP growth rates. In other words, most of the related previous studies report that the change in aggregate accounting earning is a leading indicator with a positive relationship with GDP growth rate.

Konchitchki and Patatoukas (2014a) proved that aggregate accounting earning is actually a predictor of future economic growth by finding that changes in aggregate accounting earning for the current period are positively related with GDP growth until the subsequent fourth quarter. Gallo et al. (2016) also published a study showing that aggregate accounting earning contains

macroeconomic information that can explain unemployment, inflation, and GDP. Hypothesis 1 of this study first verifies the relationship between aggregate accounting earnings and GDP growth rate in Korean companies in the same way as major previous studies.

Hypothesis 1: Aggregate accounting earnings have a positive relationship with future GDP growth rates.

A number of previous studies infer or suggest that aggregate accounting earnings may have information value for future consumption and investment forecasts (Gaertner et al., 2017; Gkougkousi, 2014; Konchitchki & Patatoukas, 2014a; Shivakumar, 2007; Shivakumar & Urcan, 2017). In particular, there are many grounds and evidence that accounting earnings can be expected to be more directly connected to investment than consumption or import and export. Intuitively, an increase in corporate earnings enhances the possibility of investment opportunities or low-cost internal finance, so future investment can be expected to increase. Empirical analysis results confirm that accounting earnings account for a significant portion of the change in investment at the corporate and aggregate levels (Barro, 1990; Blanchard et al., 1993). Recent studies have also reported consistent evidence that aggregate accounting earning is a leading indicator of investment (Arif, 2012; Arif & Lee, 2014; Kothari et al., 2014).

Hypothesis 1a and 1b attempt to empirically analyze the reasoning of previous studies such as Konchitchki and Patatoukas (2014a) that raise the predictive power of aggregate accounting earning for GDP growth rate will be exercised through various direct and indirect channels. In light of the results of previous studies and the path of national income flow, it is expected that aggregate accounting earning is stronger and more directly connected to investment than consumption. Consumption is less related to corporate earnings than investment and is relatively rigid in changes in macroeconomic conditions.

Hypothesis 1a: Aggregate accounting earnings have a positive relationship with future consumption growth rate and investment growth rate, respectively.

Hypothesis 1b: Aggregate accounting earnings have a higher explanatory power for investment growth rate than consumption growth rate.

Previous studies report conflicting research results on the time series attributes of operating cash flows and accruals, persistence, and predictive power for future cash flows. Some argue that the prediction power of operating cash flows for future earnings are superior, some argue that accruals are superior, and others report that the two are complementary. In terms of the persistence of accounting earnings, many studies have shown that operating cash flows are superior to accruals. On the other hand, the findings of Dechow et al. (1998) suggest that accounting earning predicts future cash flows better than current operating cash flows. This means that among the components of accounting earning, there are elements other than operating cash flows that contribute to the forecasting of future cash flows.

Gaertner et al. (2017) is the only direct study on the GDP prediction power of operating cash flows and accruals. They analyzed the predictive power for future GDP growth by dividing accounting earning into operating cash flow and accrual factors as an additional analysis. As a result of the analysis, only the negative change of aggregate accruals consistently predicts the future GDP growth rate. In contrast, the change in aggregate operating cash flow has no predictive power for future GDP growth. They explained that the results were consistent with the fact that accruals in the conservative accounting system facilitate asymmetrical loss recognition, which better predicts future GDP growth when economic news is bad.

Hypothesis 2a, Hypothesis 2b, Hypothesis 3a, and Hypothesis 3b verify the assumptions of previous studies by dividing the aggregate accounting earning by the aggregate operating cash flow and aggregate accruals. In other words, aggregate operating cash flow containing historical information on corporate performance and aggregate accrual containing future macroeconomic information are expected to have a positive relationship with future GDP growth, consumption growth, and investment growth, respectively. In addition, since accruals increase the information value of operating cash flows through the timing of accruals, it is expected that the model exhibits additional explanatory power for GDP growth, if the model adds the aggregate accruals to the model that already contains aggregate operating cash flow.

Hypothesis 2a: When aggregate accounting earning is divided into aggregate operating cash flows and aggregate accruals, aggregate operating cash flows and aggregate accruals have a positive relationship with future GDP growth rates, respectively.

Hypothesis 2b: When aggregate accounting earning is divided into aggregate operating cash flows and aggregate accruals, the predictive power for future GDP growth rates is higher than before division.

Hypothesis 3a: Aggregate operating cash flows and aggregate accruals have a positive relationship with future consumption growth rate and investment growth rate, respectively.

Hypothesis 3b: Aggregate operating cash flows and aggregate accruals have a higher explanatory power for investment growth rate than consumption growth rate.

In order to confirm whether the predictive power of accounting earnings and accruals for GDP growth rate is purely due to accrual-based accounting factors' or managers' discretionary accounting choices, it is necessary to divide the accruals into discretionary accruals and non-discretionary accruals. Several previous studies on the persistence of accounting earnings, the relationship between accounting earnings and stock returns, suggest that discretionary accruals play an important role in the display of predictive power (Kang et al., 2010; Subramanyam, 1996; Teoh et al., 1998; Warfield et al., 1995; Xie, 2001). The predictive power of discretionary accruals also varies depending on whether they are opportunistic or they provide additional information, but it is difficult to distinguish them in advance. Barth et al. (2001) demonstrated that dividing accounting earnings into cash flows and sub-factors of accruals (six factors including increase or decrease in accounts receivable, inventory, and depreciation expense) enhances accounting earnings' ability to predict future cash flows.

At the aggregate level, there is no direct study on the relationship of the non-discretionary accruals and discretionary accruals with the GDP growth rate or the growth rate of the sub-factors of GDP. Therefore, the hypothesis of the GDP predictive power and its working path of the aggregate non-discretionary accrual and aggregate discretionary accrual is set in accordance with Hypothesis 2 and 3.

Hypothesis 4a: When aggregate accrual is divided into aggregate non-discretionary accrual and aggregate discretionary accrual, aggregate non-discretionary accruals and aggregate discretionary accruals have a positive relationship with future GDP growth rates.

Hypothesis 4b: When aggregate accrual is divided into aggregate non-discretionary accrual and aggregate discretionary accrual, the predictive power for future GDP growth rates is higher than before division.

Hypothesis 5a: Aggregate non-discretionary accruals and aggregate discretionary accruals have a positive relationship with future consumption growth rate and investment growth rate, respectively.

Hypothesis 5b:: Aggregate non-discretionary accruals and aggregate discretionary accruals have a higher explanatory power for investment growth rate than consumption growth rate.

3. Research design

3.1. Research model

In this study, the research model below of Konchitchki and Patatoukas (2014a) is partially modified and used for hypothesis verification.

$$G_{q+k} = \alpha + \beta_1 X_q + \in_{q+k}$$

Here, G_{q+k}: GDP growth rate in the q + k quarter (k = 1 ~ 4)

X_q: Changes in aggregate accounting earning in quarter q

Hypothesis 1 and Hypothesis 1a are verified by reviewing the significance and the sign of β_1, and adjusted R^2 in the results of regression analysis using Equation (1), and (2),(3), respectively. A positive (+) value is expected for the variable of interest, β_1. There are limitations in using adjusted R^2 to compare the predictive power between the two equations with the same independent variables but different dependent variables, such as verifying Hypothesis 1a. In this study, the significance of the regression coefficient, the duration, and the value of the adjusted R^2 are comprehensively evaluated and judged. Hypothesis 3 and hypothesis 5 are analyzed in the same way.

$$GP_{q+k} = \alpha + \beta_1 EARN_q + \in_{q+k} \quad (1)$$

$$CP_{q+k} = \alpha + \beta_1 EARN_q + \in_{q+k} \quad (2)$$

$$IP_{q+k} = \alpha + \beta_1 EARN_q + \in_{q+k} \quad (3)$$

Here, GP_{q+k}: Quarterly nominal GDP growth rate in quarter q + k

$EARN_q$: Changes in aggregate accounting earning in quarter q

CP_{q+k}: Quarterly nominal consumption growth rate in quarter q + k

IP_{q+k}: Quarterly nominal investment growth rate in quarter q + k

Hypothesis 2a and Hypothesis 2b are verified by the significance and the sign of β_1, and adjusted R^2 in the results of regression analysis using Equation (4). For Hypothesis 3a and Hypothesis 3b, we use Equations (5) and (6). A positive (+) value is expected for the variable of interest, β_1.

$$GP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \in_{q+k} \quad (4)$$

$$CP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \in_{q+k} \quad (5)$$

$$IP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \in_{q+k} \quad (6)$$

Here, CFO_q: Changes in aggregate operating cash flow in quarter q

$ACCR_q$: Changes in aggregate accrual in quarter q

Hypothesis 4a and 4b are verified by the significance and the sign of β_1 in the results of regression analysis using Equation (7). The regression analysis for Hypothesis 5a and 5b uses Equations (8) and (9). A positive (+) value is expected for the variable of interest, β_1.

$$GP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \in_{q+k} \quad (7)$$

$$CP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \in_{q+k} \quad (8)$$

$$IP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \in_{q+k} \quad (9)$$

Here, NDA_q: Changes in aggregate non-discretionary accrual in quarter q

DA_q: Changes in aggregate discretionary accrual in quarter q

4. Data and empirical results

4.1. Data and sample characteristics

To investigate the hypotheses, first, financial accounting data of 758 companies with settlement dates at the end of December are obtained from FnGuide database among listed companies in the Korea Stock Exchange as of June 2019. As operating cash flow data are available from 2003 and GDP data are available to 2018, the first sample is constructed from the first quarter of 2003 to the fourth quarter of 2018.

There are a number of missing values and errors in the first sample data, so they are individually modified or reinforced compared to KissValue database and Financial Supervisory Service's electronic disclosure system (DART) data. Finally, a sample consisting of quarterly 559 to 754 corporate data is obtained. In addition, statistics data related to the capital market, including stock market capitalization data by company, are obtained from FnGuide, and data related to GDP and other control variables are collected from the National Statistical Portal (KOSIS), Bank of Korea (BOK) Economic Statistics System (ECOS), and published data from Bank of Korea.

The companies listed in the Korea Stock Exchange are divided into a total of 13 industries (middle industrial classification). As for the large industrial classification, the manufacturing industry accounts for about 70% of the total sample, and by small industrial classification, chemical product manufacturing, and financial industry samples account for about 14%, followed by distribution, transportation equipment manufacturing, and electronic manufacturing.

This study calculates the "change in aggregate accounting earnings" for earnings and its subcomponents in the same way as most previous studies, including Konchitchki and Patatoukas (2014a). First, earnings, operating cash flows, accruals, non-discretionary accruals, and discretionary accruals are scaled as underlying total assets, and then a year-on-year change is calculated for each. Considering that aggregate accounting earning variable is calculated quarterly, the sample is readjusted for changes in earning, operating cash flow, accrual, non-discretionary accrual, and discretionary accrual, after adjusting the extreme value of the upper and lower 1% quarterly. After adjusting the extreme value, sample data consisting of quarterly 486 to 662 corporate data is obtained. The adjusted accounting earning data (earnings change, operating cash flows change, accruals change, non-discretionary accruals change, discretionary accruals change) is weighted average by the stock market capitalization at the beginning of the period to build a time series aggregate accounting earnings data for the quarter from the first quarter of 2005 to the fourth quarter of 2018.

Non-discretionary accruals are estimated using the time series modified Jones model, and discretionary accruals are calculated by subtracting the estimated non-discretionary accruals from the total accruals. In general, it is known that the accuracy of the cross-sectional modified

Jones model is higher than that of the time series model, but when the discretionary accruals are aggregated quarterly, the aggregate discretionary accruals converge to 0. To avoid this problem, this study used the time series modified Jones model. Only cases where there were 10 or more effective observations for each company in the sample data are included in the non-discretionary accrual estimation.

As dependent variables, GDP, consumption and investment growth rate, are used on a nominal basis consistent with quarterly financial accounting data, are calculated as year-on-year figures to eliminate seasonal factors, and are calculated from quarterly provisional GDP statistics (usually released within 70 days after the end of the quarter) that announced after the quarterly corporate earnings release (within 45 days after the end of quarter).

Table 1 summarizes the descriptive statistics of major variables used in the empirical analysis. The average and standard deviation of the changes in aggregate accounting earnings scaled to total assets are −0.1180 and 0.5942, respectively. The average and standard deviation of changes in aggregate accounting earnings are smaller than the average (−0.1455) and standard deviation (0.7080) of changes in aggregate operating cash flows. This is because the changes in aggregate accruals (average 0.0275, standard deviation 0.5416) alleviated the changes in aggregate accounting earnings. Among the sub-factors of the changes in aggregate accruals, the average and standard deviation of the changes in aggregate non-discretionary accruals are 0.0438, 0.1334, while the average and standard deviation of the changes in aggregate discretionary accruals are −0.0163 and 0.5494. While the aggregate discretionary accruals have a smaller size than the aggregate non-discretionary accruals, they have a larger standard deviation, due to the nature of the variable.

Meanwhile, during the sample period, the quarterly provisional nominal GDP growth rate is 4.8%, and the standard deviation is 2.4%. The average of the quarterly nominal consumption growth rate and investment growth rate is 5.1% and 4.3%, respectively, while the standard deviation is 1.7% and 9.9 percent, which is very large. This is the result of reflecting the characteristics of variables that while consumption is relatively stable despite changes in economic conditions, but investment is not.

Table 2 summarizes the correlation between independent variables (Pearson correlation coefficient). The changes in aggregate accounting earnings show a significant correlation with its sub-components, aggregate operating cash flows, aggregate non-discretionary accruals, and aggregate discretionary accruals at the significance level of 1–5%. In particular, a correlation is found between the changes in aggregate operating cash flows and the changes in aggregate accruals as well as between the changes in aggregate accruals and the changes in aggregate discretionary accruals, though these variables are simultaneously used as an independent variable in one

Table 1. Descriptive statistics

Variable	N	Mean	Median	Standard Deviation	Minimum Value	Maximum Value
EARN	56	−0.1180	−0.1292	0.5942	−1.6527	1.3131
CFO	56	−0.1455	−0.1792	0.7080	−1.9752	1.9265
ACCR	56	0.0275	0.0112	0.5416	−1.3635	1.2666
NDA	56	0.0438	0.0311	0.1334	−0.2556	0.3319
DA	56	−0.0163	−0.1888	0.5494	−1.2958	1.1468
GP	56	4.8	4.6	2.4	−1.6	11.7
CP	56	5.1	5.1	1.7	1.4	8.5
IP	56	4.3	4.7	9.9	−25.3	34.3

Table 2. Pearson correlation matrix (independent variables)

	EARN	CFO	ACCR	NDA	DA
EARN	1.0000				
CFO	0.6667***	1.0000			
ACCR	0.2256*	− 0.5757***	1.0000		
NDA	− 0.4834***	− 0.4547***	0.0640	1.0000	
DA	0.3397***	− 0.4571***	0.9702***	− 0.1797***	1.0000

verification model. Therefore, multicollinearity is suspected between these variables, so we check the multicollinearity of the related hypothesis verification models. As a result, it is found that the variance expansion index (VIF) is significantly lower than 10, so it is confirmed that multicollinearity did not exist.

Table 3 analyzes the correlation (Pearson correlation coefficient) between the independent variables and the dependent variables used in this study. The changes in aggregate accounting earnings are showing a positive correlation with GDP growth rate in the next and after next quarter, with consumption growth rate in the next quarter, and with investment growth rate until the third next quarter, consistent with the hypothesis of this study. The changes in other subcomponents of aggregate accounting earnings, except for changes in aggregate accounting earnings, have only been found a correlation with GDP-related variables sporadically. The relationship between these variables needs to be additionally confirmed through regression analysis.

4.2. Empirical results

Table 4 shows the regression results of the relationship between the changes in aggregate accounting earnings and the quarterly provisional nominal GDP growth rate. First, the changes in aggregate accounting earnings show a positive relationship with GDP growth rates for the next

Table 3. Pearson correlation matrix (between dependent and independent variables)

	GP_q	GP_{q+1}	GP_{q+2}	GP_{q+3}	GP_{q+4}
	CP_q	CP_{q+1}	CP_{q+2}	CP_{q+3}	CP_{q+4}
	IP_q	IP_{q+1}	IP_{q+2}	IP_{q+3}	IP_{q+4}
$EARN_q$	0.5342***	0.5997***	0.3791***	0.1025	− 0.1716
	0.1774	0.3128**	0.1730	0.0033	− 0.1143
	0.2310*	0.5900***	0.5723***	0.3767***	0.0325
CFO_q	0.3176**	0.3049**	0.1832	− 0.0005	− 0.0332
	0.0673	0.1222	− 0.0180	− 0.0616	− 0.1181
	0.1205	0.2725**	0.3459**	0.1862	0.0565
$ACCR_q$	0.1709	0.2519*	0.1718	0.1116	− 0.1434
	0.1066	0.1793	0.2106	0.0838	0.0285
	0.0959	0.2836**	0.1691	0.1654	− 0.0377
NDA_q	0.0761	− 0.0127	0.0282	0.1243	0.1692
	0.0780	0.0056	0.0255	0.1504	0.1991
	0.1893	0.0309	− 0.0661	− 0.025	− 0.0023
DA_q	0.1500	0.2512*	0.1626	0.0801	− 0.1820
	0.0861	0.1779	0.2015	0.0465	− 0.0200
	0.0486	0.2718**	0.1827	0.1692	− 0.0365
N	56	55	54	53	52

Table 4. ***Regression results for hypothesis 1.***
$GP_{q+k} = \alpha + \beta_1 EARN_q + \epsilon_{q+k}$

	GP_{q+1}	GP_{q+2}	GP_{q+3}	GP_{q+4}
$EARN_q$	2.463***	1.551**	0.419	−0.705
	(2.39)	(2.36)	(0.58)	(−0.70)
Intercept	5.053	4.988	4.888	4.769
	(12.32)	(10.77)	(9.55)	(9.05)
F-value	11.09***	5.57**	0.34	0.48
Adjusted-R^2	0.3475	0.1272	−0.0089	0.0101
N	55	54	53	52

quarter and after next quarter at 1% and 5% significance levels, respectively, supporting Hypothesis 1. These regression analysis results mean that the changes in aggregate accounting earnings are leading indicator of GDP growth, and if the changes in aggregate accounting earnings increases by 1 standard deviation (0.5942), the nominal GDP growth rate in the next quarter increases by about 1.5%p.

These analysis results fall short of the research results of Konchitchki and Patatoukas (2014a), which showed a significant positive relationship between aggregate accounting earnings and nominal GDP growth up to 4 quarters, using US data. That means, compared to US, the persistence of prediction is shorter in Korea.

Table 5 analyzes the relationship between the changes in aggregate accounting earnings and the consumption growth rate and investment growth rate, which are the main components of quarterly provisional nominal GDP. It is confirmed through which path the GDP predictive power of aggregate accounting earnings is exercised by this analysis. The changes in aggregate accounting earnings show a positive relationship with the consumption growth rate in the next quarter (q + 1), while the investment growth rate remains significant until the next third quarter (q + 3), lasting longer than the consumption growth rate. In addition, the explanatory power for the investment growth rate in the next quarter (adjusted-R^2) is 0.3358 and the explanatory power for the consumption growth rate is 0.0808. These analysis results support Hypothesis 1a and 1b. In other words, the predictive power of changes in aggregate accounting earnings for the nominal GDP growth rate is being exerted through consumption channel and investment channel, and in particular, the predictive power of investment channel is higher.

Table 6 is the result of a regression analysis between aggregate operating cash flow, aggregate accrual, and quarterly provisional nominal GDP growth rate. Both the change in aggregate operating cash flow and the change in aggregate accrual show a positive relationship with the quarterly provisional nominal GDP growth rate for the next quarter and after next quarter. However, the explanatory power of the model (0.3506) for the GDP growth rate in the next quarter is higher than that of the model (0.3475) using the change in aggregate accounting earning as an explanatory variable, but the difference is insignificant. Moreover, the explanatory power for the next quarter GDP growth rate is higher in Equation (1) (0.1272) than in Equation (4) (0.1186) and is not consistent.

These results support Hypothesis 2a but do not support Hypothesis 2b. In the model, which divides the change in aggregate accounting earning into change in aggregate accrual and change in aggregate cash flow, both explanatory variables showed a significant positive relationship with the nominal GDP growth rate. This means that the historical information of the aggregate

Table 5. ***Regression results for hypothesis 1a & 1b.***
$CP_{q+k} = \alpha + \beta_1 EARN_q + \epsilon_{q+k}$
$IP_{q+k} = \alpha + \beta_1 EARN_q + \epsilon_{q+k}$

	q + 1		q + 2		q + 3		q + 4	
	CP	IP	CP	IP	CP	IP	CP	IP
EARN	0.918*	9.952***	0.507	9.654***	0.010	6.352**	−0.331	0.550
	(1.99)	(3.44)	(1.25)	(2.77)	(0.03)	(2.33)	(−0.71)	(0.23)
Intercept	5.230	5.428	5.176	5.416	5.099	5.026	5.025	4.481
	(14.82)	(3.47)	(14.33)	(3.50)	(13.71)	(2.78)	(13.32)	(2.23)
F-value	3.98*	11.87***	1.56	7.67***	0.00	5.44**	0.50	0.05
Adjusted-R^2	0.0808	0.3358	0.0113	0.3146	−0.0196	0.1251	−0.0067	−0.0189
N	55	55	54	54	53	53	52	52

Table 6. *Regression results for Hypothesis 2a & 2b.*
$GP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \epsilon_{q+k}$

	GP_{q+1}	GP_{q+2}
CFO_q	2.349***	1.468**
	(3.00)	(2.13)
$ACCR_q$	2.907***	1.879***
	(4.37)	(2.84)
Intercept	5.024	4.968
	(12.29)	(10.63)
F-value	10.57***	4.05**
Adjusted-R^2	0.3506	0.1186
N	55	54

Note: No significant relationship was found between explanatory variables of interest and future nominal GDP growth rates in the third and fourth quarters, so it was omitted from the convenience table and excluded from the analysis

operating cash flow and the future information of the aggregate accrual are exerting the predictive power for the GDP growth rate. However, the model that divides aggregate accounting earnings into aggregate operating cash flow and aggregate accrual does not show consistently higher explanatory power than the non-division model, so the detailed effect of aggregate accounting earning cannot be confirmed. This suggests the possibility that aggregate accounting earning has not been divided into sub-factors enough to reveal the subdivision effect. This is re-checked in Hypothesis 4.

Table 7 shows the results of regression analyses on the relationship between consumption growth rate and investment growth rate, which are sub-factors of quarterly provisional nominal GDP growth after dividing the change in aggregate accounting earning into change in aggregate operating cash flow and aggregate accrual. As shown in the table, in the model (Equations 5, 6), which divides the change in aggregate accounting earning into change in aggregate operating cash flow and change in aggregate accrual, the change in aggregate operating cash flow shows a positive relationship with consumption growth rate in the next quarter and investment growth rate until the next third quarter. The change in aggregate accrual shows a significant positive relationship with the consumption growth rate in the next quarter and the investment growth rate

Table 7. *Regression results for hypothesis 3a & 3b.*
$CP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \epsilon_{q+k}$
$IP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 ACCR_q + \epsilon_{q+k}$

	q + 1		q + 2		q + 3	
	CP	IP	CP	IP	CP	IP
CFO_q	0.843*	9.351***	0.390	9.486**	−0.046	6.030**
	(1.75)	(3.23)	(0.98)	(2.56)	(−0.13)	(2.11)
$ACCR_q$	1.211**	12.29***	0.965*	10.31***	0.229	7.616**
	(2.23)	(4.09)	(1.91)	(3.24)	(0.51)	(2.64)
Intercept	5.211	5.275	5.147	5.376	5.086	4.952
	(15.21)	(3.46)	(14.66)	(3.38)	(13.65)	(2.71)
F-value	2.57*	8.91***	1.98	5.28***	0.27	3.53**
Adjusted-R^2	0.0764	0.3487	0.0244	0.3031	−0.0324	0.1161
N	55	55	54	54	53	53

Note: No significant relationship is found between the explanatory variable and the growth rate of future nominal consumption and investment in the next fourth quarter, so it is omitted from the table and excluded from the analysis for convenience.

Table 8. ***Regression results for hypothesis 4a & 4b.***
$GP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \epsilon_{q+k}$

	GP_{q+1}	GP_{q+2}	GP_{q+3}
CFO_q	3.212***	2.122***	0.844
	(4.33)	(3.69)	(1.08)
NDA_q	10.38***	7.548**	5.167
	(4.11)	(2.65)	(1.53)
DA_q	3.462***	2.295***	1.070
	(5.44)	(3.79)	(1.14)
Intercept	4.808	4.796	4.730
	(13.99)	(10.99)	(9.43)
F-value	12.23***	6.07***	0.78
Adjusted-R^2	0.4476	0.1641	−0.0029
N	55	54	53

Note: No significant relationship is found between the explanatory variable and the growth rate of future nominal consumption and investment in the next fourth quarter, so it is omitted from the table and excluded from the analysis for convenience.

until the next third quarter. In addition, the explanatory power for the investment growth rate is consistently higher than that of the consumption growth rate. The regression coefficients for the investment growth rate also consistently maintain a larger value than the consumption growth rate. Although omitted from the table, the regression coefficients for the investment growth rate are consistently larger than the consumption growth rate even when compared using the standardized regression coefficients.

These results support Hypotheses 3a and 3b. When the change in aggregate accounting earning is subdivided into change in aggregate operating cash flow and change in aggregate accrual, the predictive power for the nominal GDP growth rate is exerted through consumption and investment channels. In addition, the explanatory power of the model for the investment growth rate is consistently higher than the model for the consumption growth rate.

Table 9. ***Regression results for hypothesis 5a & 5b.***
$CP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \epsilon_{q+k}$
$IP_{q+k} = \alpha + \beta_1 CFO_q + \beta_2 NDA_q + \beta_3 DA_q + \epsilon_{q+k}$

	q + 1		q + 2		q + 3	
	CP	IP	CP	IP	CP	IP
CFO_q	1.147**	13.32***	0.577	12.35***	0.264	8.024***
	(2.02)	(4.21)	(1.27)	(3.62)	(0.52)	(3.28)
NDA_q	3.846	46.68***	2.582	35.12***	2.922	24.90*
	(1.52)	(4.01)	(0.91)	(3.25)	(0.98)	(1.92)
DA_q	1.406**	14.85***	1.084**	12.13***	0.425	8.872***
	(2.40)	(4.76)	(2.08)	(4.10)	(0.83)	(3.21)
Intercept	5.135	4.285	5.098	4.624	5.002	4.408
	(14.77)	(3.25)	(14.20)	(3.12)	(13.52)	(2.35)
F-value	1.98	7.86***	1.49	7.31***	0.42	4.36***
Adjusted-R^2	0.0851	0.4737	0.0149	0.3603	−0.0256	0.1315
N	55	55	54	54	53	53

Note: No significant relationship is found between the explanatory variable and the growth rate of future nominal consumption and investment in the next fourth quarter, so it is omitted from the table and excluded from the analysis for convenience.

Table 8 presents the results of regression analysis on the relationship with GDP growth rates by further dividing aggregate accounting earning into aggregate operating cash flow, aggregate non-discretionary accruals, and aggregate discretionary accruals.

In Equation 7, all three explanatory variables show a significantly positive relationship with nominal GDP growth rates for the next and after next quarter. The explanatory power of the model is 0.4476 and 0.1641, respectively, which are significantly higher than the model with aggregate accounting earning as explanatory variable (Equation (1)) and the model with aggregate operating cash flow and aggregate accrual (Equation (4)). With these results, we can conclude that Hypothesis 4a and 4b are supported.

Table 9 summarizes the results of regression analysis for nominal consumption growth rate and investment growth rate to verify the predictive power working path of changes in aggregate non-discretionary accrual and changes in aggregate discretionary accrual.

In the regression model (Equation (8), (9)), which divides the change in aggregate accounting earning into change in aggregate operating cash flow, aggregate non-discretionary accrual, and aggregate discretionary accruals, change in aggregate discretionary accrual shows a significantly positive relationship until the after next quarter for consumption growth and change in aggregate operating cash flow shows a significantly positive relationship until the next quarter. On the other hand, in the case of change in aggregate non-discretionary accrual, the null hypothesis that there is no significant relationship with consumption growth was not rejected according to the regression coefficient and the F value (1.98) which verifies the suitability of the entire model.

The reason why the change in the aggregate non-discretionary accrual does not show a significant relationship with the consumption growth rate can be inferred from the characteristics of the non-discretionary accrual. Much of the non-discretionary accruals are caused by accounting techniques rather than economic factors. For example, most of the depreciation expenses that has a high proportion of non-discretionary accruals are mechanically allocated amount of fixed assets acquisition costs. Therefore, the non-discretionary accruals are expected to have a relatively weak relationship with the consumption growth rate. Previous studies such as Rayburn (1986) and Dechow (1994) also reported that non-current accruals including depreciation expense have relatively weak explanatory power for persistence and future cash flows compared to current accruals.

In contrast, for the investment growth rate, all three independent variables show a significant positive relationship until the next third quarter. In addition, the explanatory power of the model for the investment growth rate remains consistently higher than that of the consumption growth rate. The regression coefficients of all three independent variables also maintained a higher value than the consumption growth rate for the investment growth rate. These results partially support Hypothesis 5a and support Hypothesis 5b.

5. Conclusion

5.1. Summary of research results

In this study, the positive relationship between aggregate accounting earnings and GDP growth rate is re-verified through an empirical analysis using the sample that consists of listed companies in the Korea Stock Exchange. Furthermore, since aggregate accounting earnings are a leading indicator of future corporate earnings, we expect that aggregate accounting earnings are also exerting predictive power on the future GDP growth rate, so, we attempt to perform an empirical analysis for the information factors and action paths of the predictive power from an informational perspective.

In order to verify this, the research hypotheses are established by decomposing the aggregate accounting earning and the GDP growth rate into detailed items. In addition, the research hypotheses are verified by conducting a regression analysis using the model extending the basic model of Konchitchki and Patatoukas (2014a).

The results of the empirical analysis of this study are summarized as follows. First, aggregate accounting earning is a leading indicator of GDP growth rate and has predictive power over the GDP growth rate until the next second quarter. Second, with historical and future information, the sub-factor subdivision effect of aggregate accounting earning is simultaneously working for aggregate accounting earning to exert predictive power on GDP growth. This suggests that the disclosure of quarterly financial statements by sub-category provides additional information value on the macro economy. Third, the predictive power of the change in aggregate accounting earning for the nominal GDP growth rate is exerted through various channels, and there is a combination effect of sub-factors of aggregate accounting earning in explanatory power among the channels. This study confirms that the predictive power of aggregate accounting earning for the GDP growth rate is exercised through consumption channel and investment channel. In addition, it is also confirmed that the investment channel has a consistently higher significance and duration than the consumption path. In light of this, additional research on export channel, import channel, or industry-specific channel can contribute to an in-depth understanding of the relationship between aggregate accounting earning and GDP growth rate and using it in policy and practice. Finally, this study explores a new area that identifies the factor of predictive power of aggregate accounting earning by dividing aggregate accounting earning into sub-elements and examining the relationship with GDP growth. Moreover, it is empirically confirmed that the predictive power of aggregate accounting earning for the GDP growth rate, which was inferred only in previous studies and did not attempt to prove it, is being exercised in various channels, such as consumption and investment channels.

5.2. Implications and limitations

Through the results, this study can help to promote the use of corporate accounting data as basic data for GDP estimation as well as GDP prediction by increasing interest and understanding of the relationship between the national account system and corporate accounting.

If aggregate accounting earning is a potential leading indicator of macroeconomic trends, the overall investor response to the announcement of accounting earning may be used as a proxy indicator of market participants' collective views on the expected sustainability and non-expected earnings in the future. Such information on market expectations and market sentiment is very important for economic policymakers who have difficulty securing reliable data on economic expectations. By using aggregate accounting data that have both speed and accuracy, policymakers will be able to accurately grasp of macroeconomic conditions and timely cope with policy, and help investors and consumers determine asset allocation. Ultimately, this approach will serve as an opportunity to expand the horizons of accounting research and to increase the usefulness of accounting information through integration with economics.

On the other hand, this study leaves the following limitations and tasks for future research on the relationship between aggregate accounting earnings and macroeconomic variables.

First is a limitation due to the lack of prior studies. In a situation where research on the source and path of aggregate accounting earnings for GDP prediction is very insufficient, there were many parts that had to rely on research results or reasoning on similar topics in the hypothesis setting of this study as well as the interpretation of empirical analysis results. In order to logically identify and theorize the relationship between aggregate accounting earnings and GDP growth rate, follow-up studies on the attributes and time-series characteristics of aggregate accounting earnings from an information perspective should be expanded.

Second is a limitation due to the lack of basic financial accounting data. The time series of total accounting data in this study is 56 quarters, which is still insufficient compared to previous overseas studies reaching 100 quarters. In order to research on aggregate accounting earnings in the future, it is urgent to secure a longer time series by securing a time series of operating cash flows before 2003. In addition, research in this field is restricted because there is no reliable quarterly financial accounting data DB in Korea. The Korean government and academia need to pay attention to the establishment and improvement of quarterly time series accounting data DB as well as annual.

Third is a limitation according to the research topic and methodology. This study confirmed the existence of a significant relationship between aggregate accounting earnings and its sub-factors, GDP growth rate, and its sub-factors (consumption growth rate, investment growth rate), and mainly compared the relative explanatory power using the revised coefficient. It is expected that subsequent studies will continue to analyze and statistically verify the information value of aggregate accounting earnings on GDP growth in a more improved manner. In addition, various factors that can affect the relationship between aggregate accounting earnings and GDP growth, i.e., the attributes of accounting earnings (earnings management, etc.), corporate characteristics (size of the company, etc.), and the role of capital markets and asset prices, were not addressed. Further research on this is also expected.

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