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Intangible Assets and Analysts' Overreaction and Underreaction to Earnings Information: Empirical Evidence from Saudi Arabia

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Abstract: Several prior studies indicate that financial analysts exhibit systematic underreaction to information; others illustrate systematic overreaction. We assume that cognitive biases influence analysts' behavior and that these misreactions are not systematic, but they depend on the nature of news. As cognitive biases intensify in situations of high ambiguity, we distinguish between bad and good news and investigate the impact of intangible assets—synonymous with high uncertainty and risk—on financial analysts' reactions. We explore the effect of information conveyed by prior-year earnings announcements on the current-year forecast error. Our findings in the Saudi financial market reveal a tendency for overreaction to positive prior-year earnings change (good performance) and positive prior-year forecast errors (good surprise). Conversely, there is an underreaction to the negative prior-year earnings change (bad performance) and negative prior-year forecast error (bad surprise). Notably, analysts exhibit systematic optimism rather than systematic underreaction or overreaction. The results also highlight that the simultaneous phenomena of overreaction and underreaction is more pronounced in high intangible asset firms compared to low intangible asset firms.

Keywords: intangible assets; earnings announcement; cognitive biases; overreaction; underreaction; prior-year earnings change; prior-year forecast error

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1. Introduction

Intangible assets have become a critical component of many firms' values, particularly in the technology sector. However, intangible assets are often more difficult to value and quantify than physical assets, and their value can be subject to significant uncertainty (Daniel et al. 2001; Banker et al. 2019; Barker et al. 2021). In this context, the value of a patent may depend on the success of a product that has not yet been developed, or the value of a brand name may be affected by changing consumer preferences or market conditions. R&D expenditures are also considered synonymous with uncertainty because they represent investments in projects that are highly uncertain and risky (Bah and Dumontier 2001; Elkemali and Ben Rejeb 2015; Chen et al. 2017). R&D projects may fail to generate any return, or they may generate a significant return if successful. In addition, companies that invest heavily in R&D are often seen as more innovative and forward-looking than companies that do not invest as much in R&D. This can be important for investors and stakeholders who are interested in the long-term prospects of a company. Therefore, the level of R&D expenditures can be seen as an indication of the level of uncertainty that a company is facing. While the International Accounting Standard (IAS) 38 is very conservative in recognizing and measuring intangible assets, with only a few subject to a higher level of judgment, prior studies have predominantly focused on the impact of total intangible assets on earnings uncertainty. Barth et al. (2001) focus on total balance sheet intangible assets

(including goodwill) and suggest that investors show greater interest in earnings forecasts for companies possessing intangible assets due to the inherent uncertainty surrounding the realization of these assets. Barron et al. (2002) find that total intangible assets increase uncertainty and lead to lower analyst forecast accuracy. Gu and Wang (2005) show that the intricate nature of information regarding intangible assets pose challenges for analysts in comprehending and integrating these data, thereby resulting in heightened forecast errors.

The value of intangible assets may be affected by external factors, such as changes in technology, regulation, or competition, which can introduce additional uncertainty. As a result, financial analysts may struggle to accurately assess the value of companies with significant intangible assets. This can lead to a potential overreaction or underreaction to new information, as analysts may be too slow or too quick to update their forecasts based on new information. In this paper, we aim to delve into the influence of intangible assets on financial analysts' misreactions, emphasizing the factors contributing to this irrational behavior.

The prior literature has largely documented that financial analysts often fail to accurately and efficiently integrate new information into their earnings forecasts. This forecast inefficiency typically results in systematic underreaction, where similar earnings surprises tend to follow earnings announcements (Mendenhall 1991; Ali et al. 1992; Abarbanell and Bernard 1992). However, De Bondt and Thaler (1990) document that financial analysts overestimate new information, which generates systematic overreaction. Other studies find that the overreaction and the underreaction depend on the nature of the information, in the sense that analysts tend to respond excessively to favorable information and insufficiently to unfavorable information. In both cases, these findings suggest that analysts are systematically optimistic rather than misinterpreting new information (Amir and Ganzach 1998; Easterwood and Nutt 1999).

Several researchers have been interested in explaining analysts' upward forecast. Financial analysts provide biased earnings predictions, either for rational reasons or influenced by psychological biases. Some studies suggest that financial analysts make upwardly biased forecasts to maintain good relations with managers as the primary source of information and to benefit from privileged information (Francis and Philbrick 1993; Das et al. 1998; Brown et al. 2022; Zhao et al. 2022). Other studies argue that such underreaction and overreaction are consistent with irrational behavior and an inefficient financial market, as analysts' forecasts are influenced by psychological biases.

Prior studies show that three heuristics can affect analysts' behavior and lead to overreaction and underreaction: representativeness, anchoring, and leniency.

Under the representativeness bias, people predict an event by the degree to which it is representative of a similar previous one, that is, by the likelihood that the predicted event will resemble the previous one. Therefore, a series of comparable data can be interpreted as a pattern and extended too far into the future, leading individuals to overestimate recent salient news when forecasting earnings (Tversky and Kahneman 1974). Representativeness thus causes an overreaction. Anchoring bias indicates that, when making judgments, people tend to rely too heavily on previous information, which is adjusted until the final value is reached (Kahneman and Tversky 1979). People who exhibit "anchoring" underreact to new information and take a long time to change their initials, which produces an underreaction. According to Campbell and Sharpe (2009), relying too heavily on the initial forecast leads to insufficient adjustments in forecasting. Leniency bias means that individuals are too positive and optimistic when making predictions. In this context, several studies show that financial analysts rationally provide optimistic forecasts to maintain good relationships with managers as their primary source of information and take advantage of more private information (Das et al. 1998; Lim 2001). Consequently, these three combined psychological biases generate an overreaction in some situations and an underreaction in others.

Amir and Ganzach (1998) investigate how these three heuristics impact the association between forecast revision, forecast change, and the subsequent forecast error. Their findings indicate a consistent pattern of underreaction to forecast revision and an overall tendency

to overreact to forecast change. When separating between positive and negative forecast revision and forecast change, the results show an overreaction for upward modifications and an underreaction for downward modifications. Easterwood and Nutt (1999) suggest that the nature of earnings release affects financial analysts' behavior. Affected by representativeness and anchoring, analysts exhibit an overreaction to extremely good news and an underreaction to extremely bad news. This overreaction to extremely good news disappears when the uncertainty is controlled, keeping a general underreaction (Gu and Xue 2007). Marsden et al. (2008) and Elkemali (2023) reexamine Amir and Ganzach's hypotheses, obtaining similar results on both Australian and European financial markets. Bouteska and Regaieg (2020) explore the anchoring bias on the Tunisian stock market. The results indicate a pattern of excessive forecast revisions and changes in response to positive information, and conversely, insufficient forecast revisions and changes when the information is negative. Chen et al. (2020) find that cognitive biases produce a serial correlation in individual analysts' revisions, confirming an underreaction to new information.

While most previous research has examined the impact of behavioral biases on financial analysts' tendency to overreact and underreact to their forecast revisions, our paper concentrates on prior-year earnings release and tests analysts' reactions to prior-year earnings changes and prior-year forecast errors. Building on Easterwood and Nutt (1999)'s methodology, we investigate how analysts in the Saudi financial market respond to good and bad news. We posit that the previous earnings announcement communicates bad and good news, depending on the nature of prior-year earnings per share change and prior forecast error. The prior-year earnings change is defined as the prior earnings variation in the two previous years before the actual earnings release. The actual (prior) forecast error is quantified as the disparity between the actual (prior) earnings and its consensus forecast. A positive change in the prior earnings performance or positive prior forecast error (good prior surprise) implies good news. A negative change in the prior earnings performance or a negative prior forecast error (bad prior surprise) implies bad news. Our study tests the effect of this bad and good news generated by previous year earnings release (year $t-1$) on the actual year forecast error (year t). Specifically, we investigate the correlation between the actual forecast error and, separately, (1) prior-year positive and negative earnings change and (2) prior-year positive and negative forecast errors. We anticipate that financial analysts tend to overreact when the prior-year earnings change and/or prior forecast error are positive (good news), leading to overly optimistic forecasts. Conversely, analysts may underreact when prior-year earnings change and/or prior forecast errors are negative (bad news), resulting in forecasts that are not pessimistic enough to reflect the true impact of the negative information.

The key variable that links analysts' irrational behavior to overreaction and underreaction is earnings uncertainty. Kahneman and Tversky (1979) indicate that judgments and decisions are based on beliefs concerning the likelihood of an uncertain event, and people rely on heuristics to decrease the complexity of assessing probabilities and predicting values. Experimental psychology research explains that behavioral biases appear in circumstances requiring more judgment when ambiguity levels are high (Lichtenstein and Fischhoff 1977; Griffin and Tversky 1992). Lim (2001) finds that the informational advantage of optimism is higher when general information about earnings is less readily available. Hirshleifer (2001) notes that psychological biases are more likely to manifest when there is a dearth of accurate fundamental knowledge. Daniel et al. (2001) emphasize that mispricing resulting from heuristics tends to be more significant for firms requiring extensive judgment for assessment, particularly those operating in industries with uncertain short-term feedback on judgment quality, such as R&D-intensive firms. Bessière and Elkemali (2014) illustrate that analysts' overconfidence bias increases with the level of uncertainty. Chang and Choi (2017) observe that during periods of heightened uncertainty, analysts face reduced sanctions for biased forecasts. Consequently, they tend to exhibit more optimism bias, aiming to take advantage of increased trading activity. Elkemali (2023) concludes that uncertainty deepens analysts' optimism bias in the European market.

As behavioral biases intensify in circumstances of low predictability, this paper extends Easterwood and Nutt (1999)'s methodology and explores the impact of intangible assets as synonyms with uncertainty on financial analysts' reactions to bad news and good news.

Our paper tests two hypotheses related to the impact of intangible assets on financial analysts' reactions to good and bad news. We assume that analysts' behavior is affected by three combined cognitive biases and depends on the nature of the announced news. When good news is announced, financial analysts exhibit representativeness bias and rely heavily on the perceived similarity between the positive news and their mental prototypes of successful companies or investments. They may excessively focus on the positive aspects of the news, ignoring other relevant factors or potential risks. This can lead them to overestimate the probability of continued positive performance or the potential impact of the news on future outcomes. Thus, financial analysts overreact to good news and issue forecasts exceeding the actual earnings.

However, when bad news is announced, analysts exhibit anchoring bias, underweight the new information, and interpret it in a way that aligns with their initial expectations. Analysts tend to anchor their expectations and judgments to certain reference points, such as past performance or previous forecast, causing them to underestimate the severity or impact of the bad news and fail to adjust their forecasts accordingly. In this context, when analysts are anchored to positive information or optimistic expectations, they may underreact to negative information because the initial anchor biases their subsequent judgments. As a result, anchoring bias leads financial analysts to underreact to bad news and issue forecasts exceeding actual earnings. The leniency bias implies that analysts are overly optimistic when predicting performances, which leads to an overreaction to good news and an underreaction to bad news. Therefore, under representativeness, anchoring, and leniency biases, we suppose that financial analysts tend to overreact to good news and underreact to bad news (H1).

Because these cognitive biases rise in circumstances of high uncertainty, we posit that this simultaneous phenomenon is more intensive for high intangible asset firms compared to low intangible asset firms (H2). Intangible assets are synonymous with high levels of uncertainty due to the lack of transparency and standardized reporting for intangible assets. Therefore, analysts may struggle to fully understand and evaluate the significance and value of a company's intangible assets, resulting in uncertainty about the company's true value, growth prospects, and potential mispricing.

H1. *Financial analysts tend to overreact to good news and underreact to bad news.*

H2. *Intangible assets boost financial analysts' overreaction and underreaction.*

To test these hypotheses, we focus on the Saudi financial market between 2010 and 2019, employing descriptive and regression analyses. In the descriptive analyses, we examine the percentage of negative actual forecast errors (excessively optimistic forecasts) as well as the median and mean forecast error when prior-year earnings change and prior-year forecast errors are positive. A negative forecast error in both positive and negative subgroups indicates an overreaction to good news and an underreaction to bad news. The regression analyses test not only the direction of the forecast error but also its magnitude. These analyses involve regressing the actual forecast error separately on positive and negative prior-year earnings change and prior-year forecast errors. A negative coefficient implies that financial analysts overreact to new information, while a positive coefficient indicates an underreaction. To explore the effect of intangible assets on financial analysts' misreactions, we repeat both analyses, separating between high intangible asset firms and low intangible asset firms according to the median of intangible assets to total assets ratio. We expect that high intangible asset firms will exhibit a more pronounced overreaction to good news and underreaction to bad news compared to other firms.

Several aspects make this study intriguing. First, it enriches the literature on intangible assets by furnishing evidence regarding the correlation between these assets as synonyms with uncertainty and financial analysts' behavior. Second, it contributes to the existing literature on behavioral biases and financial market reactions by illustrating the influence of combined cognitive biases on financial analysts' overreaction and underreaction to bad and good news. While previous research has often concentrated on analyzing analysts' reactions to forecast revisions, typically attributing these reactions to singular cognitive biases, such as anchoring or representativeness, our research diverges by exploring the effects of prior-year earnings releases in the context of combined heuristics (anchoring, representativeness, and leniency). By linking these biases to specific types of news (i.e., positive or negative prior-year earnings changes and forecast errors), the study sheds light on the underlying psychological mechanisms driving market responses and provides a deeper understanding of the role of historical data in the forecasting process under uncertainty. Third, our paper represents, to the best of our knowledge, the first paper that investigates analysts' overreaction and underreaction under uncertainty in the Saudi market, one of the top emerging markets. Finally, the paper's findings on analyst behavior represent a further illustration of investors' overreaction and overreaction in the financial market.

The rest of the paper is structured as follows: Section 2 outlines the sample and variables, Section 3 presents the results, Section 4 discusses potential implications of the findings for investors and market efficiency, and Section 5 offers a summary along with concluding remarks.

2. Sample and Variables

2.1. Sample

Our study focused on the Saudi market, with the sample sourced from the *I/B/E/S* database during the period 2010–2019. As our paper examined financial analysts' reaction to earnings announcement, the analysis required an eight-month-ahead consensus forecast of current earnings per share and the related actual earnings per share from year $t-2$ to t. Penman (1987) finds that the annual reports of 92 percent of companies are published within three months following the close of the fiscal year. According to O'Brien (1988), the usual period between the forecast and its inclusion in the IBES recordings is 34 days. We set an eight-month timeframe to guarantee that the previous year's annual statement is accessible to financial analysts when formulating their predictions. The consensus forecast is described as the I/B/E/S median forecast when there are a minimum of three individual analysts' predictions. To lessen the influence of exceptionally extreme observations and achieve a normal distribution, we removed and considered as outliers all analysts' forecasts that exceeded (in absolute value) 200 percent of the earnings per share (Easterwood and Nutt 1999; Bessière and Elkemali 2014). The removal of outliers decreased the sample size by 2.5% and caused the mean to shift closer to the center of the remaining data points. However, the median, which is less susceptible to the influence of outliers, remained relatively unchanged.

For all companies remaining in the sample, we extracted total intangible asset data from the Global Compustat database. We excluded from our sample all financial institutions and utilities because intangible assets are irrelevant for these two sectors. These data requirements yield a sample of 143 Saudi firms with 1376 firm-year observations.

To examine the impact of intangible assets on financial analysts' behavior, we split the whole sample for each year into two subsamples according to intangible assets' median: high intangible asset firms (intangible asset firms greater than the median) and low intangible asset firms (intangible asset firms greater than the median).

2.2. Variables

To examine the impact of intangible assets on financial analysts' overreaction to good news and underreaction to bad news, we extracted earnings per share (EPS) data from $t-2$ to t and the median consensus forecast (F) eight months before the actual fiscal year

end from the I/B/E/S summary history. The choice of an eight-month period ensured that financial analysts incorporate previous EPS data when formulating their predictions. Based on these data, we computed the prior-year earnings per share change as the variation of EPS from t − 2 to t − 1 scaled by EPS at t − 2. Additionally, we calculated the forecast error for years t and t − 1 by measuring the discrepancy between actual EPS and the consensus forecast, scaled by EPS. A negative forecast error indicates optimism, while a positive forecast error suggests pessimism. The aim was to test financial analysts' overreaction and underreaction by examining the association between the current forecast error (t) and, separately, the prior-year earnings change (positive and negative) and the prior-year forecast error (positive and negative). To study the influence of intangible assets, we referred to the Global Compustat Database to compute the total intangible assets to total assets ratio (INT). Based on the median of this ratio, we divided the entire sample into sub-groups of high intangible asset firms (HINT) and low intangible asset firms (LINT) and compared findings. Consequently, the following variables are described:

1. EPS_t and EPS_{t-1} denotes the actual earnings per share respectively for years t and t − 1.
2. F_t represents the EPS_t consensus forecast, calculated eight months before the fiscal year's t end.
3. FE_t defines the forecast error for year t, computed as $(EPS_t - F_t)/|EPS_t|$.
4. EC_{t-1} refers to the prior year's earnings change (prior performance) from t − 2 to t − 1, normalized by earnings per share t − 2, $EC_{t-1} = (EPS_{t-1} - EPS_{t-2})/|EPS_{t-2}|$.
5. HINT is a dummy variable, taking the value 1 if the firm belongs to high intangible asset subsample; otherwise, it is 0. The subsample was divided according to the total intangible assets to total asset ratio (Barth et al. 2001; Barron et al. 2002). The median of this ratio distinguishes high intangible asset firms (upper half) from low intangible asset firms (lower half). We assumed that this ratio reflected the effect of intangible assets more than the sectoral decomposition. Intangible asset ratio (INT) is defined as recognized intangible assets to total assets.

Table 1 presents statistical descriptions for the base sample as well as the two sub-groups of high (HINT) and low intangible asset firms (LINT).

Table 1. Statistical descriptions for the entire sample, along with the high and low intangible asset subgroups from 2010 to 2019.

Variables	Number of Obs			Mean (Median)			Std Dev		
	HINT&LINT	LINT	HINT	HINT&LINT	LINT	HINT	HINT&LINT	LINT	HINT
FE_t	1376	688	688	−0.384 (−0.091)	−0.276 (−0.035)	−0.573 *** (−0.158 ***)	1.066	0.718	1.267 ***
EC_{t-1}	1376	688	688	0.198 (0.154)	0.124 (0.101)	0.235 *** (0.185 **)	0.325	0.201	0.413 ***
INT	1376	688	688	8.201(7.354)	2.312 (1.901)	15.311 *** (13.103 ***)	5.023	3.012	7.201 ***

The table reports the significance test, at *** 1% and ** 5%, for comparing means (*t*-test), medians (Wilcoxon test) and standard deviations (Std dev) for current-year forecast error (FE_t), prior-year earnings change (EC_{t-1}), and intangible assets (INT) between high intangible asset (HINT) and low intangible asset (LINT) subsamples. $FE_t = (EPS_t - F_t)/|EPS_t|$, $EC_{t-1} = (EPS_{t-1} - EPS_{t-2})/|EPS_{t-2}|$ and INT = total intangible assets/total assets. The table also presents the total number of observations of HINT and LINT firms. FE_t and EC_{t-1} are measured 8 months prior to the fiscal year end.

3. Empirical Results

In order to test the impact of intangible assets on analysts' reactions to good and bad news, we follow the findings of Abarbanell and Bernard (1992) and Easterwood and Nutt (1999) regarding underreaction and overreaction. The prior earnings release provides two important pieces of information for financial analysts: the prior forecast error and the prior-earnings change. A positive prior forecast error (good surprise) and/or positive prior-earnings variation implies good news, while a negative prior forecast error (bad surprise) and/or negative prior-earnings variation implies bad news. Our study examines underreaction and overreaction through the relationship between these two variables and the current forecast error. Overreaction implies a negative association between

good or bad news and the current forecast error, while a positive association indicates an underreaction. We expect an overreaction to good news and an underreaction to bad news, reflecting analysts' optimism. To examine the effect of intangible assets on analysts' overreaction and underreaction, respectively, to good and bad news, we compare results between high and low intangible asset subsamples. As intangible assets are synonymous with uncertainty, we expect that analysts' misreactions will be greater for firms with high intangible asset firms. To ensure that analysts' reactions are due to prior earnings announcements, all analyses are performed eight months prior to year-end (one month after the prior earnings announcement).

3.1. Prior-Earnings Change and Current Forecast Error

3.1.1. Descriptive Analysis

This section descriptively investigates the relationship between the current forecast error (year t) and the prior year's earnings change (from $t-2$ to $t-1$). We split the whole sample into two subsamples according to the prior year's earnings change sign to separate between good news (positive prior earnings change) and bad news (negative prior earnings change). All observations with zero prior performance were removed. We focus on the initial month following the previous earnings announcement, and we test the average and median forecast errors for year t as well as the proportion of negative forecast errors for both bad and good news.

1. *Analysts' overreaction to good news and underreaction to bad news: Descriptive test of the impact of positive (good news) and negative (bad news) prior year earnings change on current forecast error.*

In line with previous studies, Table 2 shows a significantly negative mean and forecast error for both negative and positive prior performance. Furthermore, most forecast errors are negative for the two groups, as the proportion of negative forecast errors significantly exceeds 50% (Z test).

These results indicate that financial analysts react excessively (overreaction) when they receive good news and insufficiently (underreaction) when they receive bad news. In both cases, financial analysts react optimistically and issue forecasts exceeding the actual earnings. These findings confirm our initial hypothesis, indicating financial analysts' tendencies to overreact to good news and underreact to bad news.

Table 2. The association of the current-year forecast error with positive and negative prior-year earnings change.

	$EC_{t-1} > 0$	$EC_{t-1} < 0$	Obs
FE_t MEAN	−0.245 ***	−0.351	1228
FE_t MEDIAN	−0.135 ***	−0.241	1228
% Negative FE_t	60.5 ***	69.8 ***	1228

The table reports the significance test at *** 1% for comparing means (*t*-test), medians (Wilcoxon test) for current forecast errors between the two subgroups of positive ($EC_{t-1} > 0$) and negative ($EC_{t-1} < 0$) prior-year earnings change. The table also provides the significance level of the z-test at *** 1%, assessing the comparison between the proportion of negative forecast errors and 50%.

2. *Impact of intangible assets on analysts' overreaction to good news and underreaction to bad news: Descriptive test of the association between positive (good news) and negative (bad news) prior-year earnings change and the current-year forecast error for both subgroups of high and low intangible assets.*

To investigate the impact of intangible assets, we expand our descriptive analysis by comparing results between high intangible asset and low intangible asset subsamples. For positive prior earnings change, Table 3 reveals a greater percentage of negative forecast errors, along with more negative mean and median forecast errors in companies with high intangible assets compared to those with low intangible assets. These assets, synonymous with uncertainty and risk, accentuate financial analysts' overreaction to good news.

Moreover, Table 3 confirms that the underreaction to negative prior earnings change is significantly higher for companies with substantial intangible assets. These findings align with our second hypothesis, illustrating that intangible assets boost analysts' overreaction and underreaction. The impact of psychological biases on financial analysts is stronger for high intangible asset firms, where the level of uncertainty and risk is heightened.

Table 3. Association between the prior-year earnings change and the current-year forecast error for both subgroups of high and low intangible assets.

	$EC_{t-1} > 0$		$EC_{t-1} < 0$		Obs
	HINT	**LINT**	**HINT**	**LINT**	
FE_t MEAN	−0.388 ***	−0.125	−0.469 ***	−0.195	1228
FE_t MEDIAN	−0.305 ***	−0.104	−0.388 ***	−0.141	1228
% Negative FE_t	67.4 ***	56.2	76.8 ***	65.2	1228

The table reports the significance test at *** 1% for comparing means (*t*-test), medians (Wilcoxon test), and proportion of negative forecast error (%) between both subgroups of high (HINT) and low intangible asset firms (LINT) when prior-year earnings change is positive ($EC_{t-1} > 0$ and negative ($EC_{t-1} < 0$).

3.1.2. Regression Analysis

To provide a more meaningful analysis for financial analysts' overreaction and underreaction to good and bad news, we regress the forecast error on the prior-year earnings change based on the subsequent model.

$$FE_t = \alpha + \beta\ EC_{t-1} + \zeta \quad (1)$$

where FE_t represents the actual forecast error one month after the prior-year earnings release and $EC_{t-1\ is}$ the prior-year earnings change between years $t-1$ and $t-2$. An efficient FE_t implies that the intercept α and the slope β equal zero. An estimate for α and β that is different from zero is indicative of biased behavior. The key implication of the model is that a positive β indicates underreaction, while a negative β indicates overreaction. A negative (positive) α is indicative of optimism (pessimism). In line with previous studies, the model does not include controllable variables as it investigates biased behavior. Therefore, we expect an insignificant R^2.

1. *Test of general underreaction or overreaction to prior-year earnings change: regression of the current-year forecast error on prior-year earnings.*

Estimates of (1) eight months before the fiscal year end are presented in Table 4. For the whole sample, the results show a general underreaction to previous performance, as β is significantly positive. Compared to a descriptive analysis, a regression investigates not only the orientation of the forecast inaccuracy but also its extent. The coefficient β specifies that, on average, 12% of the prior year's performance is not considered in financial analysts' forecasts. The negative intercept α confirms that financial analysts are optimistic and issue predictions exceeding the earnings per share.

Table 4. Regression of current-year forecast error on prior-year earnings change $FE_t = \alpha + \beta\ EC_{t-1} + \zeta$.

	α	β	R^2	Obs
Whole Sample	−0.297 (−2.125 **)	0.121 (8.125 ***)	0.042	1228

The table reports the regression of the current-year forecast error FE_t on prior-year earnings change (EC_{t-1}) for the whole sample. FE_t is defined as $FE_t = (EPS_t - F_t)/|EPS_t|$ EC_{t-1} is defined as $(EPS_{t-1} - EPS_{t-2})/|EPS_{t-2}|$. FE_t and EC_{t-1} are measured eight months prior to the fiscal year end. *** and ** indicate significance of t statistics (in parentheses) respectively at 1% and 5%.

2. *Test of analysts' overreaction to positive (good news) and negative (bad news) prior-year earnings change: regression of the current-year forecast error on subgroups of positive and negative prior-year earnings change.*

To further analyze analysts' misreactions to bad and good news, we replicate the regression above for both subsamples of positive ($EC_{t-1} > 0$) and negative ($EC_{t-1} < 0$) prior-year earnings change. Table 5 reveals a slope significatively positive (0.185) when prior performance is positive and significatively negative (−0.062) when prior performance is negative. These results are aligned with Easterwood and Nutt (1999) and Abarbanell and Bernard (1992) in that they confirm that financial analysts tend to respond excessively to positive news (overreaction) and insufficiently to negative news (underreaction). The comparison in absolute value between both slopes indicates that the underreaction to bad news is greater than the overreaction to good news, which explains the general underreaction in Table 4. When good news is revealed, financial analysts overreact as they estimate that similar good news will continue in the future (representativeness bias). However, when bad news is announced, financial analysts underreact and remain anchored to previous optimistic forecasts (anchoring bias). The negative intercept for both positive (−0.138) and negative (−0.407) performance and the simultaneous phenomena of overreaction to good news and underreaction to bad news imply that financial analysts exhibit optimism and that this optimism is larger in the context of bad news.

Table 5. Regression of current-year forecast error on subgroups of positive and negative prior-year earnings change $FE_t = \alpha + \beta\ EC_{t-1} + \zeta$.

	$EC_{t-1} > 0$	$EC_{t-1} < 0$
α	−0.138 (−1.614 *)	−0.407 (−4.524 ***)
β	−0.062 (−4.084 ***)	0.185 (12.091 ***)
$\mathbf{R^2}$	0.024	0.083
Obs	482	746

The table reports the regression of the current-year forecast error FE_t on subgroups of positive ($EC_{t-1} > 0$) and negative ($EC_{t-1} < 0$) prior-year earnings change. *** and * indicate significance of t-statistics (in parentheses), respectively, at 1% and 10%.

3. *Test of the impact of intangible assets on analysts' overreaction (good news) and underreaction to (bad news): regression of the current-year forecast error on both subgroups of positive (good news) and negative (bad news) prior-year earnings change for high and low intangible asset firms.*

To examine the impact of intangible assets on financial analysts' misreactions, we divide the entire sample into two subsets of high and low intangible asset companies and test the following model when prior performance is negative and positive.

$$FE_t = \alpha_0 + \alpha_1\ HINT + \beta_0\ EC_{t-1} + \beta_1\ HINT.EC_{t-1} + \zeta \quad (2)$$

where HINT is a dummy variable, taking 1 if the firm belongs to high intangible asset subsample; otherwise, it is 0. A negative $\beta_0 + \beta_1$ (positive) indicates overreaction (underreaction), while a negative (positive) $\alpha_0 + \alpha_1$ implies optimism bias. The slope β1 and the intercept α1 capture the additional effect on intangible assets on analysts' behavior.

The results of Table 6 confirm our second hypothesis: that intangible assets significantly boost analysts' tendency to overreact to good news and underreact to bad news. The overreaction to positive prior performance is significantly larger for high intangible asset firms, as the slope $\beta_0 + \beta_1$ (−0.196) and the additional effect β_1 (−0.164) are significantly negative. The results also indicate a greater underreaction to negative prior performance for high intangible firms as the slope $\beta_0 + \beta_1$ (0.318) and the additional effect β_1 (0.213) are significantly positive. The intercept $\alpha_0 + \alpha_1$ appears also more negative for these firms (when EC > 0 and EC < 0), revealing that uncertainty leads analysts to overestimate future benefits of high intangible assets; therefore, they issue more optimistic forecasts. These findings affirm that intangible assets, such as research and development, intellectual property, brand value, and goodwill often play a significant role in a company's long-term

success but can be challenging to quantify accurately. Analysts struggle to assess the value of these intangibles, leading to uncertainty in their forecasts. In addition, intangible assets may contribute to information asymmetry between firms and analysts. Companies may possess detailed information about their intangible assets, while analysts may have limited access to this information. This information gap leads to overreaction and underreaction in analysts' perceptions and forecasts.

Table 6. Regression of current-year forecast error on both subgroups of positive and negative prior-year earnings change for high and low intangible asset firms $FE_t = \alpha_0 + \alpha_1$ HINT + β_0 EC_{t-1} + β_1 HINT.EC_{t-1} + ζ.

	$EC_{t-1} > 0$			$EC_{t-1} < 0$		
	HINT	**LINT**	**DIFFERENCE**	**HINT**	**LINT**	**DIFFERENCE**
	$\alpha_0 + \alpha_1$	α_0	α_1	$\alpha_0 + \alpha_1$	α_0	α_1
	−0.268 (−1.853 **)	−0.075 (−1.375)	−0.193 (−1.782 *)	−0.658 (−7.846 ***)	−0.202 (−2.218 **)	−0.456 (−5.836 ***)
	β0 + β1	**β0**	**β1**	**β0 + β1**	**β0**	**β1**
	−0.196 (−7.412 ***)	−0.032 (−3.126 ***)	−0.164 (−5.297 ***)	0.318 (15.223 ***)	0.105 (8.451 ***)	0.213 (12.041 ***)
R^2		0.035			0.094	
Obs		482			746	

The table reports the regression of the current-year forecast error FE_t on subgroups of positive ($EC_{t-1} > 0$) and negative ($EC_{t-1} < 0$) prior-year earnings change for high (HINT) and low intangible asset firms (LINT). FE_t is calculated as $(EPS_t - F_t)/|EPS_t|$ EC_{t-1} is defined as $(EPS_{t-1} - EPS_{t-2})/|EPS_{t-2}|$. FE_t and EC_{t-1} are measured 8 months prior the fiscal year end. α_0 and $(\alpha_0 + \alpha_1)$ represent, the regression intercepts, for LINT and HINT subsamples, respectively. β_0 and $(\beta_0 + \beta_1)$ represent, respectively, the regression's coefficient for LINT and HINT subsamples. α_1 and β_1 depict the additional impact of intangible assets (HINT) on our regression. ***, **, and * report the significance of t-statistics (in parentheses) respectively at 1%, 5%, and 10%.

3.2. Prior-Year and Current-Year Forecast Errors

3.2.1. Descriptive Analysis

This section examines analysts' reactions to bad and good news through their response to prior-year forecast errors. A forecast from the previous year greater than the earnings from that same year (negative prior forecast error) implies a bad surprise; however, a prior-year forecast lower (positive prior forecast error) than the prior-year earnings imply a good surprise. A negative correlation between the previous-year forecast error (year $t-1$) and current forecast error (year t) indicates an overreaction, while a positive correlation suggests an underreaction.

1. *Analysts' overreaction to goods news and underreaction to bad news: Descriptive test of the impact of the positive (good news) and negative (bad news) prior-year forecast error on current forecast error.*

Table 7 presents analysts' reaction to prior-year forecast errors. The forecast error's mean and median for year t demonstrate a significant negativity, and the proportion of the negative forecast error significantly exceeds 50% for both subsamples of positive and negative prior-year forecast error. This result confirms the simultaneous phenomena of overreaction to positive news and underreaction to negative news.

2. *Impact of intangible assets on analysts' overreaction to good news and underreaction to bad news: Descriptive test of the association between the positive (good news) and negative (bad news) prior-year forecast error and the current-year forecast error for both subgroups of high and low intangible assets.*

Table 7. Association between the current-year forecast error and positive and negative prior-year forecast error.

	$FE_{t-1} > 0$	$FE_{t-1} < 0$	Obs
FE_t MEAN	−0.301 **	−0.396	1192
FE_t MEDIAN	−0.165 ***	−0.312	1192
% Negative FE_t	62.5 ***	68.5	1192

The table reports the significance test, at *** 1% and ** 5%, for comparing means (t-test), medians (Wilcoxon test) for current forecast errors FE_t, between the two subgroups of positive ($FE_{t-1} > 0$) and negative prior forecast errors ($FE_{t-1} < 0$). $FE_t = (EPS_t - F_t)/|EPS_t|$ and $FE_{t-1} = (EPS_{t-1} - F_{t-1})/|EPS_{t-1}|$. The forecast error is computed eight months prior to the fiscal year end. The table also provides the significance level of the z-test at *** 1%, assessing the comparison between the proportion of negative forecast errors and 50%.

The distinction between high and low intangible asset subgroups (Table 8) shows that the median and mean of the current forecast error are predominantly negative for high intangible asset firms, regardless of the sign (positive or negative) of the previous year's forecast error. Moreover, the proportion of negative forecast errors for year t increases significantly with intangible asset level. These findings corroborate the results from previous sections, indicating financial analysts' tendency to overreact to positive news and underreact to negative news, and the presence of intangible assets amplifies this overreaction/underreaction dynamic.

Table 8. Comparison between the current-year forecast error of high and low intangible asset subgroups when prior-year forecast errors is positive and negative.

	$FE_{t-1} > 0$		$FE_{t-1} < 0$		Obs
	HINT	**LINT**	**HINT**	**LINT**	
FE_t MEAN	−0.391 ***	−0.163	−0.445 ***	−0.213	1192
FE_t MEDIAN	−0.289 ***	−0.122	−0.361 ***	−0.158	1192
% Negative FE_t	66.1 ***	57.5	75.5 ***	64.1	1192

The table reports the significance test at *** 1% for comparing means (*t*-test), medians (Wilcoxon test), and proportion of negative forecast error (%) (z-test) between both subgroups of high (HINT) and low intangible asset firms (LINT) when prior-year forecast error is negative ($FE_{t-1} < 0$) and positive (FE_{t-1}) > 0.

3.2.2. Regression Analysis

To explore the information content of the forecast error from the prior year (t − 1) to the current-year forecast (t), we employ the same method outlined in Section 3.2.1 and regress the following equation:

$$FE_t = \alpha + \beta\ FE_{t-1} + \zeta \quad (3)$$

where FE_t and FE_{t-1} are, respectively, the current-year t forecast error and the year t − 1 forecast error measured eight months before the end of the fiscal year (the first month after prior earnings release). If financial analysts' behavior is rational, the slope β must equal zero, and there would be no relationship between FE_t and FE_{t-1}. Any negative (positive) β implies overreaction (underreaction). Negative (positive) intercept α suggests optimism bias (pessimism).

1. *Test of general overreaction or underreaction to prior-year forecast error: regression of the current-year forecast error on prior-year forecast error.*

In contrast to analysts' underreaction to prior-year earnings change revealed in Section 3.2.1, estimates of model 3, for the entire sample (Table 9), show a general overreaction to forecast error t − 1 as the slope β is significantly negative (−0.285). Therefore, this result does not align with the conclusions of systematic underreaction as presented in Mendenhall (1991), Abarbanell and Bernard (1992), Ali et al. (1992), Elliott et al. (1995), and the related literature. However, it does support the findings of general overreaction as illustrated by De Bondt and Thaler (1990), Amir and Ganzach (1998), and Elkemali (2023).

Table 9. Regression of current forecast error on prior-year forecast error.

$FE_t = \alpha + \beta\ FE_{t-1} + \zeta$				
	α	β	R^2	Obs
Whole Sample	−0.356 (−3.452 ***)	−0.285 (−12.446 ***)	0.059	1192

The table reports the regression of the current-year forecast error FE_t on prior-year's forecast error (FE_{t-1}) for the whole sample. $FE_t = (EPS_t - F_t)/|EPS_t|$ and $FE_{t-1} = (EPS_{t-1} - F_{t-1})/|EPS_{t-1}|$. FE_t and FE_{t-1} are measured eight months prior the fiscal year end. *** indicates significance of t-statistics (in parentheses) at 1%.

2. *Test of analysts' overreaction to good news and underreaction to bad news: regression of the current-year forecast error on positive (good news) and negative (bad news) prior-year forecast error.*

An expanded analysis of model 3 (Table 10) for positive and negative prior forecast errors proves that financial analysts overreact to a good surprise and underreact to a bad surprise, as, respectively, the slope β is negative for the positive prior-year forecast error and positive for the negative prior-year forecast error. The intercept α is more negative for the positive prior forecast error, which indicates that financial analysts tend to be more optimistic after a good surprise.

These results are consistent with Abarbanell and Bernard (1992) as well as Easterwood and Nutt (1999), who indicate that financial analysts are generally optimistic and tend to overreact to good news and underreact to bad news.

Table 10. Regression of current-year forecast error on positive and negative prior year.

Forecast Error $FE_t = \alpha + \beta\ FE_{t-1} + \zeta$		
	$FE_{t-1} > 0$	$FE_{t-1} < 0$
α	−0.544 (−5.201 ***)	0.188 (−2.101 **)
β	−0.341 (−10.645 ***)	0.098 (7.143 ***)
R^2	0.074	0.031
Obs	507	685

The table reports the regression of the current-year forecast error FE_t on subgroups of positive ($FE_{t-1} > 0$) and negative ($FE_{t-1} < 0$) prior-year forecast errors. *** and ** indicate significance of t-statistics (in parentheses), respectively, at 1% and 5%.

3. *Test of the impact of intangible assets on analysts' overreaction to good news and underreaction to bad news: Regression of the current-year forecast error on the positive (good news) and negative (bad news) prior-year forecast error for high and low intangible asset firms.*

To investigate how intangible assets influence financial analysts' behavior, we replicate model (2)'s methodology by regressing the year t forecast error on the year (t − 1) forecast error for high and low intangible asset subgroups. We then estimate the following model.

$$FE_t = \alpha_0 + \alpha_1\ HINT + \beta_0\ FE_{t-1} + \beta_1\ HINT.FE_{t-1} + \zeta \quad (4)$$

The results of model (4), as reported in Table 11, suggest that the tendency to underreact to negative forecast errors and overreact to positive forecast errors, observed in Table 10, is more prominent in firms with high intangible assets. The slope $\beta_0 + \beta_1$ is greater in absolute value for high intangible asset firms compared to β_0 of low intangible asset firms for both groups of positive (the difference $\beta_1 = -0.228$ is significant) and negative (the difference $\beta_1 = 0.123$ is significant) prior forecast errors.

The optimism appears more significant for high intangible asset firm, as the intercept in absolute value is greater for high intangible asset firms when the prior forecast error is positive (the difference $\alpha_1 = -0.303$ is negative and significant) and negative (the difference $\alpha_1 = -0.227$ is negative and significant). These findings are consistent with our second

hypothesis that intangible assets boost financial analysts' overreaction to good news and underreaction to bad news through the effect, respectively, on representativeness and anchoring cognitive biases.

Our results in the Saudi market confirm those of Bessière and Elkemali (2014) and Elkemali (2023) in the European market, who find that uncertainty intensifies cognitive biases and therefore the simultaneous phenomena of overreaction and underreaction to positive and negative information.

Table 11. Regression of current-year forecast error on positive and negative prior-year forecast error for high and low intangible asset firms FEt = $\alpha 0 + \alpha 1$ HINT + $\beta 0$ FE_{t-1} + $\beta 1$ HINT.FE_{t-1} + ζ.

	$FE_{t-1} > 0$			$FE_{t-1} < 0$		
	HINT	**LINT**	**DIFFERENCE**	**HINT**	**LINT**	**DIFFERENCE**
	$\alpha_0 + \alpha_1$	α_0	α_1	$\alpha_0 + \alpha_1$	α_0	α_1
	−0.644 (−6.117 ***)	−0.341 (−4.085 ***)	−0.303 (−3.008 ***)	−0.325 (−3.821 ***)	−0.098 (−1.522 *)	−0.227 (−2.176 **)
	β0 + β1	**β0**	**β1**	**β0 + β1**	**β0**	**β1**
	−0.512 (−15.057 ***)	−0.284 (−12.102 ***)	−0.228 (−11.136 ***)	0.201 (8.112 ***)	0.078 (4.232 ***)	0.123 (5.626 ***)
R^2		0.096			0.051	
Obs		507			685	

The table reports the regression of the current-year forecast error FE_t on subgroups of positive ($FE_{t-1} > 0$) and negative ($FE_{t-1} < 0$) prior-year forecast error for high (HINT) and low intangible asset firms (LINT). $FE_t = (EPS_t - F_t)/|EPS_t|$ and $FE_{t-1} = (EPS_{t-1} - F_{t-1})/|EPS_{t-1}|$. α_0 and $(\alpha_0 + \alpha_1)$ represent the regression intercepts for LINT and HINT subsamples, respectively. β_0 and $(\beta_0 + \beta_1)$ represent, respectively, the regression's coefficient for LINT and HINT subsamples. α_1 and β_1 depict the additional impact of intangible assets (HINT) on our regression. ***, **, and * report the significance of t-statistics (in parentheses), respectively, at 1%, 5%, and 10%.

4. Potential Implications for Investors and Market Efficiency

Understanding the implications of our findings regarding the impact of intangible assets on financial analysts' behavior is crucial for investors and market efficiency. Financial analysts serve as key intermediaries between companies and investors, and their forecasts play a significant role in shaping investment decisions and market dynamics. Inaccuracies or biases in analysts' forecasts in the presence of high intangible assets can have several implications.

Investors often rely on analysts' forecasts and recommendations when making investment decisions, and any biased forecast systematically leads to market inefficiency. Our findings confirm that the combined behavioral biases of representativeness, anchoring, and leniency lead to simultaneous phenomena of overreaction and underreaction.

Under representativeness, analysts assume that past successes of companies are representative of similar outcomes that will occur in the future. This can lead to overreaction to good news. However, if bad news is released, anchoring bias leads analysts to make conservative adjustments to their forecasts, assuming that the negative effects will be temporary or easily mitigated. This can lead to the underestimation of the magnitude of the impact on the company's future earnings. Leniency bias implies that financial analysts are generally optimistic and overestimate positive information and underestimate negative information. Thus, the combined effect of these cognitive biases suggests that financial analysts tend to overreact to good news and underreact to bad news (Hypothesis 1). If analysts overreact or underreact, investors may follow suit, leading to the mispricing of securities. This could result in investors either overpaying or undervaluing stocks, impeding their investment returns (Abarbanell and Bernard 1992; Kadiyala and Rau 2004).

As behavioral biases increase with uncertainty, financial analysts' overreaction and underreaction will be more intense in high intangible asset firms (Hypothesis 2). Therefore, these results represent a potential explanation for investor overreaction and underreaction in the presence of uncertainty, as illustrated by the prior literature (Zhang 2006).

While research on behavioral biases and their effects on financial analysts' behavior exists in other global contexts, including developed markets, such as the United States and Europe, the Saudi financial market presents a unique and underexplored landscape. The Saudi financial market operates within the framework of an emerging economy, characterized by distinct regulatory environments, cultural influences, and market structures compared to established Western markets. Saudi Arabia has been undergoing rapid economic development and diversification efforts in recent years, leading to significant changes in industry compositions and market dynamics. With the shift towards knowledge-based economies, understanding how financial analysts navigate these evolving landscapes, particularly concerning intangible assets, sheds light on the challenges and opportunities unique to the Saudi market and the latent effect on investors' overreaction and underreaction in emerging markets.

5. Conclusions and Discussion

A traditional perspective of financial analysts portrays them as knowledgeable and rational experts within the information market, specialized in forecasting earnings and providing essential recommendations. This perspective assumes that financial analysts' forecasts swiftly and impartially integrate all new data. However, recent research indicates that cognitive biases, such as representativeness, anchoring, and leniency, lead analysts to exhibit, respectively, patterns of overreaction and underreaction to new information (Abarbanell and Bernard 1992; De Bondt and Thaler 1990; Amir and Ganzach 1998). These findings seem contradictory to each other and do not align with the concept of rational forecasting.

Our study focuses on the information contained in earnings announcement and examines analysts' misreactions to bad and good news in the Saudi market during the period 2010–2019. We suppose that the prior earnings release conveys two crucial pieces of information; the first concerns the prior-year earnings change, and the second relates to the prior-year forecast error. Based on the positive and negative pattern of these two pieces of information, we distinguish between bad and good news and test the effect on the actual forecast error. Therefore, we test the association between the current forecast error as a dependent variable and, separately, the prior year's earnings change and the prior year's forecast errors as independent variables. Under rationality, no relationship should be detected between these variables.

As prior studies prove that uncertainty enhances heuristics, our paper also investigates the impact of intangible assets as a synonym for high uncertainty and risk on financial analyst's overreaction and underreaction to good and bad news.

Based on descriptive and regression analyses, we observe that cognitive biases of representativeness, anchoring, and leniency lead financial analysts to exhibit both overreactions to positive prior performance and positive prior forecast errors (good news) as well as underreactions to negative prior performance and negative prior forecast errors (bad news). They issue an earnings forecast that exceeds the actual earnings, regardless of whether the announcement is bad or good news. These findings align with the perspective that financial analysts are generally optimistic (Amir and Ganzach 1998; Easterwood and Nutt 1999) and contradict the notion of systematic underreaction as illustrated by Abarbanell and Bernard (1992) or systematic overreaction as suggested by De Bondt and Thaler (1990).

Our findings also indicate that financial analysts in the Saudi financial market demonstrate greater underreaction/overreaction for high intangible asset firms. This tendency is particularly pronounced due to the higher level of uncertainty associated with this category of assets. This result affirms that intangible assets boost analysts' reaction to earnings announcements, aligning with the findings presented by Elkemali (2023) regarding the impact of uncertainty on financial analysts' behavior in the European financial market.

Our paper is interesting theoretically and practically for multiple reasons. First, this paper represents one of the first studies that investigates financial analysts' overreaction and underreaction in the Saudi financial market, as the 3rd largest stock market amongst its emerging market peers. Second, unlike most prior studies that explored the effects of

cognitive biases through analysts' reactions to private information, our paper focuses on earnings announcements and examines the phenomena of overreaction and underreaction to both good and bad news. Third, to the best of our knowledge, few papers have explored the influence of intangible assets on the simultaneous phenomena of overreaction and underreaction, while these assets represent a crucial factor of uncertainty. In practice, our study enhances investors' insights by uncovering the degree of optimism and inefficiency in financial analysts' forecasts for firms with significant intangible assets.

As our research is centred on the period before 2020, further study is necessary to comprehend financial analysts' behavior during and after COVID-19, a period expected to exhibit heightened uncertainty. Expanding our research could involve investigating the individual effects of intangible asset components, such as research and development and goodwill, not only on financial analysts but also on investors.

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