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Analysts' Forecasts and Asset Pricing: A Survey

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Abstract

This survey reviews the literature on sell-side analysts' forecasts and its implications for asset pricing. We review the literature on the supply and demand forces shaping analysts' forecasting decisions as well as the implications of the information they produce for both the cash flow and the discount rate components of security returns. Analysts' forecasts bring prices in line with the expectations they embody, consistent with the notion that analysts' forecast contain information about future cash flows. However, analysts' forecasts exhibit predictable biases and the market appears to underreact to the information in forecasts and not fully filter the biases in the forecasts. Analyst forecasts are also helpful in estimating expected returns on securities, but evidence on the relation between analysts' forecasts and expected returns is still scarce. We conclude by identifying unanswered questions and offering suggestions for future research.

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1.0 Introduction

This survey reviews the literature on sell-side analysts' forecasts and their implications for asset pricing. Analysts are information intermediaries who gather, analyze, and produce information for the investment community. As a result, analysts' forecasts have the potential to influence asset prices by conveying information about future cash flows as well as the discount rates applied to future cash flows. We discuss the implications of the information produced by analysts for both the cash flow and the discount rate components of security returns. In doing so, we identify unanswered questions and offer suggestions for future research.

Understanding how analysts influence (and are influenced by) market prices is predicated on a detailed understanding of the information analysts produce and their incentives to convey accurate and unbiased information. These dimensions jointly shape the information transmitted to investors, the timing of information transmission, and the extent to which market participants rely on analysts as information intermediaries. Thus we begin by reviewing the literature on the supply and demand forces shaping the properties of analysts' outputs. A key insight from Section 2 is that the influence analysts' forecasts have on asset prices depends upon both the nature of information they produce and their incentives to convey it accurately and without bias.

Analyst information is potentially useful for asset pricing because it provides essential inputs for security valuation. For example, earnings forecasts provide estimates of expected cash flows; stock recommendations and price targets can be useful in identifying mispriced stocks; dispersion in analysts' forecasts can be used to identify

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appropriate discount rates; and long-term growth forecasts can serve as benchmarks for calculating expected growth rates. All of these are relevant parameters in asset pricing models. In this sense, analyst research and asset pricing are closely intertwined.

Our survey proceeds by looking at the relation between analysts' forecasts and both the cash flow and discount rate components of asset prices. Specifically, Section 3 reviews the literature on analysts' forecasts and their implications for cash flow news. We begin with early evidence on the use of analysts' forecasts as a proxy for the market's expectations of future earnings and the extent to which analysts' forecast revisions convey information about future cash flows. We then examine whether the market's response to analysts' forecasts is timely and complete. We conclude Section 3 with evidence on whether market prices unravel predictable biases in analysts' forecasts, or whether prices behave as if market participants fixate on analysts' forecasts with biases embedded in them. Collectively, the evidence suggests that while investors appear to recognize predictable sources of bias, they fail to fully reflect these biases into market prices in a timely fashion.

Section 4 focuses on the implications of analysts' forecasts for expected returns. We first summarize the evidence on the use of analysts' forecasts in estimating expected returns. We proceed with a discussion of classical asset pricing models where analysts play no role in affecting expected returns. We then introduce information frictions that allow analysts to influence expected returns. We focus on two types of frictions: (i) information uncertainty and (ii) information asymmetry and liquidity. A central conclusion of Section 4 is that analysts' forecasts are helpful in mitigating both types of frictions. Consequently, analysts' forecasts influence asset prices through several

channels (beyond cash flow expectations), and are thus relevant to a wide array of capital market studies on prices, expected returns, and liquidity.

A picture emerging from our survey is that, while extensive evidence identifies sources of cross-sectional and time-series variation in analysts' forecast bias and accuracy, the answer to how forecast properties influence expected returns is not clear. We find limited evidence on (i) the channels through which analyst forecast properties impact expected returns, (ii) the direction of these effects, and (iii) how the various properties --such as bias, accuracy, timeliness, and intensity-- interact. Understanding these effects is crucial for assessing the efficacy of regulation, internal controls, and media scrutiny aimed at curtailing predictable biases and inaccuracies in analysts' forecasts.

Another fruitful area of research will be a deeper dive into modeling analysts' beliefs over firms' future performance. As we discuss in Section 2, as researchers we observe analysts' forecasts, which reflect a potentially biased indication of analysts' underlying expectations. Most prior research in this area explores the biased component of analysts' forecasts, while relatively little research sheds light on the formation of the non-biased component. Much research focuses on the directional impact of analysts' employment incentives on forecast bias and accuracy, but it typically stops short of using the predictable links to study analysts' beliefs over firms' future cash flows. Understanding how analysts form and revise their true expectations over future earnings is crucial to how information about firm performance is disseminated to investors.

Last, a broader challenge for this area is the difficulty of obtaining exogenous variation in the properties of analysts' forecasts that could be used to make casual

inferences. Generally speaking, prior studies examine the link between market outcomes and analysts' forecasts without accounting for analysts' decision to initiate coverage and provide a forecast. Because of the first-stage selection problem underlying analysts' coverage decisions, it is difficult to attribute observable effects of forecast properties to the forecasts themselves versus to the underlying incentives that prompted the initial forecasting decision. As we briefly discuss in Section 2, asset pricing attributes (e.g., trading volume and stock liquidity) influence analysts' coverage decisions, which in turn influence how analysts' forecasts affect prices. In the spirit of isolating exogenous variations in forecast properties, we also survey the recent literature on regulation (e.g., Regulation Fair Disclosure and Global Settlement) as examples of avenues to study the sources of bias in analysts' forecasts and their implications for asset prices.

Before we proceed, we note that, due to the focus on asset pricing, our survey is not designed as a comprehensive review of the role analysts play in capital markets. We refer the interested reader to Givoly and Lakonishok (1984), Schipper (1991), Brown (1993), Bradshaw (2011), and Ramnath, Rock, and Shane (2008), Beyer et al. (2010) for related reviews of the literature on analysts. Even within the asset-pricing framework, we restrict our focus to equity prices and as a result do not survey work on other securities (e.g., bond pricing).[1]

[1] See, for example, De Franco, Vasvari, Wittenberg-Moerman (2009) for early evidence on the role of bond analysts.

2.0 Properties of analysts' forecasts

As in any industry, supply and demand forces shape the properties of analysts' outputs, forecasts and stock recommendations. The survey focuses on analysts' forecasts with a limited discussion of recommendations. While the realization of earnings at earnings announcements provides a natural benchmark for studying variation in the bias, accuracy, and timeliness of analysts' forecasts, the open-ended nature of recommendations makes them less useful for evaluating analysts' performance and their implications for asset prices.

Two properties of analysts' forecasts have received considerable attention in the literature: (1) forecast *accuracy* and (2) forecast *bias*. Accuracy generally refers to the absolute difference between the analysts' forecast and the realization of an output whereas bias generally refers to the signed difference between them. Forecast accuracy and bias are a function of the complexity of the task, the skill level of the analyst, and incentives facing the analyst (e.g., effort). Complexity undermines accuracy whereas skill enhances accuracy. Further, incentives can influence both the accuracy and bias in forecasts.

Understanding the drivers of cross-sectional and time-series variation in analysts' forecast accuracy and bias is important because the information content of analysts' forecasts is, of course, dependent on the extent to which analyst information is unbiased and precise (i.e., the first and second moment properties of errors in analysts' outputs). Bias and accuracy influence market prices as well as researchers' inferences. To the extent that market participants identify predictable variation in analyst accuracy, market prices respond more strongly to credible forecasts. Similarly, to the extent that market

participants anticipate variation in forecast bias, researchers can improve estimates of earnings expectations by estimating the component of forecast bias that is unanticipated by market participants. On the other hand, to the extent that these weights are imperfect, understanding the predictive component of analysts' errors could also yield predictable patterns in stock returns (assuming that the expectation errors will eventually be corrected in the future) (see Elgers et al., 2003; Bradshaw et al., 2001; Frankel and Lee, 1998; and So, 2013).

Before we proceed, we note that an implicit assumption underlying papers that study analysts' forecasts is that firms already receive analyst coverage in the first place. This is important because prior research shows coverage decisions are a function of the relative costs and benefits shared among several market participants, including firms, analysts and investors. For instance, analysts face strong economic incentives to follow firms that are expected to establish reputational credibility, yield higher salaries, secure investment-banking business, and generate trading revenue for his/her employer. At the same time, analysts must balance a series of considerations including resource constraints, and opportunity costs, as well as catering to firms' and users' objective functions, among others.[2]

[2] The literature on the determinants of analyst coverage is extensive and beyond the scope of this paper. Among different features affecting the decision to cover a firm, early research focused on firm characteristics such as institutional holdings, firm size, and return variability (e.g., Bhushan, 1989; O'Brien and Bhushan, 1990). Subsequent studies have placed a greater emphasis on the role of the costs of acquiring information. Some studies document a positive association between analyst following and firms' disclosures (e.g., Lang and Lundholm, 1996; Healy et al., 1999; Hope, 2003a, 2003b; Lang et al., 2004; De Franco et al., 2011) whereas other research documents a positive relation between firm complexity (an inverse proxy for disclosure) and analyst following (e.g., Barth et al., 2001; Kirk, 2011; Lehavy et al., 2011). Another stream of the literature examines the link between investment banking incentives and analysts coverage decisions (e.g., Dunbar, 2000; Krigman et. al., 2001; Bradley et al., 2003; Cliff and Denis, 2004; Ljungqvist et. al., 2006; O'Brien et al., 2005; James and Karceski, 2006; McNichols et al., 2007; Clarke et al., 2007).

The implication of this literature for asset pricing is that the factors driving analysts' decisions to cover a firm are likely to capture direct properties of asset prices such as trading volume, volatility, information asymmetry, etc. as well as factors correlated with it (e.g., firm size, the presence of institutional investors, etc.). Further, the decision to cover a firm is not only influenced by asset prices but also has the potential to influence asset prices. Regarding the latter, Kelly and Ljungvist (2012) show that exogenous coverage terminations lead to a reduction in prices and an increase in expected returns due to increased adverse selection risk. As a result, because the factors driving the first-stage selection problem underlying analysts' coverage decisions are likely to be correlated with the factors driving variation in the propertied of analysts' forecasts, it is difficult to attribute observable effects of forecast properties to the forecasts themselves versus to the underlying incentives that drove the initial forecasting decision.

2.1 Forecast accuracy

Forecast accuracy is perhaps the single most important attribute of the quality of an analyst's output. Naturally, it has attracted tremendous attention in the literature and in practice. A substantial portion of the existing literature on analysts' forecasts focuses on how and to what extent information processing costs, experience, and employment incentives impact the accuracy of analysts' forecasts.

Several characteristics are associated with the accuracy of analysts' forecasts. For example, forecast accuracy decreases with measures of uncertainty such as firm complexity and volatility in earnings and returns (Kross, Ro, and Schroeder (1990), Lang and Lundholm (1996)) and when firm performance is transitory (Heflin, Subramanyam,

and Zhang (2003)). Forecast accuracy is also negatively associated with forecast horizon, as it is harder to forecast more distant firm performance (Sinha, Brown, and Das (1997), Clement (1999), Brown and Mohd (2003)). In addition, factors such as analysts' ability, available resources, and portfolio complexity also significantly influence forecast accuracy. For example, Clement (1999) shows that forecast accuracy is increasing with experience (a proxy for ability) and employer size (a proxy for available resources) and decreasing with the number of firms and industries followed (a proxy for portfolio complexity).

Another stream of research studies whether compensation incentives motivate analysts to provide accurate forecasts. Forecast accuracy and *Institutional Investor* "All-Star" status are positively associated, which in turn is likely to influence analysts' compensation and career prospects (e.g., Stickel, 1992; Groysberg, Healy, and Maber 2011). The evidence, however, seems to collectively document that compensation does not materially influence forecast accuracy. One explanation for this evidence is that analysts' employers, such as investment banks, do not rely on forecast accuracy as a first-order determinant of annual compensation because it is easy for analysts to free ride off of the forecasts of competing analysts. Due to the ease of mimicking other analysts' behavior, forecast accuracy is a noisy signal about analysts' ability and/or effort relative to other outcomes such as motivating or securing investment banking business.

Despite the lack of evidence for an impact of accuracy on analyst compensation, research documents a strong relation between analysts' accuracy and other career outcomes (e.g., Mikhail et al. 1999; Hong et al. 2000; Wu and Zang, 2009; and Groysberg et al., 2011). For example, Groysberg et al. (2011) use proprietary

compensation data from a prominent investment bank to document that inaccurate analysts are more likely to move to lower status banks or exit the I/B/E/S database, a sign of "termination"; but find no evidence of a relation between forecast accuracy and compensation. Overall the evidence suggests that small deviations in accuracy have a minimal impact on analyst compensation, but large (negative) forecast inaccuracy can affect analyst wealth by increasing the probability of dismissal.

Overall, forecast accuracy appears to be a firm characteristic influenced by firm-level attributes such as the riskiness of its investments, firm size, and temporary shocks. By contrast, forecast accuracy is less of an analyst-specific attribute likely because analysts can free ride off of other analysts' forecasts. Still, accuracy of an analyst's forecasts influences his/her career success, especially when it stands out positively or negatively.

2.2 Forecast bias

Another attribute of analysts' forecasts that has attracted attention is whether they exhibit a bias. The source of bias could trace to information supplied by management or analysts' own economic motivations. We discuss the evidence and potential sources of bias in analysts' forecasts in this section. Prior literature documents various sources of bias in analysts' forecasts of earnings and in their recommendations (e.g., Michaely and Womack (1999), McNichols and O'Brien (1997), and Groysberg, Healy, Maber (2011)). A central theme in this literature is that forecast bias varies in the cross-section and over forecast horizon (e.g., long-term forecasts are generally too high whereas short-term

forecast are too low). Below we discuss the key mechanisms driving the variation in bias that is related to forecast-horizon and in the cross-section.

A variety of economic temptations facing analysts introduce cross-sectional variation in analyst bias. For instance, in exchange for a favorable coverage of deals that the analysts' employer underwrites, analysts might be rewarded for maintaining existing or possibly attracting new underwriting business.[3] Similarly, analysts might ingratiate themselves to management by optimistically biasing their earnings forecasts in order to gain access to private information. In both instances, the lure of a good relationship with management might motivate analysts to optimistically bias their forecasts. Motivated by this intuition, a significant part of the literature investigates the extent to which the optimistic bias in analysts' forecasts is explained by analysts' incentives to appease management and generate revenues for investment banks.

A commonly cited source of bias is analysts' incentives to gain access to management by issuing forecasts that conform to managers' preferences. Francis and Philbrick (1993) study firms with negative buy/sell recommendations and show that analysts who do not provide a recommendation are more likely to issue optimistic earnings forecasts. The study interprets this result as evidence that analysts generate bias in their forecasts to distinguish themselves from competing analysts (who previously provided unfavorable recommendations), in hopes of receiving access to management as part of a *quid pro quo* arrangement. Similarly, Das et al. (1998) find that analysts produce more optimistic earnings forecasts for firms with less predictable earnings. The study interprets this finding as evidence that when earnings are less predictable, analysts

[3] Related, Hayes (1998) and Irvine (2000) demonstrate that analysts' desire to generate trading commissions for their employers creates an incentive for analysts to bias their forecasts.

optimistically bias their earnings forecasts to ensure access to management's private information (see also Chen and Matsumoto, 2006; Mayew, 2008).[4] A related stream of research links investment banking affiliation to analysts' incentive to curry favor with management in order to have superior access to information, and finds that affiliated analysts are systematically overoptimistic relative to non-affiliated ones (e.g., Hunton and McEwen, 1997; Lin and McNichols, 1998; Michaely and Womack, 1999; Dechow et al., 2000; Agrawal and Chen, 2008).

Recently, research has begun to examine the role social and professional networks play in influencing the accuracy and bias of the information analysts supply to investors. Westphal and Clement (2008) show that managers invest in, and leverage, personal relationships with analysts to deter them from conveying negative information. This points to a reciprocal relationship where managers and analysts perform favors for one another. Cohen, Frazzini, and Malloy (2010) show that shared backgrounds, as measured by education ties, serve as a conduit of information between managers and analysts and that these shared backgrounds result in less biased analysts' forecasts and more profitable investment recommendations in the pre- Regulation Fair Disclosure era (and it is still the case in the UK where Regulation Fair Disclosure restrictions do not apply). Related evidence in Brochet, Miller, and Srinivasan (2014) shows that analysts tend to initiate coverage of firms when they have a past relationship with the firms' management and these past relationships are associated with higher forecast accuracy. Overall, these studies suggest an influence of social and professional networks in both informing, and compromising the integrity of, analysts' outputs.

[4] Eames and Glover (2003), however, point out that the findings of Das et al. (1998) are likely due to the failure to control for the level of earnings. That is, the association between analysts' forecast error and earnings predictability is no longer significant once the level of earnings is controlled for.

While we observe economic incentives facing analysts to bias their forecasts, we would naturally also expect offsetting forces such as reputational concerns that would rein in such bias. With respect to reputation, some studies find limited evidence of biased forecasts leading to more profitable investment banking deals for the analysts' employers (e.g., Krigman et al. 2001; Ljungqvist et al. 2006; Cowen et al. 2006; Clarke et al. 2007, Kolasinski and Kothari 2008). Rather, these studies suggest that analysts are sufficiently concerned with their reputation as credible information intermediaries to be motivated to issue unbiased, accurate forecasts.

Second, managers' preference for optimistically biased forecasts appears to be contextual or timing-specific. For instance, optimistic earnings forecasts are more difficult to beat and evidence shows that meeting or beating targets are important managerial objectives (e.g., Burgstahler and Dichev, 1997; Degeorge et al., 1999, Brown 2001; Kasznik and McNichols, 2002; Matsumoto 2002; Bartov et al., 2002).[5] Hence, if analysts indeed seek to appease management, we might expect analysts' forecasts to be pessimistic sometimes. Consistent with this intuition, by examining the intertemporal patterns of forecast bias, Richardson et al. (2004) and Ke and Yu (2006) document that managers seem to prefer initially optimistic forecasts, but also prefer to have the optimistic forecasts "walked down" prior to earnings announcements to beatable levels. Similarly Hilary and Hsu (2013) document evidence that analysts who consistently "low

[5] See also, Graham et al (2005) for survey evidence on managers' perceptions of analysts' targets and the potential price impact of beating analysts' targets.

ball" forecasts (to curry favor with management by providing beatable targets) have better career prospects and better access to management's private information.[6]

Last, some studies depart from the incentives-based explanations to analysts' forecast bias and exploit how the cognitive limitations of analysts may affect forecast bias. Many studies show that analyst do not fully and rationally incorporate publicly available data (e.g., Lys and Sohn 1990; Abarbanell, 1991; Abarbanell and Bernard, 1992). Further, Sedor (2002) suggests that optimism in analysts' annual earnings forecasts are in part explained by their reactions to causal narratives that managers employ when communicating about enhancing future firm performance.

Collectively, research in this area shows that analysts' forecasts are often biased as a result of analysts' career concerns, compensation incentives and desire to maintain reciprocal relationships. The interaction between analysts' incentives and management's preference for the nature of bias creates both cross-sectional and intertemporal variation in both the sign and magnitude of forecast bias. Future research will benefit from a deeper understanding of how litigation risk and sector-wide demands for analysts and their employers impact the information they supply to investors.

2.3 Role of regulation

Before we conclude section 2, we briefly discuss the role of regulation on analysts' behavior.[7] As we discussed above, firm and analyst characteristics, as well as incentives, influence the properties of analysts' forecasts. In particular, we highlight two

[6] This explanation is consistent with the findings of Hong and Kubik (2003) who document annual forecasts to be optimistic on average whereas Matsumoto (2002) finds quarterly forecasts to be on average pessimistic.

[7] For comprehensive reviews, see Mehran and Stulz (2007), Ramnath, Rock, and Shane (2008),, and Koch, Lefanowicz, and Robinson (2013).

sources of conflict of interest: (1) an incentive to maintain investment banking relationships and (2) a desire to maintain access to private managerial information. Regulatory responses such as Regulation Fair Disclosure (Reg FD) and the Global Settlement (NASD 2711 and NYSE 472) took place in the early 2000's to mitigate these potential conflicts of interests.

Specifically, Reg FD was intended to 'level the playing field' by curtailing selective disclosure, so that analysts or institutional investors could no longer receive value-relevant information before others (i.e., smaller investors). A potential downside of Reg FD, however, is that it escalates the cost of analysts' services, which could lead to unintended consequences regarding the flow of information into the market. That is, if restricting private access to managerial information imposes a sufficient cost on analysts' information production process, the overall amount of information available to investors may decline, which in turn may deteriorate information flows post-Reg FD.

Acknowledging this cost-benefit tension, academic work has focused on Reg FD's influence on the quantity and quality of analysts' services as well as their implications to investor welfare. For instance, studies have shown that analysts' forecasts have become less precise (Gintschel and Markov, 2004; Agrawal, Chadha, and Chen, 2006), analysts' forecast dispersion has increased (Bailey et al., 2003; Mohanram and Sunder, 2006), and analyst coverage has declined (Mohanram and Sunder, 2006). The results collectively suggest that private communications with managers were an important input for analysts in their production of information. Curbing private communication hence adversely affects financial markets by reducing both the quantity and quality of information provided by analysts.

On the other hand, studies have also shown that Reg FD indeed leveled the playing field among market participants (Eleswarapu, Thompson, and Venkataraman, 2004; Bushee, Matsumoto, and Miller, 2004; Chiyachantana, Jiang, Taechapiroontong, and Wood 2004; Ke, Petroni, and Yu, 2008). For example, Chiyachantana et al. (2004) document that informed trading around earnings announcements declined post-Reg FD, whereas Ke et al. (2008) find a decline in abnormal trading by transient institutional investors prior to a bad news break after the introduction of the new regulation. These studies collectively suggest that the informed investors' loss of private information created a more equitable information environment between informed and uninformed investors.

With respect to Global Settlement, a stream of work investigated the effects of separating the investment-banking department and its research unit (i.e., Global Settlement, NASD 2711, and NYSE 472). These studies show that recommendations generally become more pessimistic post-regulation (Barber, Lehavy, McNichols, and Trueman, 2006; Kadan, Madureira, Wang, and Zach, 2009; Clarke, Khorana, Patel, and Rau; 2011). There is mixed evidence, however, on the regulation's effect on analyst coverage. Boni (2006) shows that the ten firms that agreed to the Global Settlement reduced coverage post-regulation, whereas Kolasinski (2006) concludes that regulatory restrictions did not adversely impact analyst coverage prior to equity issuances when conflicts of interest are potentially heightened.

3.0 Analysts' Forecasts and Cash Flow News

In this section, we discuss evidence showing the information content of analysts' forecasts, i.e., evidence that they convey cash flow news to the market. We begin with early evidence on the use of analysts' forecasts as a proxy for the market's expectations of future earnings (a proxy for future cash flows). This is important because correctly assessing the influence of analyst-supplied cash flow *news* on asset prices hinges on the quality of the proxy for the market's *expectations* of cash flows. We proceed to a discussion of the literature on the information content of analysts' forecasts – namely the market reaction to *changes* in analysts' forecast (i.e., forecast revisions). We then turn our attention to examining whether the stock price response to analysts' forecast is immediate and unbiased. This discussion primarily reviews the evidence on whether the market over-, under-, or unbiasedly reacts to analyst-provided cash flow news. We conclude this section with evidence on whether investors unravel predictable biases in analysts' forecasts when impounding news of cash flow revisions.

3.1 Analyst earnings forecasts as a proxy for market expectations for earnings

Conceptually, news (or information) is thought to be the unexpected component of a release, whether financial report or analyst forecast. Quantifying the amount of cash flow news contained in any type of cash flow announcement requires a sound proxy for (unobservable) cash flow expectations. Motivated by this requirement, early studies investigate whether analyst earnings forecasts could serve as a proxy for the market's expectations of future earnings (e.g., Elton and Gruber (1972), Barefield and Comiskey (1975), Brown and Rozeff (1978), Fried and Givoly (1982), Brown, Griffin, Hagerman, and Zmijewski (1987)). While still debated, since Fried and Givoly (1982) the

industry standard has been to use analysts' forecasts as a proxy for market expectatoins, given their superiority in time-series models (see Bradshaw, 2011).[8]

3.2 Information content of analyst earnings forecast revisions

Having established that analysts' forecasts proxy for the market's expectations about future cash flows, subsequent researchers investigate whether and to what extent *revisions* in analysts' forecasts contain news that moves contemporaneous stock prices. Analysts' forecast revisions are a significant source of cash flow information in financial markets. Unlike (quarterly) earnings announcements, analysts' forecast revisions do not have a predetermined periodicity; they occur throughout the quarter. A higher frequency of analysts' earnings forecast revisions results in timely updates about cash flow information to investors. Moreover, to the extent that analysts' forecasts reflect both public information and the analysts' private information, earnings forecast revisions serve to disseminate a valuable source of private information otherwise unattainable through public signals.

Recognizing this importance, researchers have documented a robust positive relation between market prices and analysts' forecast revisions (e.g., Griffin (1976), Givoly and Lakonishok (1979); Elton et al. (1981); Imhoff and Lobo (1984)). More recently, studies such as Lys and Sohn (1990), Asquith, Mikhail, and Au (2005), and Frankel, Kothari, and Weber (2006) confirm that revisions in analyst earnings forecasts not only incorporate publicly observed signals, but also provide new information to

[8] See also Lev (1989) and Kothari (2001) for overviews of this literature.

investors. That is, prices, trading activity, and liquidity all change around analysts' forecast revisions.[9]

While these studies find that market prices move in the direction of the forecast revisions (i.e., prices increase subsequent to upward revisions in earnings forecasts), the evidence for "response incompleteness" of market prices to analysts' forecast revisions (i.e., the degree to which the market under- or overreacts to the forecast revision) is muted. Such evidence is important for our understanding of the price discovery process and asset pricing in general. If reactions were complete, i.e., unbiased, then forecast revisions would only have short-term implications for stock prices. In contrast, if the market reaction is not complete, price drifts or reversals with respect to forecast revisions would be predictable. The following subsection reviews the literature that investigates the degree of completeness in market responses to analysts' forecast revisions, and the determinants that drive the heterogeneity in the market reaction.

3.3 Do investors fully react to analysts' forecast revisions?

The extent to which market prices efficiently incorporate information has been a central theme of investigation in asset pricing for many years (e.g., Fama (1970)). In this subsection, we review the literature investigating how analysts' forecast revisions are incorporated into prices. In an informationally efficient market, analysts' forecast revisions, like any other observable value-relevant signal, are price in a timely and

[9] Our attention is primarily given to analyst earnings forecasts but related research on the information content of analysts' recommendations also exists. For example, Bradley, Clarke, Lee, and Ornthanalai (2014) document significant information content in analysts' recommendations using high-frequency data. Further, Cornett, Tehranian, and Yalcin (2007) document that analysts' recommendation changes become less informative post-FD as it became more difficult for analysts to access value-relevant private information from managers.

unbiased fashion. Put differently, initial price reactions to analysts' forecast revisions are not able to predict subsequent returns. On the other hand, to the extent the market underreacts to analysts' forecast revisions, prices would follow a predictable drift subsequent to the forecast. In addition, any conclusions drawn from such evidence will depend on whether the underreaction is driven by (i) investors' information processing biases, i.e., investors' ability to interpret analysts' forecasts in an unbiased fashion and/or (ii) market frictions, i.e., the severity of market microstructure and trading costs might prevent arbitrageurs who might understand and seek to capitalize on the investors' biased processing of analysts' forecasts that results in security mispricing.[10]

Givoly and Lakonishok (1980) is the first study to show that market prices initially underreact to forecast revisions, resulting in short-term return drift. Subsequent studies such as Stickel (1991) and Chan et al. (1996) confirm that market prices indeed initially underreact to analysts' forecast revisions, causing predictable drifts in stock prices. Stickel (1991), for example, demonstrates that the initial underreaction takes significant time to correct, resulting in long-term return predictability. Specifically, the study shows that firms whose consensus forecast have been recently revised upward tend to earn higher abnormal returns over the next 3 to 12 months than firms whose consensus forecast has been recently revised downward.

The initial underreaction to analysts' forecast revisions is often viewed as stemming from two broad reasons. First, market frictions that could potentially influence the information diffusion process. A poor information environment, for example, can

[10] This line of argument, known as limits to arbitrage, appears, for instance, in Barber et al. (2001). They show that stock returns following analyst recommendation signals are dependent on the frequency of rebalancing, highlighting the importance of transaction costs in explaining the drift in returns following analyst recommendations.

inhibit the efficiency with which prices absorb available information, and thus cause a gradual, delayed price response to analysts' forecast revisions. Second, investors' information processing biases with respect to specific attributes of the analysts' forecast revision (e.g., analyst reputation) might themselves cause a delayed price response.

Gleason and Lee (2003), for example, jointly study how the above two channels influences the dissemination of analysts' forecast revision information. Specifically, they find that post-revision drift (1) decreases with analyst reputation, (2) increases with revision quantity, and (3) decreases with the number of analysts following. The paper further points out that even after controlling for various firm characteristic known to be associated with expected returns, the market still appears to underreact to revisions. Specifically, investors appear to react more strongly to star analysts, compared to less well-known analysts and analysts from smaller brokerage houses.[11] Collectively, the paper concludes that while certain analyst and firm characteristics enhance the dissemination process of forecast revision information, market prices overall do not seem to completely understand the subtler aspects (e.g., analysts' reputation) of analysts' forecast revisions.

Other studies investigate the above two channels in isolation (e.g., Stickel,1992; Park and Stice (2000); Zhang (2006); Bonner, Hugon, and Walther (2007); Hui and Yueng (2013)). Zhang (2006), for example, investigates how information uncertainty (proxied by firm size, age, analyst coverage, dispersion in analysts' forecasts, return volatility, and cash flow volatility) influences post-revision drifts. Zhang (2006) finds that lower information uncertainty enables investors to react more completely to analysts'

[11] "Innovative" revisions are those that provide new information and do not merely move toward the consensus.

forecast revisions, resulting in lower post-revision drifts. On the other hand, Hui and Yeung (2013) focus on the properties of analysts' forecasts and show that investors do not fully understand the implied persistence of industry wide analysts' forecasts.[12]

In sum, the literature shows that: (1) investors tend to underreact to analysts' forecast revisions and (2) the underreaction is a function of both the information environment and analysts' forecast characteristics. On the latter point, the extent to which investors impound forecast revisions into prices is a function of (i) information processing biases and (ii) market frictions.

3.4 Do investors unravel predictable biases in analysts' forecasts?

Section 2 reviewed the underlying determinants that drive biases in analysts' forecasts. Biases can be conscious, in the sense that analysts' self-interest might drive some of the biases, or unconscious, in the case of cognitive information-processing biases. In this section, we investigate i) to what extent market prices are able to rationally unravel these biases and ii) the factors that influence whether investors unravel analysts' forecast biases.

Evidence on whether investors unravel predictable biases in analysts' forecasts has been mixed due, in part, to differences in research methodologies and settings. On the one hand, Hughes, Liu, and Su (2008) find evidence suggesting market prices fail to incorporate predictable biases in analyst forecasts. Specifically, they find that a strategy of sorting firms by predicted errors fails to generate abnormal returns, which they

[12] A related stream of work identifies how investors weight specific firm or analyst characteristics that are predictive of analysts' forecast errors. For instance, Clement and Tse (2003) find that investors respond more strongly to longer horizon forecasts, which are known to be less accurate, than shorter horizon forecasts because investors are generally more uncertain about earnings earlier in the year.

interpret as market efficiency with respect to predictable analyst errors. On the other hand, So (2013) highlights an important methodological limitation in the way Hughes et al. (2008) and other related studies calculate the predicted component of analyst errors.[13] So (2013) introduces an alternative approach. By showing profitable investment strategies based on the new measure of predicted analyst errors, he provides evidence of a market that is naïvely fixated on analysts' forecasts. In a similar vein, Frankel and Lee (1998) present indirect evidence consistent with market prices failing to incorporate the predictable component of analyst errors. They show this by demonstrating that their valuation model's performance in predicting the cross-section of stock returns improves when the predictable component of analyst errors is taken into account.

More broadly, studies in the "anomalies" literature suggest that investors naively fixate on analysts' forecasts (Abarbanell and Bernard (1992), Dechow and Sloan (1997), Bradshaw, Richardson and Sloan (2001)). The underlying motivation behind these studies is to offer a potential explanation for well-known stock market anomalies such as the post-earnings announcement drift (Ball and Brown (1968)), the value anomaly (Basu (1977), Fama and French (1992)), and the accruals anomaly (Sloan (1996)).[14] Specifically, these studies investigate whether investors' fixation on biased analyst signals is responsible for anomalous returns. For example, Abarbanell and Bernard (1992) show that markets' naïve fixation on analysts' forecasts explains up to half of the post-earnings announcement drift anomaly, and Dechow and Sloan (1997) show that bias

[13] The traditional approach involves regressing realized forecast errors on observable, lagged firm characteristics. To the extent that these firm characteristics correlate with unobservable inputs to analyst forecasts such as analysts' incentive misalignment or private information, biases in the methodology emerge. Examples of other studies that use the traditional approach include, for examples, Ali, Klein, and Rosenfeld (1992), Elgers and Murray (1992), Lo and Elgers (1998), Frankel and Lee (1998).

[14] See Richardson, Tuna, and Wysocki (2010) for a recent survey of this literature.

in analysts' forecasts of future earnings growth explain over half of the returns to contrarian investment strategies.

Lastly, a stream of research investigates how investor characteristics influence how they might unravel analysts' biases. For instance, Bonner, Walther, and Young (2003) show that sophisticated investors appear to have a better understanding of the factors that drive forecast accuracy than do unsophisticated investors. Similarly, Malmendier and Shanthikumar (2007) show that small investors, compared with large investors, are more naïve about analyst recommendations, which are over-optimistic due to underwriting incentives. More recently, Hilary and Hsu (2013) find evidence that institutional investors are better at unraveling *consistent* analyst errors (i.e., errora that are inaccurate with low standard deviation) compared to retail investors.

Overall this literature suggests that investors partially unravel the biases in analysts' forecasts, and that partial unraveling results in predictable stock prices. Further, the degree to which investors' unravel predictable biases in analysts' forecasts is a function of firm, analyst, and investor characteristics. Future research would benefit from a detailed understanding of the drivers of this variation, such as behavioral biases and capital constraints.

4.0 Analysts' outputs and expected returns

In this section, we discuss channels through which analysts' forecasts are linked to expected returns. Before we proceed, we preface this discussion by noting that while the implications of analysts' forecasts to cash flows is clear, and the empirical evidence is vast, the links between analysts' forecasts and expected returns are less established. We

review the literature below but note that the current state of literature presents an promising opportunity for future research.

We begin this section with a discussion of the use of analysts' forecasts in developing expected return proxies within a valuation framework. We then proceed to a discussion of the relation between analysts' forecasts and expected returns in an asset-pricing framework, focusing on (i) the effect of analysts' forecasts on information uncertainty and (ii) the effect of analysts' forecasts on information asymmetry and liquidity.

4.1 Use of earnings forecasts in estimating expected returns

Analysts' forecasts influence expected returns as well as facilitate the estimation of expected return proxies. In this sub-section, we focus on the latter (Section 4.2 focuses on the former). We begin with an earnings-based valuation model to obtain an estimate of firm-value that is independent of price. Then, by comparing the valuation to observed market price, one may estimate the discount rate investors place on future earnings as a proxy for the firm's expected return.

A central goal of valuation analysis is to incorporate the latest information about the amount, timing, and uncertainty of expected future cash flows in developing estimates of firm value, which may be compared against prevailing market prices. Under classical valuation models (e.g., the dividend discount model), the fundamental value of a firm is defined as the present value of its expected future dividends. Using these approaches, firm value can be expressed as a function of two central inputs (i) its expected future

dividends and (ii) the discount rate applied to the firm's future dividends. More specifically, firm value at time t can be expressed as:

$$Value_t = \sum_{i=1}^{\infty} \frac{E_t(D_{t+i})}{(1+r_e)^i} \quad (1)$$

where $E_t(D_{t+i})$ is the firm's expected future dividends based on all information available in period t and r_e is the (constant) market discount rate applied to future dividends.

A key challenge in implementing the dividend discount model shown in Equation (1) is the need to forecast the stream of firms' future dividends, particularly among firms that do not issue dividends. Recognition of this issue gave rise to valuation models that rely on the "clean surplus relation" (Ohlson (1995)), which states that changes in a firm's book value must be attributable to either earnings or dividends. That is:

$$B_t = B_{t-1} + E_t - D_t \quad (2)$$

where B_t denotes a firm's book value, E_t is the firm's earnings in period t, and D_t is the firm's dividends in period t. Rearranging the clean surplus relation, dividends for period t can be expressed as:

$$D_t = E_t - (B_t - B_{t-1}). \quad (3)$$

Substituting Equation (3) into Equation (1), firm value can be expressed as

$$Value_t = \frac{[E_t-(B_t-B_{t-1})]}{(1+r_e)^1} + \frac{[E_{t+1}-(B_{t+1}-B_t)]}{(1+r_e)^2} + \frac{[E_{t+2}-(B_{t+2}-B_{t+1})]}{(1+r_e)^3} + \cdots \quad (4)$$

Equation (4) relates to valuation analysis using the "Q model" from Tobin (1969), which relies on forecasting firms' ability to generate value, i.e., cash flows in excess of the cost of capital, rather than their stream of future dividend payments. Valuation analysis using the Q model compares the market value of a firm to the replacement value of its physical assets.

Like the Q model, researchers commonly implement Equation (4) by estimating a firm's future residual income. The notion of residual income captures the idea that expected future accounting rates of return that exceed the firms' costs of obtaining capital create economic value. These expected earnings represent cash flows that exceed the costs of acquiring assets and thus create value for shareholders. Using this intuition, a substantial literature in economics, finance, and accounting operationalizes valuation analysis using a residual income model, where residual income (RI) refers to a firm's earnings minus the required rate of return on equity multiplied by the beginning-of-period book value:

$$RI_t = E_t - r_e B_{t-1}. \quad (5)$$

Substituting Equation (4) into (5) expresses firm value as a function of a firm's book value and forecasted earnings-per-share. More specifically, the residual income model re-expresses firm value as:

$$Value_t = B_t + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_e)B_{t+i-1}]}{(1+r_e)^i} \quad (6)$$

where ROE_{t+i} is the return on book equity corresponding to period $t+i$. The application of clean surplus accounting shifts the focus of valuation exercises from forecasting dividends to forecasting earnings.

Both academics and practitioners commonly use these valuation models because, as illustrated in Equation (6), they provide estimates of firm-value by inputting forecasts of future earnings, current book values, and discount rates. By replacing firm value with the market price of a firms' equity and using analysts' forecasts to proxy for expected future earnings, prior research demonstrates how to derive the implicit discount rate (e.g., Gebhardt, Lee, and Swaminathan, 2001; Easton, 2004; Easton and Mohanan, 2005; and

Guay, Kothari, and Shu, 2011). These estimates can be informative to investors in predicting future returns as well as to corporate managers in making internal capital investment decisions.

The estimated discount rate is commonly referred to as a firm's implied cost-of-capital (ICC). ICCs have gained appeal in recent decades, first in accounting, and now increasingly in finance, as a proxy for firm's expected return. These studies suggest that ICCs offer an alternative approach for implementing empirical asset-pricing tests (see Easton and Sommers (2007) for a review of the accounting literature on ICCs). In finance, ICCs have been used to test the Intertemporal CAPM (Pástor et al. (2008)), international asset-pricing models (Lee et al. (2009)), and the pricing of default risk (Chava and Purnanandam (2010)).

The ability of ICCs to proxy for expected returns hinges upon several key assumptions, including whether analysts' forecasts accurately reflect the market's expectation of earnings. Given the predictable and recurring nature of analysts' biases discussed in Sections 2 and 3, prior research attempts to refine ICCs as a proxy of expected returns by removing predictable biases in analysts' forecasts (e.g., Easton and Monahan (2005), Easton (2009), Hou et al. (2012), Larocque (2013)). Similarly, Guay, Kothari, and Shu (2011) show that sluggishness in analysts' forecast revisions create biased ICC estimates. They develop techniques to mitigate this form of bias. Collectively, these studies show that analysts' forecasts can facilitate the estimation of firm-level expected returns using an implied cost of capital approach while they also point to a need to recognize and address the impact of predictable variation in the biases, inaccuracies, and timeliness of analysts' forecasts.

4.2 Analysts' forecasts and models of expected returns

Valuation is a function of two unobservables: risk and cash flows. Models show that uncertainty surrounding these unobservables affects valuation. Analysts, as information intermediaries, can influence the uncertainty around estimates of risk and cash flows through their output (forecasts, recommendations, and qualitative discussion). We begin with a classical model that ignores uncertainty. We then overlay uncertainty about the parameters and examine the role analysts' outputs plays in reducing uncertainty.

In classic asset pricing models such as the CAPM, the expected return of an asset is a function of the covariance between the firm's return and the return of the market, commonly referred to as the firm's "beta." The model implicitly assumes that the investor knows the covariance between the firm's returns and the market. In other words, there is no "information uncertainty" about the firms' beta. Further, because investors have homogenous beliefs, there is no source of risk arising from information asymmetry among market participants. As a result, in such a model there is little opportunity for analysts to influence the expected return of a stock by supplying information to the market.

Subsequent studies relax the assumption of no information uncertainty by acknowledging that the beta parameter needs to be estimated, and such uncertainty introduces so-called "estimation" risk (e.g., Brown (1979), Barry and Brown (1984), Brown (1985), Coles and Loewenstein (1988)). More recently, researchers have linked the estimation risk literature to corporate disclosure (Hughes, Liu and Liu (2007);

Lambert, Leuz and Verrecchia (2007)). The idea is that firms' disclosures are imperfect signals about future cash flows and, as a result, better disclosures can reduce expected returns via a reduction in the (the estimation of) firm beta. As discussed in Lambert et al. (2007) this effect is non-diversifiable because it manifests through the covariance of a firm's cash flows and the market cash flows (i.e., it lowers the "cash flow" beta).

The insights from the estimation risk literature have implications for the literature on analysts' forecast because analysts, by supplying information into the market, can alter the extent of information uncertainty in the markets. Specifically, the literature on estimation risk predicts that firms with richer information sets due to analysts' information production have lower expected returns because analysts' forecasts reduce estimation risk, which translates to a lower beta.

Another stream of literature relaxes the assumption that investors have homogenous beliefs and exploits the extent to which information asymmetry between investors gives rise to a source of priced risk. For example, Easley and O'Hara (2004) study a model of asymmetric information and argue that information asymmetry is a source of non-diversifiable risk. Lambert, Leuz and Verrecchia (2011) argue that the effect in Easley and O'Hara (2004) is diversifiable in models of perfect competition, but show that information asymmetry is a source of non-diversifiable risk in markets with imperfect competition.[15] A related stream of research uses a rational expectations equilibrium framework that links information asymmetry to asset prices by lowering demand from uninformed traders (e.g., Grossman and Stiglitz (1980), Hellwig (1980), Admati (1985), and Wang (1993)).

The relation between analyst's information production and expected returns via

[15] See Armstrong et al. (2011) and Akins, Ng and Verdi (2012) for empirical evidence.

changes in information asymmetry, however, is more subtle. On one hand, by supplying previously privately information into the public domain, analysts' forecasts can reduce information asymmetry. This would predict analyst-supplied information to reduce expected returns due to a reduction in information asymmetry. On the other hand, analysts are compensated based on their ability to garner trading commissions and thus may cater to large institutional investors. To the extent that analysts provide selective access to their reports, analysts could also exacerbate information asymmetry among market participants, which would increase expected returns.

4.3 Empirical evidence

Evidence on the link between analysts' forecasts and expected returns is relatively scarce. One potential explanation for this scarcity is that the expected link between analysts' forecasts and asset prices is ambiguous, given two potentially offsetting effects from uncertainty and asymmetry as discussed above. Additionally, other forces such as market mispricing and trading frictions potentially confound the empirical link between analysts' outputs and market prices (e.g., Miller (1977), Diether, Malloy, and Scherbina (2002)).

In the context of Reg FD, some studies directly test the information uncertainty vs. information asymmetry mechanisms by investigating changes in cost of capital as a proxy for expected returns around the regulation's passage. Consistent with the argument that Reg FD increased the information acquisition costs for analysts, Gomes, Gorton, and Madureira (2007) document a decrease in the information environment (i.e., higher analysts' forecast errors and higher volatility) for small firms, causing a higher cost of

capital after the passage of Reg FD. The authors interpret this result as Reg FD restricting analysts' private access to managerial information and thereby choosing to produce less information (i.e., higher information uncertainty), which in turn adversely affected small firms.

In contrast, consistent with the argument that Reg FD reduced information asymmetry by leveling the playing field, Chen, Dhaliwal, and Xie (2010) document that the cost of capital for medium and large firms declined after the passage of the new regime. This suggests that prior to Reg FD analysts, especially in big firms, selectively provided information to large investors and that this channel was reduced subsequent to the new regulation.

In a similar vein, other studies show that analysts increase liquidity by mitigating information asymmetry among investors. For example, Brennan and Subrahmanyam (1995), Easley, O'Hara, and Paperman (1998), and Roulstone (2003) show that analysts create a more equitable information environment among investors by publicly disclosing information that would otherwise be costly to process. Similarly, Chung, Elder, and Kim (2010) suggest that analyst help mitigate information asymmetry between firms and investors by serving a governance role, deterring corporate wrongdoing. On the other hand, studies such as Irvine, Lipson, and Puckett (2007), Juergens and Linsey (2009), and Christophe, Ferri, and Hsieh (2010) suggest that analysts may also increase adverse selection risk among investors by sharing information privately with preferred clientele ahead of publicly releasing their forecasts or recommendations.

Last, an influential study by Diether, Malloy and Scherbina (2002) investigates the relation between analysts' forecast dispersion and the cross-section of future returns,

and finds that analysts' forecast dispersion is *negatively* associated with future returns. The authors interpret this result as differences in opinion driving overvaluation in the stock (a theory set forth by Miller (1977)).[16] Other studies attribute the findings in Diether et al. (2002) to trading costs (Sadka and Scherbina (2007)) and to financial distress (Avramov et. al. (2009)). Regardless of whether forecast dispersion captures information uncertainty or asymmetry (in the form of disagreement) among analysts or a correlated factor (e.g., trading costs or distress risk) reflecting fundamental risk (and as a result information risk), the evidence seems inconsistent with the argument that analysts' forecast dispersion is associated with priced information risk.

5.0 Conclusions

This survey reviews the literature on sell-side analysts' forecasts and their implications for asset pricing. Section 2 reviews the literature on the supply and demand forces shaping analysts' forecasting decisions, noting that research on the impact of analyst forecasts on asset prices needs to account for the information analysts produce, which firms they cover, and their incentives to convey accurate and unbiased information. Section 3 reviews the literature on analyst forecasts and their implications for cash flow news, which highlights both instantaneous and delayed reactions to analysts' forecasts as well as the role of market over- versus under-reaction. Section 4 reviews the literature on analyst forecasts' implications for expected returns.

Despite a substantial literature on the intersection of analysts' forecasts and asset pricing, the specific mechanisms through which analysts' forecasts influence asset prices,

[16] See also Ang et al. (2006) for initial evidence and Stambaugh, Yu and Yuan (2015) for more recent evidence of a similar pattern using idiosyncratic volatility and the cross section of returns.

and expected returns in particular, are still not entirely clear. We identify unanswered questions and offer suggestions for future research to better understand the channels through which analysts' forecasts influence expected returns, the formation of analysts' beliefs, and techniques to causally link forecasts to market outcomes.

Before we conclude, we note that it has been over 20 years since Schipper (1991) highlighted a disproportionate focus within academic research on analysts' forecasts, largely because of the availability of analyst forecast data and the use of this data within studies of earnings news (see Bradshaw (2011) for a similar remark). In our view, this disproportion remains despite the proliferation of new data sources and technologies, such as textual analysis, that afford researchers the ability to paint a more complete view of the information analysts themselves convey to the market. We encourage future research to help fill this void and, in doing so, enhance our understanding of how information supplied by analysts gets reflected in market prices.

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