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Price adjustment to news with uncertain precision☆

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A B S T R A C T

We analyze how markets adjust to new information when the reliability of news is uncertain and has to be estimated itself. We propose a Bayesian learning model where market participants receive fundamental information along with noisy estimates of news' precision. It is shown that the efficiency of a precision estimate drives the slope and the shape of price response functions to news. Increasing estimation errors induce stronger nonlinearities in price responses. Analyzing high-frequency reactions of Treasury bond futures prices to employment releases, we find strong empirical support for the model's predictions and show that the consideration of precision uncertainty is statistically and economically important.

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News on economic fundamentals drives asset prices. A larger amount of news leads to greater and faster price reactions. This is well confirmed by a wide range of empirical studies in asset pricing, market microstructure analysis, corporate finance and financial accounting. Asset-specific news naturally enlarges investors' information set, allowing them to revise their expectations with regard to the underlying fundamental value. We address the issue of precision uncertainty and show that agents underreact to news when there is a chance that the precision of the news could be a lot lower than under regular circumstances.

Investors' updating of expectations in response to the arrival of news and its implications for the underlying asset price process is theoretically best understood in terms of a Bayesian learning model. However, though the mechanism of Bayesian learning is theoretically appealing and tractable, only little empirical evidence of Bayesian updating effects in news-implied asset price reactions is existent. A major reason for this lack of evidence is that Bayesian updating processes ultimately depend on the reliability of the news. Think of announcements on economic fundamentals – typically stemming from surveys – as realizations of a random distribution with a given variance. The reliability of the news is then naturally measured in terms of the random variable's precision (i.e., the inverse of its variance). A major implication of Bayesian learning is that prices react more strongly to more precise news. However, the reliability of a piece of news is generally unknown in reality. If they can at all, market participants can only *estimate* precision of news, leaving them with a noisy estimate.

This paper addresses the missing link between Bayesian learning theory and actually observed news-implied asset price reactions. To confront the theoretical framework with empirical observations, we address the fundamental question of how market participants actually do infer the reliability of news in practice. In this context, we distinguish between two ways in which investors estimate the precision of announcements: first, traders might use additional publicly available information linked to the reliability of news releases. This results in a so-called "external" precision estimate. For example, natural precision indicators could be sampling statistics on the underlying survey, information on sampling errors, or information on the expected magnitude of revisions to currently released figures as suggested by Hautsch and Hess (2007). Second, in situations where no information on the quality of announcements is readily available, investors are left with inferring the precision of the news from the released information itself, e.g., by looking at the size of a surprise as suggested by Subramanyam (1996). This would result in a non-linear price response. However, such a size-based (or "internal") precision signal is rather uninformative and restrictive since it implicitly conjectures that large surprises can only come with low precision.

A major contribution of the paper is to show that the distinction between these two types of precision signals is theoretically important and is empirically supported by the data. In an extended Bayesian learning framework we illustrate that the relative impact of both types of precision proxies ultimately depends on the efficiency of the external estimate. If traders have a highly reliable external precision estimate, the magnitude of a surprise itself provides only little additional information on news' quality. In the limiting case, when the precision of the news is certain, the size of a surprise as a reliability proxy can be completely ignored. In this situation, the resulting price reaction function is linear with its slope positively depending on the indicated precision of releases. In contrast, if the external precision estimate is very noisy, traders are left alone with the size (and sign) of the release. This induces deviations from linearity which increase with surprises' magnitude making the price response curve S-shaped. We empirically show that actually observed news-implied price reactions are significantly driven by both underlying effects and that their neglect can induce severe pricing errors.

To date, surprisingly little emphasis has been placed on the role of uncertainty in the reliability of news in financial models. For example, in the informed trade models of Kyle (1985) and Admati and Pfleiderer (1988), information asymmetry is introduced via private signals drawn from a distribution with *known* parameters. Similarly, in the market microstructure models of Blume, Easley, and O'Hara (1994) or Easley, Kiefer, and O'Hara (1997), privately informed agents hold different beliefs but individuals have parameter certainty regarding the distribution (and hence the precision) of their beliefs. Providing another example, models of speculative trade are focusing on the combination of private information and public announcements. Awaiting public releases, heterogeneity among agents is created by differences in prior beliefs (e.g., Holthausen and Verrecchia (1988, 1990), Harris and Raviv (1993) or Kim and Verrecchia (1991a, 1991b)), additional efforts to acquire private information Kim