Sentiment dynamics within CEO letters: Stylized facts and information content

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Many Chief Executive Officers (CEOs) write a letter to their shareholders several weeks after the end of the fiscal year to describe their past results and expectations about the future. These letters are an important information channel by which CEOs directly communicate to investors about their past and future performance and constitute an integral part of annual reports. Their discretionary nature makes them interesting for research as they allow investors to measure CEOs' sentiment concerning the firm's future performance (Abrahamson and Amir, 1996).

Abrahamson and Amir (1996) and Patelli and Pedrini (2013) show that CEO sentiment, measured as the difference between the proportion of positive and negative words in annual letters, contains valuable information about their firm's future performance. However, little attention has been devoted to how these letters are structured and, as a result, little is known on how to accurately measure CEO sentiment. Abrahamson and Amir (1996) and Patelli and Pedrini (2013) use basic measures of sentiment generated by the DICTION software or refer to the proportion of negative words, arguing that positive words in voluntary corporate filings are `sugar-coated, irrelevant and ritualistic' (Abrahamson and Amir, 1996). These measures of CEO sentiment have in common that they assume all the words to be made equal, irrespective of their position in the text.

The goals of this paper are twofold. First, we study the text structure within CEO letters. We argue that CEO letters are part of a firm's discretionary narrative discourse in annual reports and are expected to have both a cohesive and coherent structure (Halliday and Hasan, 1976). Second, if annual letters are well crafted documents, the dynamics of CEO sentiment within the letter should send a signal concerning the CEO's confidence about future performance. We investigate whether a weighted measure of CEO sentiment is more accurate in predicting future performance (measured as return on assets), where the weights are defined in function of the position of the (positive or negative) word in the text. Our measure of CEO sentiment is inspired by the *position method* in computational linguistics which relies on the fact that texts in a discourse generally observe a predictable structure, and that key words tend to occur in certain specifiable locations (Edmundson, 1969).

Our intra-textual analysis uncovers interesting stylized facts about CEOs' text organization strategies and how they convey information to investors. CEOs seem to carefully craft their annual letters with clear stylized facts in positive and negative sentiment. We find a U-shape in the use of positive words and a decreasing smirk in the use of negative words. To explain this, we note that most CEO letters start by an account of the past and current state of the firm and conclude with the expected future performance. As such, the dynamics are compatible with the hypothesis of optimistic CEOs who see the future as brighter than the past. In addition, the pattern is consistent with the hypothesis of impression management, as it is future earnings that matter for investors' firm valuation.

Given the stylized facts in CEO letters, we raise the question whether measuring text sentiment by assigning equal weights to positive and negative words irrespective of their location in the text is optimal. There are at least two reasons to question this. First, the effect of CEOs' optimism/overconfidence bias (hypothesis 1) and tendency for impression management (hypothesis 2) can be expected to be larger for the words at the end of the text, since those are the words referring to the future. In addition, since they are read last, these words tend to affect the reader's memory the most. Second, if the misclassification rate is uniform over the text, a higher than average percentage number of positive or negative words indicates a lower noise to signal ratio and, therefore, should be assigned a higher weight (hypothesis 3).

Based on this, we propose a more general sentiment measure, defined as the spread between the weighted sum of positive and negative words. Our identification scheme of the weights consists of a constrained threshold least squares regression of future return on assets on the weighted net sentiment by bin. To avoid overfitting, the weights are parsimoniously specified as a linear combination of flexible Almon polynomials that are smooth functions of the words' position in the text.

Our results indicate that a higher forecast efficiency is obtained by underweighting the sentiment measures of the end-of-text bins. For the positive words, that are relatively dominant at the end of the text, this is consistent with the optimism/overconfidence and impression management hypothesis. Those behavioral biases distort the signal at the end of the text. The fact that negative words, which occur less frequently at the end of the text, are also underweighted is compatible with all three hypotheses.

To quantify the impact of CEO net sentiment on future firm performance, we aggregate the weights of each portion of the text to obtain a weighted measure of sentiment. Consistent with Abrahamson and Amir (1996) and Patelli and Pedrini (2013), we find that CEO sentiment is a key predictor of future firm performance. However, we find that sentiment measures used in prior research are potentially inefficient as they assume all words to be made equal, irrespective of their position in the text. When comparing the prediction accuracy of the equally weighted measure of CEO sentiment (standard measure of sentiment) with our weighted measure of sentiment, we significantly increase the prediction accuracy of our model by six percentage points. This result thus indicates that the structure of sentiment within CEO letters provides a signal to investors concerning future performance and that an intra-textual analysis is required to accurately measure CEO sentiment within the CEO letter.

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