



Facebook's daily sentiment and international stock markets



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ABSTRACT

We examine the relation between daily sentiment and trading behavior within 20 international markets by exploiting Facebook's Gross National Happiness Index. We find that sentiment has a positive contemporaneous relation to stock returns. Moreover, sentiment on Sunday affects stock returns on Monday, suggesting causality from sentiment to stock markets. We observe that the relation between sentiment and returns reverses the following weeks. We further show that negative sentiments are related to increases in trading volume and return volatility. These results highlight the importance of behavioral factors in stock investing.

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1. Introduction

An important part of behavioral finance concerns the relation between investor sentiment and stock market returns. Measuring sentiment is, however, not a trivial exercise. The conventional method to obtain measurements of sentiment is to take surveys of households. In this type of study, researchers typically select a random number of households and ask a small number of questions to identify the level of optimism or pessimism per household. The responses are then aggregated to construct an average sentiment level.¹ Although these studies have provided important insights, the survey method has some important weaknesses. One weakness is that sample sizes and participation rates are typically low. For example, the Michigan Consumer Sentiment survey is sent to only 500 households, and the Consumer Confidence Index to 5000 households. Another weakness is that the surveys are typically conducted on a monthly frequency. The resultant studies then typically rely on the assumption that sentiment remains stable from day to day over the survey period.²

We propose to use an alternative measure of sentiment, based on status updates on Facebook, which is the world's largest social network site. Facebook's Gross National Happiness Index (FGNHI) has been developed by Facebook's data team and offers daily sentiment for twenty international markets. The website *investorwords.com* defines sentiment as "a measurement of the mood of a given investor or the overall investing public, either bullish or bearish." Facebook measures people's mood by examining the positive and negative terms used by Facebook participants. The assumption is that happy

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¹ Sentiment indexes based on surveys include the University of Michigan Consumer Sentiment Index, and the Consumer Confidence Index (see for example Brown and Cliff, 2004; Lemmon and Portniaguina, 2006; Qiu and Welch, 2006).

² Several other studies have used indirect measures of sentiment. Indirect sentiment measures represent economic and financial variables that are believed to capture investors' state of mind. Examples of indirect proxies are fund flows, trading volume, IPO volume–first day return, and closed-end fund discounts (see also Lee et al., 1991; Baker and Wurgler, 2007; Brown et al., 2008).

participants on average use more positive terms when updating their status and unhappy participants on average use more negative terms.

Although many participants on Facebook are young, Facebook is no longer the exclusive domain of young people, and a substantial amount of Facebook users are likely to invest. Appendix A reports the percentage of a nation's population that has a Facebook account. Typically, this percentage is close to 50%, which highlights the high participation rates of Facebook. The average age of Facebook users in recent times is about 31 years (Kramer and Chung, 2011), with more than a quarter of Facebook users being older than 45. It is also important to note that even when investors are underrepresented on Facebook, it is still the case that the underlying factors that make Facebook users optimistic, like their nation's win in the World Cup, are also likely to make the investors in that country more optimistic.

The data from Facebook provide some important advantages. First, the index has been constructed based on text analyses of the status updates of millions of participants, which stands in contrast to the limited sample sizes of household surveys.³ Second, FGNHI represents sentiment on a daily level, which allows us to test contemporaneous relations between sentiment and stock market returns. Third, status updates on Facebook are undirected by any particular question that may be asked in surveys, but are self-descriptive messages.⁴ A fourth benefit of our data is the international coverage. Other sentiment indexes are typically only available for the United States (like the University of Michigan Consumer Sentiment Index) or for a small number of developed markets (the UBS/Gallup Index of Investor Optimism offers monthly sentiment levels for France, Germany, Italy, Spain, and the United Kingdom). We obtain a direct measure of sentiment for twenty countries.⁵

We explore whether Facebook's Gross National Happiness Index is related to stock market returns for the period September 2007–March 2012. Our main hypothesis is that positive sentiment leads to positive biases in returns. This hypothesis follows from the behavioral finance theory of De Long et al. (1990), who predict that noise trader sentiment affects financial markets when noise traders are plentiful and there are limits to arbitrage. Other studies have mostly focused on a related prediction following from De Long et al. (1990), which is that prices will revert to fundamental values in the long term. Most notably, Schmeling (2009) and Baker et al. (2012) show that their measures of investor sentiment are related to negative returns in the future, when any overly optimistic or pessimistic expectation is corrected. Our daily sentiment measure from Facebook allows us to also test behavioral finance's predictions on the contemporaneous relation between sentiment and stock returns.

We find a significant positive relation between sentiment and contemporaneous stock market returns, showing that optimistic (pessimistic) sentiment is related to gains (losses) in the market index. These results hold for different regions, languages, and religions. Moreover, these results are not solely driven by particular days on which Facebook's measure of sentiment reaches extremely high or low levels. In the cross-section, we expect that optimism is especially related to stock returns for stocks that are disproportionately held by noise traders (Lee et al., 1991). Because small firms might have relatively more noise traders as compared to institutional traders, Lemmon and Portniaguina (2006) and Baker and Wurgler (2007) argue that behavioral biases are expected to be mostly present in the stock returns of small firms. We exploit MSCI indexes and confirm that our results are strongest for small firms.

Potentially, the relation between sentiment and stock returns is subject to reverse causality, as good market performance could create positive feelings (Brown and Cliff, 2004). Our data provide substantial research leverage in this regard. As people also update their status in the evening (after the markets close), we expect to find that sentiment on day t affects returns on day $t + 1$. In line with this expectation, we observe that sentiment is related to the next day's market returns. In addition, we exploit the availability of sentiment data on Sundays. Any sentiment observed on Sunday is not likely to be the direct result of market returns on Friday, reducing worries of reversed causality when returns are auto-correlated. We find that sentiment on Sunday is related to market returns on Monday.

To examine causality further, we use models that adjust for lead-lag effects. The results of our analysis with these models again suggest that sentiment affects market returns. Although these results provide new insights into the relation between sentiment and stock returns, it is important to stress that our results on causality have to be interpreted with appropriate caution, as several events might affect both sentiment and stock returns. For example, NASA's successful Mars landing could at the same time increase people's sentiment and increase expected future spending on space programs. Still, we consider it unlikely that these types of events happen frequently enough to drive our results across international markets and in the cross-section.⁶ In addition, we find that controlling for macroeconomic conditions by using the Policy Uncertainty Index (as developed by Baker et al., 2013) does not change our conclusions. Our results are further strengthened as we show that the relation between sentiment and stock returns reverses over the following weeks, indicating a correction to fundamental values.

³ Kramer (2010) reports that, on average, over 40 million status updates are posted on Facebook per day.

⁴ Facebook users write their status updates in a box that contains an open question, which is typically: "How are you feeling?", "How are you doing?", "What's on your mind?", or "How is it going?"

⁵ Using indirect measures of sentiment also allows for an international study. In particular, Baker et al. (2012) construct sentiment indexes within six developed countries, using indicators like volatility premiums, IPO underpricing, and number of IPOs. Schmeling (2009) uses consumer confidence levels within 18 countries as a measure of sentiment.

⁶ We have checked all the status updates of our Facebook friends over January 2013 and observed that less than one percent of the updates relate to an event with potentially important effects on the economy.

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