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Predictability and underreaction in industry-level returns: Evidence from commodity markets

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ABSTRACT

This paper finds significant evidence that commodity log price changes can predict industry-level returns for horizons of up to six trading weeks (30 days). We find that for the 1985–2010 period, 40 out of 49 U.S. industries can be predicted by at least one commodity. Our findings are consistent with Hong and Stein's (1999) "underreaction hypothesis." Unlike prior literature, we pinpoint the length of underreaction by employing daily data. We provide a comprehensive examination of the return linkages among 25 commodities and 49 industries. This provides a more detailed investigation of underreaction and investor inattention hypotheses than most related literature. Finally, we implement data-mining robust methods to assess the statistical significance of industry returns reactions to commodity log price changes, with precious metals (such as gold) featuring most prominently. While our results indicate modest out-of-sample forecast ability, they confirm evidence that commodity data can predict equity returns more than four trading weeks ahead.

1. Introduction

The "underreaction" of participants in one financial market to information originating in other segments of the financial ecosystem has been studied with theoretical and empirical frameworks.[1] Hong and Stein (1999) define underreaction as a delayed reaction by equity market participants to commodity returns (log price changes).[2] We examine the links between commodity and equity markets in this context. Prior literature (such as Driesprong et al. (2008), and Fan and Jahan-Parvar (2012)) generally centers on monthly energy (oil) data. We are primarily interested in *how long* it takes for equity markets to fully incorporate information from fluctuations in commodities.

Our approach has certain benefits compared with previous work. First, by modeling at daily frequency, we can pinpoint the length of underreaction in U.S. industry-level equity returns to information originating in commodity markets while minimizing effects of conflating dynamics at business cycle frequencies. Second, we do not limit emphasis to a single industry but undertake a comprehensive examination by considering a large swath of commodities and industries. Finally, we are one of the first papers to study gradual information diffusion among commodities and industries. We do so using an approach that explicitly accounts for data-mining, which builds upon the key work of Rapach and Wohar (2006) and Herrera et al. (2011). To our knowledge, ours is the first study that documents Hong and Stein's (1999) underreaction hypothesis within the commodity markets.

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[1] See Hong and Stein (1999) and Hong, Torous, and Valkanov (2007) for examples of theoretical and empirical investigations, respectively.
[2] We use "(log) commodity price changes" and "commodity returns" interchangeably.

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The key findings of our paper are the following: First, it often takes a several weeks before commodity price information is fully incorporated into industry returns (i.e. there is an underreaction), second, commodities seemingly unrelated to a sector have strong predictive ability for the returns of that particular sector, third there are strong predictive links between most commodities, considered. These findings have implications for asset allocation decisions and for market makers. For asset allocation they could assist in the timing of asset purchases or sales and suggests that information that is more than two weeks old should be considered. For market makers they potentially provide information which would help them if a fall was predicted to set lower ask prices (or slightly wider spreads) to manage potential losses should a price drop occur. In addition, these results more broadly are inconsistent with the Efficient Market Hypothesis and implicitly mean that prices are not even Markovian let alone based on rational expectations.

A closer look into our results indicates that we find the length of delayed reaction of US industry-level equity returns to information originating in commodity is frequently longer than 20 trading days. We determine that some non-energy commodities can predict industry equity returns. For example, since 1985 precious metals provide more evidence of equity market predictability than energy. We provide evidence using both "underreaction" methods and Granger causality tests and find that market participants react to new information with a non-negligible lag.[3] Our results indicate that information spills over slowly i) within commodity sectors and ii) from precious metals to other commodities. This gradual diffusion of information from commodity to equity markets may be surprising to proponents of the Efficient Market Hypothesis. However, this seemingly surprising observation lends support to Hong and Stein's (1999) theoretical analysis.

The rest of the paper proceeds as follows: in Section 2, we provide the background to the study. Section 3 introduces and discusses the data, while the econometric models used in this study are outlined in Section 4. We present new empirical findings in Section 5. Section 6 concludes.

2. Background

The efficient market hypothesis implies that all relevant information is immediately incorporated into asset prices. Implicitly, this assertion means that market participants can identify relevant information and process it accurately. A growing body of literature questions this notion. Investors may focus on specific sources of information and may also be subject to behavioral biases in information processing and decision making (see, for example, Barberis and Thaler, 2003, and Hirshleifer, 2008 for a review of this literature). Few traders pay attention to all potential sources of information. Many traders specialize in very limited asset classes, certain geographic regions, certain sectors, or even trading styles. At best, they are only boundedly rational (see Shiller, 2000, and Sims, 2003). The rise of high-frequency and algorithmic trading, so far, has not fundamentally altered this fact (see Chaboud et al., 2014). Thus, time and information processing constraints may open an important avenue through which delayed reactions to commodity returns could systematically appear. Our results in this paper are consistent with this conclusion.

Hong and Stein (1999) and Hirshleifer and Teoh (2003) develop theoretical models to explain asset price behavior under conditions of limited information.[4] Importantly, these theoretical models demonstrate that if there are information frictions, then asset returns can respond with a delay. Hong and Stein (1999) develop a dynamic model of a single asset in which information gradually diffuses across the investing public and investors are unable to extract information from prices. In this model, the price reacts gradually to new information (underreacts) and over time information becomes fully incorporated into stock price, leading to return predictability. Hirshleifer and Teoh (2003) suggest an alternative model where investors may not fully react to information due to limited attention and processing power. In particular, data from which it is more difficult to extract the appropriate price response is more likely to be neglected. Consequently, indirect information about an asset is less likely to be quickly incorporated into prices than direct information.

Driesprong et al. (2008), Kilian and Park (2009), Gogineni (2010) and Fan and Jahan-Parvar (2012) examine oil prices and their impact on index and industry level returns.[5] Huang et al. (1996) conjecture that information originating from a commodity market, in their case the oil futures market, may either influence the future cash flows of a company or an industry, or it may affect the discount rate.[6]

It is possible that commodity prices could have both a direct and an indirect impact upon industry stock returns. A direct impact could result, for example, if an industry uses the commodity as an input or produces the commodity as an output. Some commodities will only have an indirect link to industry returns. It is harder to rule out the indirect impact of any commodity's price movements on industry returns. First, commodity prices could be correlated with business cycle conditions and thus contain information that could impact expected future returns (see e.g. Fama and French, 1988). Gorton and Rouwenhorst (2006) find commodity index returns depend on phase of expansion / recession. Jacobsen et al. (2010) find that the correlation between industrial metals and equity

[3] Studies that investigate the incorporation of macroeconomic data into equity prices such as Schwert (1981) and Pearce and Roley (1985) imply that these data are impounded into asset prices within one trading week (five trading days).

[4] Merton (1987) also develops a static model in which investors have information about a limited number of stocks and only trade those that they have information about. As a result, less recognized stocks have a smaller investor base (neglected stocks) and trade at a greater discount because of limited risk-sharing.

[5] Kilian and Park (2009) suggest that the response depends on whether the origin is from supply or demand shocks. They argue that the major channel is shocks to aggregate demand, rather than through aggregate supply. Lee and Ni (2002) also investigate this issue. They find that the major effects of oil price shocks are on the demand side, unless the industry is highly oil-intensive (such as industrial chemicals) where supply side dominates.

[6] Huang et al. (1996) use daily data, as we do in this paper, but their study is focused on the impact of price changes in crude oil futures contracts, and they do not address the underreaction question. In contrast, we are concerned with spot prices for commodities and their information content.