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Quantification of the high level of endogeneity and of structural regime shifts in commodity markets[☆]

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We propose a “reflexivity” index that quantifies the relative importance of short-term endogeneity for several commodity futures markets (corn, oil, soybean, sugar, and wheat) and a benchmark equity futures market (E-mini S&P 500), from mid-2000s to October 2012. Our reflexivity index is defined as the average ratio of the number of price moves that are due to endogenous interactions to the total number of all price changes, which also include exogenous events. It is obtained by calibrating the Hawkes self-excited conditional Poisson model on time series of price changes. The Hawkes model accounts simultaneously for the co-existence and interplay between the exogenous impact of news and the endogenous mechanism by which past price changes may influence future price changes. Our robustness tests show that our index provides a ‘pure’ measure of endogeneity that is independent of the rate of activity, order size, volume or volatility. We find an overall increase of the reflexivity index since the mid-2000s to October 2012, which implies that at least 60–70 percent of commodity price changes are now due to self-generated

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activities rather than novel information, compared to 20–30 percent earlier. While our reflexivity index is defined on short-time windows (10–30 min) and thus does not capture long-term memory, we discover striking coincidence between its dynamics and that of the price hikes and abrupt falls that developed since 2006 and culminated in early 2009.

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1. Introduction

The increasing importance of non-traditional participants on commodity futures markets over the last decade — referred to as the “financialization” of commodity futures markets (Domanski and Heath, 2007) — coincided with another major structural change in trading: the transition from an open outcry trading platform to a computer/electronic order matching platform. These two structural changes resulted, at the very least, in the following developments. First, market access expanded. Second, direct trading costs declined. Third, investments tracking a commodity index became an accepted alternative investment for institutions and pension funds. Fourth, exchange traded funds and synthetic investment vehicles that tracked or are based on commodity indices or even single futures markets were introduced. As a result, these changes undoubtedly contributed to the increase in the volume of trade on commodity futures markets (Irwin and Sanders, 2012).

Arguably, the growing liquidity emanating partly from the financialization of commodity markets, coupled with a shift in trading strategies and technological progresses, has favored the expansion of quantitative trading on commodity futures markets. In parallel, many commodity prices have experienced roller-coaster rides since the mid-2000s. Overall, these developments have fueled an intense debate regarding the roles of financial investors and quantitative trading. Disagreements relate to whether these new actors have improved the price discovery process of commodities futures markets or whether they have made the process less effective and more unstable.

The proponents of these developments argue that the benefits are at least threefold. First, futures prices become closer to their underlying fundamentals. Second, liquidity increases. Third, risks are transferred to agents who are better prepared to assume it (see e.g. Stoll and Whaley (2010, 2011); Irwin and Sanders (2012) and references cited therein). In short, this process supports the efficient market hypothesis (EMH) (Samuelson, 1965; Fama, 1970, 1991). By contrast, other observers argue that financial investors and quantitative trading can have negative effects on commodity markets because they distort the price formation process (see e.g. UNCTAD (2009, 2011); Tang and Xiong (2010); Bicchetti and Maystre (2012) and references cited therein). In some occasions, these prices distortions culminated in “speculative bubbles”¹ in commodity prices (see e.g. Gilbert (2007); Phillips and Yu (2011) and references cited therein).

To contribute to this debate, we analyze the microstructure of several commodity futures markets at short time scales and provide quantitative dynamic estimates of their degree of reflexivity. More precisely, we present a measure of the “reflexivity” or endogeneity of high-frequency price movements, defined as the average ratio of the number of price moves that are due to endogenous interactions to the total number of all price changes, which also include exogenous events. Robustness tests show that our measure of endogeneity is independent of the rate of activity, order size, volume or volatility. We calibrate our measure on several commodity futures markets (corn, oil, soybean, sugar, and wheat) and also on a benchmark equity futures market (E-mini S&P 500). The obtained reflexivity index shows that at least 60–70 percent of commodity price changes are now due to self-generated activities rather than novel information, compared to 20–30 percent in the mid-2000s.

¹ According to the CFTC, a “speculative bubble” refers to “a rapid run-up in prices caused by excessive buying that is unrelated to any of the basic, underlying factors affecting the supply or demand for a commodity”. See http://www.cftc.gov/ConsumerProtection/EducationCenter/CFTCGlossary/glossary_s

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