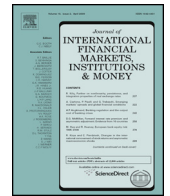


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Arbitrage opportunities and feedback trading in emissions and energy markets[☆]

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ABSTRACT

This paper extends Sentana and Wadhvani (SW 1992) model to study the presence of feedback trading in emissions and energy markets and the extent to which such behaviour is linked to the level of arbitrage opportunities. Applying our augmented models to the carbon emission and major energy markets in Europe, we find evidence of feedback trading in coal and electricity markets, but not in carbon market where the institutional investors dominate. This finding is consistent with the notion that institutional investors are less susceptible to pursuing feedback-style investment strategies. In further analysis, our results show that the intensity of feedback trading is significantly related to the level of arbitrage opportunities, and that the significance of such relationship depends on the market regimes.

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1. Introduction

Economists have long debated the impact of feedback traders on equilibrium market prices, especially after the dramatic rises and falls of stock markets in recent years.¹ Some argue that their existence is destabilising, causing inefficiency and instability in asset prices (Black, 1986).² However, it has also been recognised that the presence of trend-following investors can be beneficial as they provide market participants with liquidity (De Long et al., 1990). Numerous papers have been devoted to the study of feedback trading activities in global markets. The literature has focused primarily on positive feedback strategy whereby investors buy (sell) when prices rise (fall), i.e., chasing the trend. Evidence of this type of behaviour is found in both individual and institutional investors (Nofsinger and Sias, 1999) and also in a wide variety of markets; see, for example, Sentana and Wadhvani (1992) for evidence of feedback trading in the U.S. stock market, Antoniou et al. (2005) for the G-7

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¹ A positive (negative) feedback trader follows a simple trading rule of buying (selling) after a price rise and selling (buying) after a price fall, i.e., trend-following strategies.

² It should be noted that feedback trading need not be irrational or noise trading in the sense of Black (1986). It is consistent with, for example, portfolio insurance strategies and stop-loss orders. Nonetheless, as Shleifer (2000) points out, the interaction of feedback traders and rational investors could lead to price movements that are not warranted by their fundamental values.

stock markets, [Laopodis \(2005\)](#) for foreign exchange markets, [Salm and Schuppli \(2010\)](#) for index futures markets, and [Chau et al. \(2011\)](#) for exchange-traded fund (ETF) markets. When it comes to commodity markets, however, there is no clearly identified evidence of the feedback trading, despite the increasing use of commodities as an investment tool by the fund industry.³

In recent years, with the historically low interest rates and meltdowns of financial markets, many institutional investors and portfolio managers have turned to commodity markets as a way of meeting their investment objectives and, to a lesser extent, as a means of controlling risk.⁴ [The World Bank \(2012, p. 70\)](#) estimates that “*Investment fund activity in commodities is currently at 330 US\$ billion (as of 2012:Q1). . . 9 times higher than a decade ago, when this activity started becoming a popular investment vehicle within the financial community.*” Despite the growing popularity of commodity markets in strategic asset allocation, scarce evidence exists in the extant literature on the trading behaviour of commodity investors, and in particular we can identify a little research examining the presence of feedback (trend-following) behaviour in these important markets.⁵ This is somewhat surprising given the nature and design of commodity futures markets (i.e., the low cost of trading, absence of short-sales constraints, and high leverage opportunity) can appeal to several feedback-style investment strategies such as portfolio insurance, short selling, and margin trading.⁶

Previous empirical investigations have generally assumed the behaviour of feedback traders is, *ceteris paribus*, invariant to the level of arbitrage opportunities in financial markets. However, it is widely recognised that arbitrage activities and rational speculation are among the most significant factors contributing to feedback trading ([Cutler et al., 1990](#); [De Long et al., 1990](#)) and there is growing evidence that the arbitrage opportunities – as measured by the spot-futures basis or convenience yield – have a predictive value in future price variations ([Khoury and Yourougou, 1991](#); [Knetsch, 2007](#); [Gorton et al., 2013](#)), it seems overly restrictive to assume that the behaviour of feedback traders is unaffected by the level of arbitrage opportunities.

Against this backdrop, we seek to examine in this paper the presence of feedback trading in commodity markets and the extent to which such behaviour is linked to the level of arbitrage opportunities using a daily dataset of four major energy markets in Europe (coal, electricity, natural gas and crude oil) and the more recently launched carbon emission market. The carbon emission market was opened in 2005 to reduce the emission of greenhouse gases. The market is built on a “cap-and-trade” system launched by the European Union whereby only firms in certain industries can receive free allocation of carbon assets and individuals cannot claim carbon assets from emission reduction. As a result, almost all the participants in carbon markets are identified as institutional investors.⁷ This provides us with a unique opportunity of investigating the relation between institutional investors and feedback trading. In addition, the carbon market price was generally trending downward with periods of high volatility and illiquidity. This allows us to test the hypothesis that feedback traders may be responsible, at least in part, for the declining prices. [Antoniou et al. \(2005, p. 230\)](#) finds that “*positive feedback trading is more acute at high levels of volatility,*” confirming the view that feedback traders had a destabilising influence on market prices. Similar findings are reported by [Dean and Faff \(2008\)](#) for the Australian bond and equity markets.⁸

More specifically, building on [Sentana and Wadhvani \(1992, hereafter SW\)](#) feedback trading model, we aim to address the following questions:

- Is feedback trading significant in commodity markets? Particularly, whether the investors (mostly institutions) in carbon emissions market engage in feedback-style activities?
- Whether and to what extent arbitrage opportunities affect the intensity of feedback trading?
- Does the relation between arbitrage opportunities and feedback trading vary across market regimes?

The empirical evidence gathered in this paper has a broad appeal to those who have invested (or considering investing) in commodities, and bears practical significance for portfolio managers and commodity traders relying on trend-chasing investment strategies. Our results are also of direct relevance to regulators and policymakers in formulating effective policies

³ A notable exception is the recent work of [Cifarelli and Paladino \(2010\)](#) who finds evidence of feedback trading in the crude oil market. However, as [Koutmos \(2012\)](#) argues, the use of low frequency data such as the weekly data employed by [Cifarelli and Paladino \(2010\)](#) is inadequate to study the short-run feedback trading activity.

⁴ Indeed, the potential risk-diversification benefits of investing in commodity markets should offer broad appeal across investor types, see [Bodie and Rosansky \(1980\)](#) and [Baker and Filbeck \(2013\)](#).

⁵ The majority of previous studies investigate the benefits of including commodities as a separate asset class ([Campbell et al., 2003](#)), the trends in commodity price forecasting ([Gerlow et al., 1993](#)), and the profitability of technical trading rules such as momentum and contrarian strategies ([Wang and Yu, 2004](#); [Miffre and Rallis, 2007](#); [Marshall et al., 2008](#)). In contrast, empirical evidence concerning the presence of feedback trading in commodity markets is limited.

⁶ For instance, [Cutler et al. \(1990\)](#) argues that margin call-induced selling after a series of negative returns is one of the main reasons for positive feedback trading. Therefore, it is not uncommon to observe the margin call-motivated feedback trading activities in commodity futures markets.

⁷ According to the European Union Emission Trading Scheme Transaction Log published in November, 2012, less than 6% of total accounts are personal holding accounts (2050 out of a total of 34,492 accounts), suggesting that the vast majority of participants in the European carbon markets are institutional investors.

⁸ Furthermore, given that it is still a relatively new market (opened in 2005), it is natural to expect that the carbon market may attract noise traders in general and positive feedback ‘trend-chasing’ traders in particular. [Bohl and Siklos \(2008, p. 1380\)](#), for example, finds that “*there is evidence of more pronounced positive feedback trading strategies in emerging markets relative to mature ones.*”

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