Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER Journal of Economic Dynamics & Control 29 (2005) 1577–1596
JOURNAL OF Economic Dynamics & Control
www.elsevier.com/locate/econbase

Commodity markets, price limiters and speculative price dynamics

Xue-Zhong He[a], Frank H. Westerhoff[b,*]

[a]*School of Finance and Economics, University of Technology, Sydney, Australia*
[b]*Department of Economics, University of Osnabrueck, Rolandstrasse 8, D-49069 Osnabrueck, Germany*

Received 18 December 2003; accepted 16 September 2004

Abstract

We develop a behavioral commodity market model with consumers, producers and heterogeneous speculators to characterize the nature of commodity price fluctuations and to explore the effectiveness of price stabilization schemes. Within our model, we analyze how nonlinear interactions between market participants can create either bull or bear markets, or irregular price fluctuations between bull and bear markets through a (global) homoclinic bifurcation. Both the imposition of a bottoming price level (to support producers) or a topping price level (to protect consumers) can eliminate such homoclinic bifurcations and hence reduce market price volatility. However, simple policy rules, such as price limiters, may have unexpected consequences in a complex environment: a minimum price level decreases the average price while a maximum price limit increases the average price. In addition, price limiters influence the price dynamics in an intricate way and may cause volatility clustering.

JEL classification: D84; G18; Q11

Keywords: Commodity markets; Price stabilization; Simple limiters; Technical and fundamental analysis; Bifurcation analysis; Chaos control

*Corresponding author. Tel.: +49 0 541 969 2743; fax: +49 0 541 969 12742.
E-mail address: fwesterho@oec.uni-osnabrueck.de (F.H. Westerhoff).

0165-1889/$ - see front matter
doi:10.1016/j.jedc.2004.09.003

1. Introduction

Commodity prices are, by any standard, extremely volatile. After inspecting 13 primary commodities over the period 1900–1987 (deflated annual data), Deaton and Laroque (1992) found price variation coefficients, defined as the standard deviation over the mean, ranging from 0.17 (bananas) to 0.60 (sugar). In addition, one often observes dramatic boom and bust episodes. For instance, the decline in prices from the highest level reached in the period from 1974 to August 1975 was 67 percent for sugar, 58 percent for sisal, more than 40 percent for cotton and rubber, and more than 25 percent for cocoa and jute (Newbery and Stiglitz, 1981). In a recent study, Osborne (2003) reported that in Ethiopia the price of maize has more than doubled three times over the last 15 years.

Not only many developing countries, but also the United States and the European Union, have thus experimented with some form of commodity price stabilization scheme in the past. In particular, attempts have been made to stabilize agricultural commodity markets by means of a commodity buffer stock scheme. The idea of such schemes is to put a certain amount of output into storage in years in which there is a good harvest, thus increasing the price from what it would have been, and to sell output from the storage in years in which there is a small harvest, thus reducing the price from what it would have been. Another prominent example is the oil market. Following the oil crises in the 1970s, many countries built up huge oil reserves in order to influence the market.

Demand and supply schedules, storage and fully rational speculators are the key elements in neo-classical commodity market models (Waugh, 1944; Brennan, 1958; Williams and Wright, 1991; Deaton and Laroque, 1992, 1996; Chambers and Bailey, 1996; Osborne, 2003). While these models undoubtedly capture some important aspects of commodity markets, their ability to mimic features such as bubbles and crashes is, however, limited. Supporters of these models – in which the markets are efficient by nature – judge commodity price stabilization schemes as unlikely to have a significant beneficial effect (Newbery and Stiglitz, 1981).

Contrary to the efficient market hypothesis, however, there is not only widespread populist feeling that speculators are a major cause of price instability, but also theoretical papers have started to explore this aspect. The chartist–fundamentalist approach, developed in the last decade, offers a new and promising alternative behavioral perspective of financial market dynamics. The main feature of this approach is that interactions between heterogeneous agents, so-called chartists and fundamentalists, may generate an endogenous nonlinear law of motion of asset prices. In Day and Huang (1990), Chiarella (1992) and Farmer and Joshi (2002), the nonlinearity originates from nonlinear technical and fundamental trading rules whereas in Kirman (1991), Brock and Hommes (1998) and Lux and Marchesi (2000), the nonlinearity is caused by the agents switching between a given set of predictors. More recent refinements and applications include Chiarella and He (2001), Chiarella et al. (2002) and Westerhoff (2003). Since these models have demonstrated their ability to match the stylized facts of financial markets quite well one may conclude that this framework is suitable to conduct some policy evaluation experiments.