



Examining the effectiveness of price limits in an artificial stock market

Chia-Hsuan Yeh*, Chun-Yi Yang

Department of Information Management, Yuan Ze University, Chungli, Taoyuan 320, Taiwan

ARTICLE INFO

Article history:

Received 27 December 2007

Accepted 28 April 2010

Available online 27 May 2010

JEL classification:

D83

D84

G11

G12

Keywords:

Price limits

Artificial stock market

Agent-based modeling

Genetic programming

ABSTRACT

This paper proposes an agent-based framework to examine the effectiveness of price limits in an artificial stock market. The market is composed of many boundedly rational and heterogeneous traders whose learning behavior is represented by a genetic programming algorithm. We calibrate the model to replicate several stylized facts observed in real financial markets. Based on this environment, the impacts of price limits are analyzed from the perspectives of volatility, price distortion, volume, and welfare. We find that the imposition of price limits possesses both positive and negative effects. However, compared with the market without price limits, appropriate price limits help to reduce volatility and price distortion, and increase the liquidity and welfare.

© 2010 Elsevier B.V. All rights reserved.

1. Introduction

The efficient market hypothesis (EMH) (Fama, 1970) is one of the cornerstones of financial economics. Basically, the EMH requires that, on average, traders behave rationally and have rational expectations. It asserts that asset prices fully reflect all available information and always reflect their intrinsic value. In this situation, future price movements cannot be predicted on the basis of past information. Any financial regulation imposed on the market should generate no substantial effects but may result in delayed revelation of the information. Examining the efficiency of real financial markets has thus been an interesting topic over the past three decades. Many studies have questioned the validity of the EMH in real financial markets and provide the theoretical foundations or empirical evidence to show the existence of market inefficiency. De Long et al. (1991) point out that noise traders may survive in the long run and exert their impact on price dynamics. Kogan et al. (2006) further indicate that irrational traders can persistently maintain a large impact even though their relative wealth becomes quite small. Lo and MacKinlay (1988), Campbell and Shiller (1988), Brock et al. (1992), and Neely et al. (1997) all find evidence of predictability and profitability in financial markets. In addition, financial markets usually experience high volatility, and bubbles and crashes never cease. This phenomenon cannot be purely explained by the changes in fundamentals. The question that naturally arises is whether there exist ways to effectively regulate financial markets.

* Corresponding author. Tel.: +886 3 4638800x2616; fax: +886 3 4352077.

E-mail addresses: yeh.chiahsuan@gmail.com, imcyeh@saturn.yzu.edu.tw (C.-H. Yeh), ckhyde.yang@gmail.com (C.-Y. Yang).

URL: <http://comp-int.mis.yzu.edu.tw/faculty/yeh/> (C.-H. Yeh).

The financial market crashes that took place in 1987 gave rise to much debate regarding how to prevent the markets from experiencing such large fluctuations. Recommendations that circuit breakers such as price limits and trading halts be implemented were some of the outcomes. Price limits and trading halts work in different ways. They differ in that trading is only permissible within the pre-specified daily price variation range in the former case, while the latter results in the suspension of the trading process once the asset prices reach the pre-specified boundaries. After some pre-determined time duration, the market is reopened and new boundaries of prices are provided.

The main purpose behind imposing price limits is to reduce price volatility by repressing excessive speculation and mob psychology. The rationale for supporting price limits is referred to as the overreaction hypothesis. Proponents assert that traders are prone to overreacting to new information, so that asset prices may deviate from their fundamental values. The empirical evidence from cognitive psychology also supports this argument, e.g. [Tversky and Kahneman \(1974\)](#). It is believed that price limits may provide a cooling-off period for traders to reassess the intrinsic asset value. Volatility is then reduced. The empirical results obtained in [Ma et al. \(1989\)](#) and [Lee and Kim \(1995\)](#) are consistent with the overreaction hypothesis. By contrast, opponents of price limits who support the information hypothesis, e.g. [Fama \(1989\)](#), [Chen \(1998\)](#), and [Kim and Rhee \(1997\)](#), argue that traders in financial markets are able to process information efficiently. The imposition of price limits may generate negative effects such as delayed price discovery, volatility spillover, and trading interference. Although many papers have focused on examining the effectiveness of price limits,¹ a consensus in terms of opinion has so far not been reached.

From a theoretical point of view, the results may present different pictures based on different assumptions or frameworks ([Brennan, 1986](#); [Kodres and O'Brien, 1994](#); [Chowdhry and Nanda, 1998](#); [Chou et al., 2000](#)). In addition, such debates mainly result from the different assumptions regarding rationality that the researchers adopt to characterize market traders. People who advocate the imposition of price limits presume that traders are generally irrational in the sense that they use wrong beliefs. However, this contention overlooks the fact that traders, even though they are irrational, may adapt to and learn how to react to the market environment. As time goes by, they may behave rationally in that they perceive the fundamental values of the asset, and the negative impacts of the imposition of price limits then emerges. By contrast, those who disagree with the usefulness of price limits assume that traders are rational. Being completely rational means either that traders inherently perceive the intrinsic values of the asset, or that traders have tremendous computational abilities that make them correctly respond to any change in market conditions. However, such reasoning has been questioned by many empirical results. [Simon \(1957\)](#) and [Tversky and Kahneman \(1974\)](#) argue that humans do not behave rationally.

Examining the effectiveness of price limits based on empirical data also poses great difficulties. First, it may suffer from econometric ([Chou, 1997](#)) or data-acquisition problems. Second, the rationality at the top, i.e. from the perspective of market phenomena, is not necessarily consistent with that at the bottom, i.e. traders' rationality. [Gode and Sunder \(1993\)](#) find that the market's rationality could result from the individuals' irrationality. Third, empirically discriminating between the information hypothesis and the overreaction hypothesis would be problematic, when neither understanding what had been on the traders' minds nor being able to predict what would have happened had the price limits not been imposed. Actually, a similar concept has been mentioned in [Harris \(1998\)](#):

Without mind-reading techniques and without reliable methods for reconstructing a false history, one cannot reliably discriminate between the two perspectives. (p. 34)

To resolve these problems, a simulated financial market composed of many interacting, heterogeneous, and boundedly rational traders whose learning behavior is appropriately represented, together with an environment without exogenous shocks, seems to be a more reasonable framework. In such a framework, the interaction between the traders themselves and that between traders and market regulations could be well examined. Moreover, a pure environment which can serve as the objective benchmark is obtainable, so that we would be able to answer how the market would behave if current rules on price limits faced a different situation.

The studies on financial markets based on the heterogeneous agent model (HAM) have grown quite rapidly in the past decade since traditional arguments regarding traders' rationality have been challenged. [Simon \(1957\)](#) argues that bounded rationality is a more acceptable concept for describing a human's behavior. Besides, financial data usually exhibit several stylized facts such as volatility clustering and fat tails for the return series, as well as volume persistence of which the causes cannot be well-explained by traditional asset pricing models. [Kirman \(2006\)](#) points out that heterogeneity is an essential part of the evolutionary system, and heterogeneous and varying expectations may account for many of the stylized facts. Many heterogeneous agent models have been proposed to generate rich and complicated market dynamics, and they successfully mimic the stylized facts observed in financial markets and provide explanations regarding some of these phenomena.²

The advantages of heterogeneous agent models of financial markets are addressed in [Hommes \(2006\)](#) and [LeBaron \(2006\)](#), who also provide an extensive review of this research area. [Hommes \(2006\)](#) pays more attention to the simple,

¹ A more detailed survey regarding the effectiveness of circuit breakers can be found in [Kim and Yang \(2004\)](#).

² Studies such as [Day and Huang \(1990\)](#), [Kirman \(1991\)](#), [Chiarella \(1992\)](#), [Lux \(1995, 1997, 1998\)](#), [Arthur et al. \(1997\)](#), [Brock and Hommes \(1998\)](#), [LeBaron et al. \(1999\)](#), [LeBaron \(2000, 2001\)](#), [Hommes \(2001\)](#), [Chiarella and He \(2001, 2002, 2003\)](#), and [Chiarella et al. \(2002, 2006\)](#) are examples.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات