



On possible origins of trends in financial market price changes



Ryo Murakami^a, Tomomichi Nakamura^{a,*}, Shin Kimura^a, Masashi Manabe^b,
Toshihiro Tanizawa^c

^a Graduate School of Simulation Studies, University of Hyogo, 7-1-28 Minatojima-minamimachi, Chuo-ku, Kobe, Hyogo 650-0047, Japan

^b Faculty of Business Innovation, Kaetsu University, 2-8-4 Minami-cho, Hanakoganei, Kodaira-shi, Tokyo 187-8578, Japan

^c Kochi National College of Technology, 200-1 Monobe-Otsu, Nankoku, Kochi 783-8508, Japan

HIGHLIGHTS

- We investigate possible origins of trends using a deterministic threshold model.
- The work is done from the viewpoint of dealers' expectation for the price.
- Monotonic trends can be generated by dealers' minuscule changes in mood.
- A variety of trends spontaneously emerge when incomplete information about deals is obtained.

ARTICLE INFO

Article history:

Received 12 June 2014

Received in revised form 3 October 2014

Available online 8 November 2014

Keywords:

Price change

Irregular fluctuations

Trends

ABSTRACT

We investigate possible origins of the trends in financial markets, where trend we refer to as is a relatively long-term fluctuation observed in price change (price movement), using a simple deterministic threshold model that contains no external driving force term to generate trends forcibly. We find that the trend can be generated by this simple model without any external driving force. Furthermore, from thorough numerical simulations, we obtain two following results: (i) a trend of monotonic increase or decrease can be generated only by dealers' minuscule price updates for the next deal trying to follow an expected forthcoming direction of price change, (ii) non-monotonic trends spontaneously emerge when dealers cannot obtain accurate information about the number of dealers participating in the next deal. We conclude from these results that the emergence of trends is not necessarily generated by an external driving force but by a natural outcome of the accumulation of minuscule price updates of individual dealers with insufficient information about the next deal.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Many phenomena in human society are dominated by human choices. Buying and selling is one of them, and we regard financial markets as an aggregation of dealers' choices and their interactions. A major indicator in a financial market is its price change (price movement). Generally speaking, price change in financial markets fluctuates irregularly, as shown in Fig. 1. However, the mechanism of the fluctuations has not been elucidated yet, and the question still remains to be challenging. There are two major approaches to tackle the question. One is to investigate features or nature of the data generated

* Corresponding author.

E-mail addresses: tomo@sim.u-hyogo.ac.jp (T. Nakamura), tanizawa@ee.kochi-ct.ac.jp (T. Tanizawa).

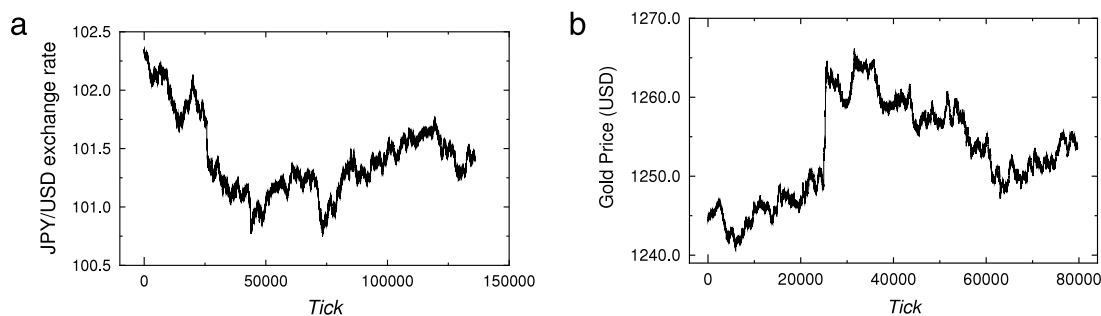


Fig. 1. Examples of price changes in financial markets showing short-term variabilities and trends: (a) Tick data of Japanese Yen/US dollar (JPY/USD) exchange rate and (b) tick data of gold price at New York Mercantile Exchange (NYMEX) futures. Both the data are taken for 48 h from twelve midnight on 3 February 2014 to twelve midnight on 4 February 2014. The data can be obtained from <http://ratedata.gaincapital.com/>.

by a dynamical system from the viewpoint of statistics [1–3], and the other is to construct an artificial market using a model and investigate events in the market [4–11]. The merit of the former approach is that it provides us with various knowledge and insights for the understandings of the nature of price changes. However, this approach is restrictive, because it does not always lead us to a deeper understanding of the mechanism of price changes produced by the interaction between dealers' choices and various market price properties [10]. In contrast, the latter approach significantly contributes to clarifying the mechanism. As the purpose of this paper is to find possible origins¹ of relatively long-term fluctuations generally observed in financial market price changes, which we refer to as “trends”, we follow the latter approach (we will describe the details of our definition of trends later).

Some models, which are categorized as the dealer model, have been proposed [4,5,11]. The dealer model is an agent-based model and constructs an artificial market. The first dealer model was introduced by Takayasu et al. in 1992 [4]. They considered that a market is composed of many dealers and buying and selling are interactions among them with discontinuous (nonlinear) and irreversible processes. To implement this mechanism they introduced a numerical model of financial market prices using threshold dynamics [4]. In the model a deterministic dynamics is assumed for an assembly of agents describing mutual trades by threshold dynamics including discontinuous irreversible interactions. After this pioneering work, numerous studies have been done (for example, see Refs. [5–11]), aiming for improvement and refinement to be able to reproduce basic empirical laws such as the power-law distribution of price changes, slow decay of auto-correlation of volatility, and so on. For the details see Ref. [11].

In this paper, we observe afresh the behaviours of financial market data carefully. As mentioned above, price changes in financial markets show irregular fluctuations (see Fig. 1). These irregular fluctuations are usually divided into two main features, short-term variabilities and “trends”.

However, we would like to emphasize that this separation seems to be done rather arbitrary by simple visual inspection. A trend we recognize is a general or rough direction of continuous movement such as upward, downward or sideways during an arbitrary “long” period of observation compared to the unit time length for taking time series data of price change. If we take a longer observational time, a trend in a certain period might be considered as a mere fluctuation around another large trend in the longer period of time (see Fig. 2). Whether a movement in price change is recognized as a short-term fluctuation or a trend is, therefore, a matter of observational time scale and the separation is rather arbitrary. This is our definition for trends and we recognize trends by this definition.

It should also be noted that there seems to be a vague consensus that trends are driven by some external factors such as economical fundamentals and that short-term variabilities are fluctuations around these trends due to stochastic nature of individual deals. Hence, existing models seem to have been built or improved based on this consensus dealing with these two fluctuations (short-term variabilities and trends) separately. A possible origin for the short-term variabilities has already been indicated by Takayasu et al. [4]. Despite numerous work after the work, curious to say, discussions on the origin of trends do not seem to be lively, although market participants are used to pay more attention to the trend rather than the details of the short-term variabilities to gain information of the overall movement of markets.

One of the major underlying reasons seems to be that the existence of the trends is taken to be granted as those driven by some external factors, such as economical fundamentals (for example, the gross domestic product (GDP) varying according to policy interest rate, remarks by senior administration officials or central bankers, and so on) and technical analyses of economists. On the other hand, it is well known that the trends can also be observed without any remarkable news about important economic index changes to be released. Hence, it brings up a following simple question on the origin of trends: if it were not for these external factors, do trends completely disappear? We focus our attention mainly on this point.

The key idea for the present work is the following. Generally speaking, to understand a certain phenomenon we need the information about its structure, mechanism, situation, condition and so on. However, it is usually impossible to obtain the entire information. Although this fact seems to be trivial, we will show that trends can emerge indeed only from this

¹ We use the term, “origin”, as the cause and source of existence.

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