Stock Price and Market Maker Inventory Dynamics with Heterogeneous Beliefs

Carl Chiarella†, Xue-Zhong He† and Mei Zhu‡

School of Finance and Economics, University of Technology, Sydney †

School of Mathematical Sciences, Peking University‡

carl.chiarella@uts.edu.au, tony.he1@uts.edu.au, meizhu66@gmail.com

Abstract

This paper develops a dynamic asset price and market inventory model that incorporates two types of agents, the fundamentalists and trend followers, and the market maker who is both a liquidity trader and an investor by actively managing the market inventory. We examine the joint effect of the market participants on the market price and inventory. We find that the stability of the fundamental equilibrium depends mainly on the activities of the fundamentalists and trend followers, whereas the stabilizing role played by the market maker in terms of the inventory management is a secondary effect. Lower extrapolation from the trend followers and speed of the price adjustment from the fundamentalists lead to a stable market. The stabilizing roles played by the market maker in terms of the inventory management are opposite for the fundamentalists and trend followers. When the fundamentalists (trend followers) are less (more) active, the market is stabilized when the speed of the market maker's inventory adjustment is neither too low nor too high, but when the fundamentalists (trend followers) become more (less) active, the market is stabilized as the speed of the market maker's inventory adjustment increases. Strong activity of either the fundamentalists or the trend followers destabilizes the market and balanced activities between them are necessary to maintain the stability of the fundamental equilibrium. Numerical analysis of a stochastic version of the model shows that it is able to replicate some of the stylized facts in asset returns (such as high kurtosis, fat tails, volatility clustering, and insignificant autocorrelations in returns but significant in the absolute returns and the squared returns) and statistical patterns in inventory holdings (including the fact that inventories are negatively correlated with contemporary returns and past returns, but positively correlated with future returns, and positive decaying autocorrelations in inventories) that have been observed in empirical studies of financial markets.

Keywords: Heterogeneous beliefs; Market maker; Inventory