Estimating the Cost of Liquidity in Livestock Futures Markets using the Information Contained in the Limit Order Book

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Agricultural commodity futures trading has shifted over the past decade from the open outcry pit to the electronic platform.

A major difference between trading systems is the presence of the limit order book (LOB) in the electronic system, which contains both bid and ask prices and their corresponding volumes at different levels.

Market microstructure research in agricultural commodity markets has been limited to the study of the best bid and best ask prices in the open outcry pit. However, commodity traders may be interested in ask and bid prices and volumes beyond these best levels. For example, a trader submitting a large order may incur higher transaction costs if their order is not fully executed at the best prices due to insufficient volume at this level and if subsequent prices are far from the best quotes.

Current research on limit order books concentrates trading in Canadian futures exchanges, making the Chicago Mercantile Exchange (CME) 0-skip livestock futures the most commonly used.

Knowledge of the behavior of the cost of liquidity is vital to market participants in devising marketing strategies aiming at managing their liquidity risk.

Objective:

Investigate the information contained in the slope of the order book. The slope summarizes the depth dimension of liquidity and has been little explored in agricultural commodity.

Examine the impact of liquidity shocks on the observed best prices and on the slope of the book, focusing on the speed at which they recover after the shock.

Data:

We use the Market Depth dataset from the Chicago Mercantile Exchange (CME) containing all market data messages required to recreate the book for five cattle December futures traded electronically between July and November 2012 (66 trading days). The recorded LOB is 5-levels deep.

A trading period from 9 a.m. to 5:30 p.m. was analyzed for each trading day, with a snapshot of the LOB constructed at every 30 minute interval (16 intervals/day). Each variable had a total of 1,056 observations.

Background:

Daily volume of live cattle contracts traded electronically and in the pit, 2007 - 2012

Data (contd.):

Data represent the impulse responses to a one standard deviation increase in the corresponding shock variable.

Methods:

Dynamic behavior of spreads and depths at bid beyond the best bid limits and their interrelationship are investigated using vector autoregression (VAR) models and impulse response framework (Kensky 2009).

In the VAR specification, all endogenous variables are modeled as a system, where the evolution of each variable is explained by its own lags and the lag of all the other variables in the model. The impulse response functions show the behavior of each variable when shocks of other variables enter into the system (Lütkepohl 2005).

Model 1: Limit Order Book Slopes

Using the methodology utilized by Watts (2008), the average elasticity (slope) for the best bid prices at the ask side of the market is computed as follows:

Model 2: Prizes and Depths in the Limit Order Book

Although limit order books offer the advantages of a concave model, it is however not possible to distinguish dynamic elasticities from static prices or depths. Therefore, we develop a second model allowing for this as well as accounting for both the differences between subsequent prices at bid and ask sides and depths, and specify the vector of endogenous variables in model 2 as:

Conclusions:

A relation exists between the best limits and liquidity beyond in the limit order book. If liquidity at the best limits declines, so does liquidity in the book.

Some measures of liquidity co-move. If the inside spread on one side of the book increases after a shock, the spread at the best prices and inside spread on the opposite side of the market also increase.

A shock is not limited to the side of the market at which it occurs. A shock that increased liquidity at the bid side was seen to also decrease liquidity on the ask side.

References:

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