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Venue: Virtual Conference

Coherent Preferences and Asset Prices in Stock Market

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Highlights

- We study intraday individual coherent preferences underlying asset prices in stock market where there is price momentum and reversal in interaction;
- We propose a set of explicit models for nonlinear V-shaped price pressure utility while market dynamics equilibrium exists;
- Using a new mathematical method from a price-volume probability wave differential equation.

Introduction (1)

- Asset prices include two parts:
 - The market equilibrium price
 - formulated by price pressure from supply-demand quantity
 - complex and hard to predict
 - The fundamental value price or rational asset price
 - determined with reference to macroeconomic variables pertaining to the trading asset
 - may be figured out in terms of its future dividends in accounting (Shiller 1981)

Introduction (2)

- Previously, Ben-David and Hirshleifer (2012) propose a simple V-shaped value function in stock market, based on the actually nonlinear utility in empirical results (see Figure 1);
- We assume that individual coherent preferences generate nonlinear price pressure utility and market dynamic equilibrium in stock market;
- Coherent preferences specify individual consistent choices by those traders who adapt themselves to buy and sell, keep constant interactive trading between momentum trading and reversal trading across all prices, and generate market dynamic equilibrium (Shi et al., 2020).

Introduction (3)

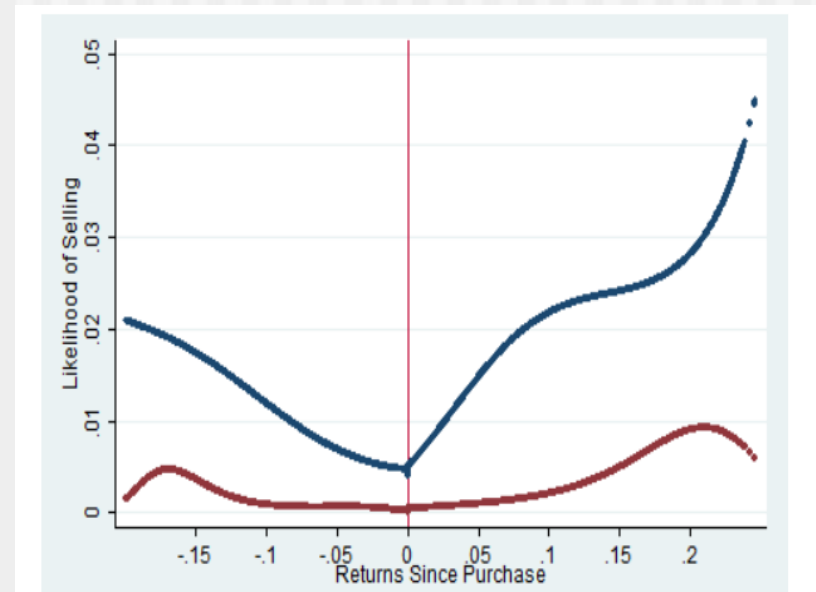
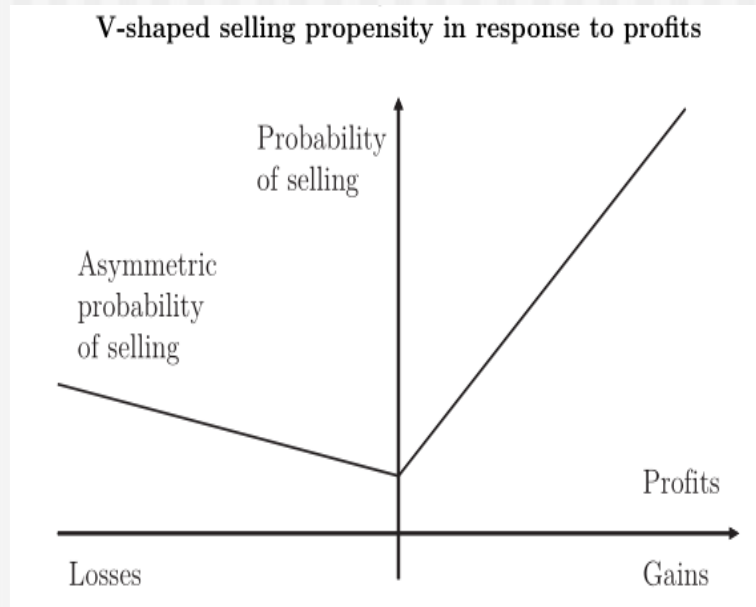


Fig. 1
Left: A simple V-shaped value function;
Right: Actually nonlinear V-shaped price pressure utility.
(Ben-David and Hirshleifer, 2012)

Problem Solving (1)

■ **A Coherent Preferences Hypothesis**

- Subject individuals behave coherent preferences and generate a nonlinear market dynamic equilibrium as long as intraday cumulative trading volume distribution exhibits a significant degree of coherence in the framework of a price-volume probability wave differential equation.
- It follows a set of the absolute of zero-order Bessel eigenfunctions (see Figure 2).

Problem Solving (2)

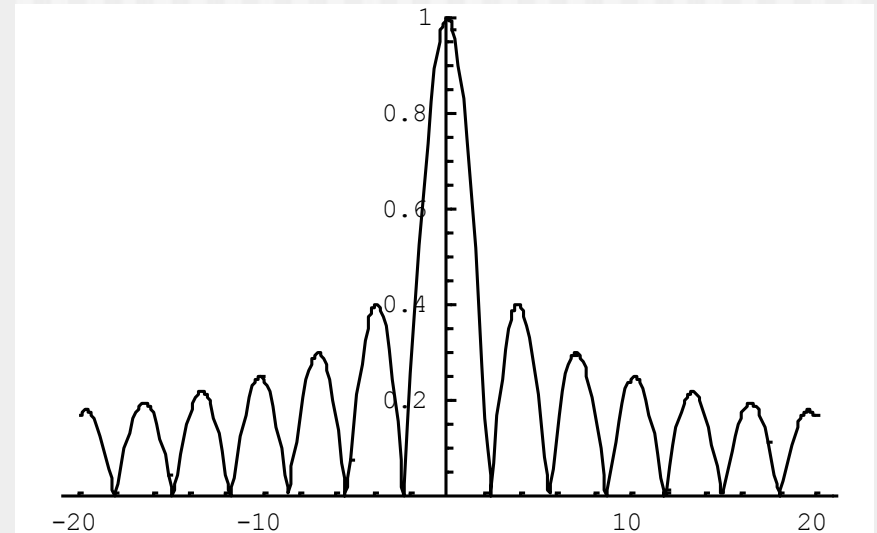
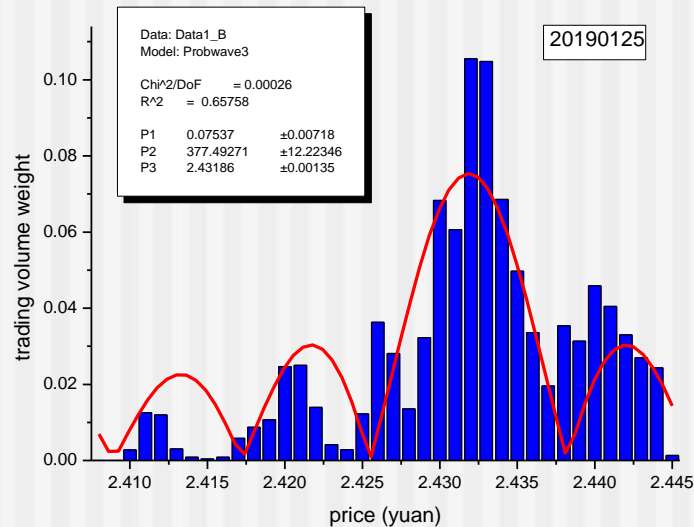


Fig. 2.

Left: Intraday cumulative trading volume distribution over a price range;
Right: A set of explicit models (Bessel family models)

Problem Solving (3)

Table 1: Empirical test for coherent preferences

	No. of Distributions	Percentage (%)
Total Number of Distributions	34	100
One Price Reference Point in Trading	32	94.12
A Price Reference Point Jump (Two Price Reference Points)	1	2.94
No Maximum Volume Prices in Independent Trading	1	2.94

Data sources: Tick by tick high frequency trading data in Huaxia SSE 50ETF (510050) in Chinese stock market from January 3 to February 28, 2019

Problem Solving (4)

The explicit models in Fig. 2 come from the equation (1)

$$\frac{B^2}{V} \left(p \frac{d^2 \psi}{dp^2} + \frac{d\psi}{dp} \right) + [E - W(p)]\psi = 0, \quad (1)$$

which satisfies individual trading utility function as

$$-E + p \frac{v_t^2}{V} + W(p - p_o) = 0 \quad (2)$$

and

$$W(p) = A_m (p - p_o) \quad (3)$$

where $W(p)$ is a price pressure utility.

Problem Solving (5)

The price pressure utility is expressed by

$$W_m(p) = A_m(p - p_0) = U - p \frac{v_t^2}{V} \quad (4)$$

or
$$W_m(p) \sim 1 - |J_0[\omega_m(p - p_0)]| \quad (5)$$

subject to

$$\omega_m^2 = v_{tt,m} - A_m = \frac{v}{V} v_{tt,m} = \text{constant}, \quad (6)$$

where $J_0[\omega_m(p - p_0)]$ is zero-order Bessel function; A is a variable rather than a constant (see Fig. 3).

Problem Solving (6)

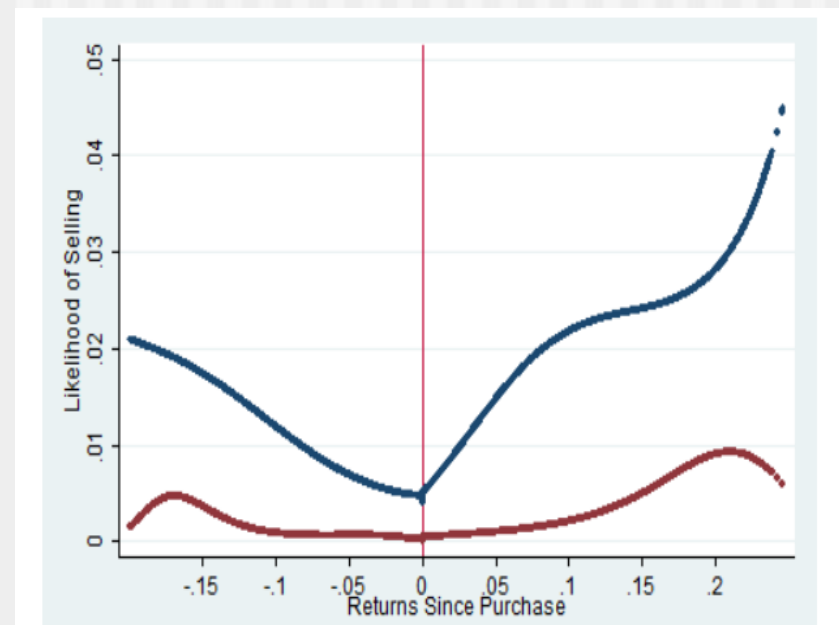
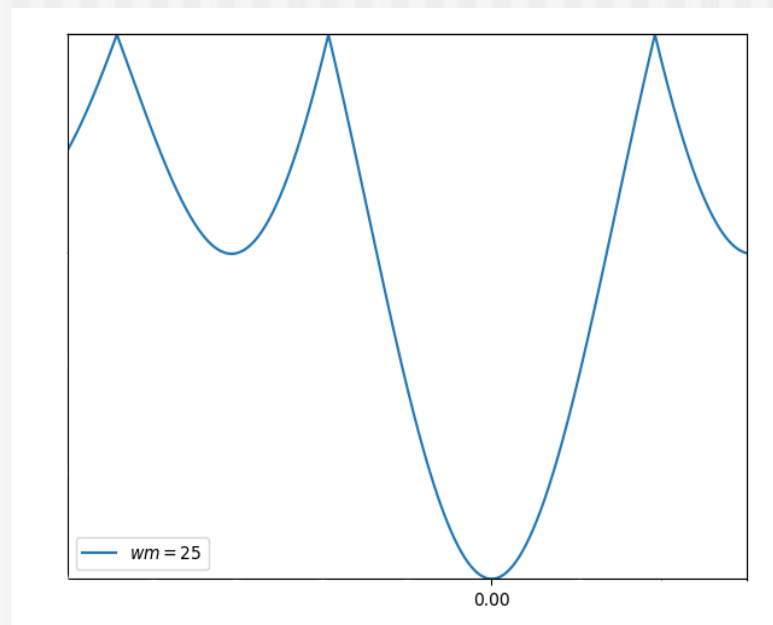


Fig. 3.

Left: An asymmetrical nonlinear V-shaped price pressure utility function;
Right: Empirical test results (Ben-David and Hirshleifer, 2012)

Conclusions

- Coherent preferences exist widely, and generate nonlinear V-shaped price pressure utility and market dynamic equilibrium in stock market, whereas beliefs contribute to discrepancy between market equilibrium price and fundamental price;
- Individual traders would be independent and homogeneous if there were a V-shaped value function. It is not true in the real world!
- Our explicit models predict the nonlinear V-shaped price pressure utility detected in prior empiric tests (Ben-David and Hirshleifer, 2012; An, 2016)
- They demonstrate Shi's price-volume probability wave differential equation validity to a certain extent (Shi, 2006).

Thank You !

Comments are welcome

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