



Incompleteness and Order: The Natural Laws of Financial Markets

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Abstract

Incompleteness of the field of real numbers implies uncertainty and volatility. The price space in the financial market is incomplete. Therefore, the price changes in the financial market tend to be correlated, meaning they are not random walks or martingale processes. This also implies that financial markets tend to be in an orderly state.

Keywords: real numbers; incompleteness; correlation; random walk; order; symmetry

1. Introduction

The financial market is directly reflected in the time and space of prices. The foundation of space lies in the real number line. This paper attempts to explore the natural laws of financial markets through the field of real numbers.

2. Incompleteness of the Field of Real Numbers Implies Uncertainty and Volatility

A number field is complete if every Cauchy sequence in the field converges to an element of the field.

The open interval $(0,1)$ and the field of real numbers are both incomplete [1], which implies that the endpoints outside these sets are undecidable within these sets. For example, the function $y = 1$ defined on the real number line and the function $y = 1$ on the interval $(0,1)$ and $y = 0$ outside the interval $(0,1)$ are two different functions. However, since they both satisfy $y = 1$ on the interval $(0,1)$, from the perspective of the interval $(0,1)$, whether $y = 1$ intersects with the endpoints 0 and 1 is undecidable.

Undecidability implies uncertainty. When this undecidable element is assumed to be true, it is one state of the system, and when this undecidable element is assumed to be false, it is another state of the system. When the system transitions between these two states, it also forms the fluctuation of the whole system.

Therefore, the incompleteness of the field of real numbers implies uncertainty and volatility.

3. Incompleteness and Order: The Natural Laws of Financial Markets

The price space in the financial market is located on the real number line and has no upper limit. Therefore, the price space in the financial market is incomplete. Consequently, the price movement in the financial market is uncertain. In the world of probability, zero correlation is a zero-probability event, which is almost impossible. Therefore, probabilistic events tend to be correlated, which means that the price changes in the financial market tend to be correlated, meaning they are not random walks or martingale processes. This also implies that financial markets tend to be in an orderly state. Of course, the micro-individuals, that is, the participants in financial markets, exhibit symmetry breaking [2].

Therefore, incompleteness and order are the natural laws of financial markets.

References

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