

BELIEFS-PREFERENCES GAUGE SYMMETRY AND DYNAMIC REPLICATION OF CONTINGENT CLAIMS IN A GENERAL MARKET ENVIRONMENT

Valery A. Kholodnyi

Research Group
TXU Energy Trading
1717 Main Street
Dallas, TX 75201
U.S.A.

Abstract. Although symmetries play a major role in physics, their use in finance is relatively new and, to the best of our knowledge, can be traced to 1995 when the author introduced the beliefs-preferences gauge symmetry. One of the main outcomes of the beliefs-preferences gauge symmetry is that it allows for the beliefs-preferences-independent valuation and dynamic replication of contingent claims in a general market environment, that is, in the case of a general, not necessarily diffusion Markov process for the prices of underlying securities. This valuation and dynamic replication is based on the novel ideas of symmetry in contrast to the standard approach which uses stochastic analysis. The practical applications of the beliefs-preferences gauge symmetry range from the detection of a new type of true arbitrage to the beliefs-preferences-independent valuation and dynamic replication of contingent claims in a general market environment.

Keywords. Beliefs-preferences gauge symmetry group, noncommutativity and randomness in finance, Lie algebra of portfolio operators, general market environment, dynamic replication.

AMS (MOS) subject classification: 91B28, 81T13, 22E60, 47D06, 60H99.

1 Introduction

Although symmetries play a major role in physics, their use in finance is relatively new and, to the best of our knowledge, can be traced to 1995 when the author introduced the beliefs-preferences gauge symmetry (see [5]).

The beliefs-preferences gauge symmetry establishes a fundamental symmetry between beliefs and preferences of market participants in a general market environment, that is, in the case of a general, not necessarily diffusion Markov process for the prices of underlying securities.

One of the main outcomes of the beliefs-preferences gauge symmetry is that it allows for the beliefs-preferences-independent valuation and dynamic replication of contingent claims in a general market environment. This valuation and dynamic replication is based on the novel ideas of symmetry in