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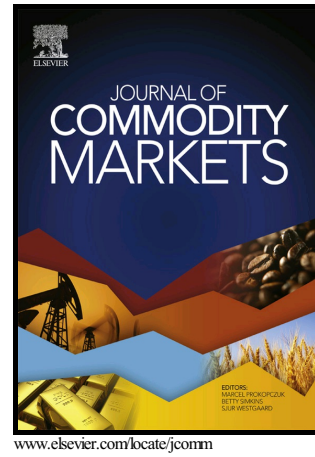
An Equilibrium Model for the OTC Derivatives Market with a Collateral Agreement

Kazuhiro Takino

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Abstract

In this study, we consider an over-the-counter (OTC) derivatives market model with counterparty risk and collateral agreement. We verify the effects of collateral agreement on derivative transactions using an equilibrium analysis. Options and forward markets are considered in this study. Options and forward markets correspond to the unilateral and bilateral counterparty risk cases, respectively. We derive the demand and supply functions for both derivative contracts using agent utility maximizations. These lead to the equilibrium prices and volumes for the contracts and enable us to observe the influence of a collateral agreement. We consider a general commodity derivatives market in the numerical implementation. Our numerical results verify how the market equilibriums for derivatives change when the collateral amount changes through shifts in demand and supply.

1 Introduction

In this study, we propose a framework in which to analyse an over-the-counter (OTC) derivatives market with counterparty risk and a collateral agreement. Counterparty risk is one of the default risks in derivative contracts, representing the risk that an agent fails to honour her/his payment for a contract. Brigo and Masetti (2005) and Sorensen and Bollier (1994) assessed the derivative prices incorporated in counterparty risk. As argued by Brockett et al. (2005) and Johannes and Sundaresan (2007), counterparty risk in a weather derivatives market attracted attention from market participants after the Enron bankruptcy. Additionally, since the financial crisis in 2008, the counterparty risks of various derivative contracts have concerned many practitioners and researchers. There are several ways to hedge counterparty risk, for example, using a credit charge (called a credit valuation adjustment: CVA), posting (cash) collateral, and transferring OTC transactions to the central clearing counterparty (CCP) (c.f., Gregory 2010). Many financial institutions manage counterparty risks using these schemes. In addition, the G20 in September 2013 decided to impose collateral agreements in interest rate swap contracts.