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Modeling the bid/ask spread: measuring the inventory-holding premium ☆

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Abstract

The need to understand and measure the determinants of market maker bid/ask spreads is crucial in evaluating the merits of competing market structures and the fairness of market maker rents. This study develops a simple, parsimonious model for the market maker's spread that accounts for the effects of price discreteness induced by minimum tick size, order-processing costs, inventory-holding costs, adverse selection, and competition. The inventory-holding and adverse selection cost components of spread are modeled as an option with a stochastic time to expiration. This inventory-holding premium embedded in the spread represents compensation for the price risk borne by the market maker while the security is held in inventory. The premium is partitioned in such a way that the inventory-holding and adverse selection cost components, as well as the probability of an informed trade, are identified. The model is tested empirically using Nasdaq stocks in three distinct minimum tick size regimes and is shown to perform well both in an absolute sense and relative to competing specifications.
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1. Introduction

Understanding the determinants of the market maker's bid/ask spread is important for a variety of reasons. From an exchange's standpoint, it provides guidance on market design. Should the exchange assign a single specialist to be responsible for making a market, or should it encourage competition among a number of willing market makers? It also provides guidance on setting an optimal minimum tick size. In a competitive market, the tick size can provide market makers with a means of recovering their fixed costs of operation. From a regulator's standpoint, the bid/ask spread provides a means of identifying the fairness of the rents being extracted by market makers. Are market makers extracting abnormally high rents for their services, or are the rents fair considering the market maker's costs of operation?

Prior research has made substantial progress toward understanding the determinants of the bid/ask spread. Initial work, including studies by Demsetz (1968), Tinic (1972), Tinic and West (1972, 1974), Benston and Hagerman (1974), and Branch and Freed (1977), focuses on empirically determining which variables can capture cross-sectional variation in spreads. Stoll (1978b) develops a theoretical model for spreads in order to impose structure on the problem, and provides a useful categorization of the costs of supplying liquidity. Harris (1994) shows that a market's tick size can affect the estimated relation between the bid/ask spread and its determinants. While these studies all have made significant contributions to the understanding of the bid/ask spread, an important unresolved issue is the functional form of the relation between spread and its explanatory variables.

The purpose of this paper is to develop and test a new model of the market maker's bid/ask spread. The model is simple, parsimonious, and well grounded from a theoretical perspective. It incorporates the effects of price discreteness induced by the minimum tick size, order-processing costs, inventory-holding costs, adverse selection costs, and competition. The inventory-holding and adverse selection cost components of spread are modeled as an option with a stochastic time to expiration. This inventory-holding premium embedded in the spread represents compensation for price risk borne by the market maker while the security is held in inventory, independent of whether the trade was with an informed or an uninformed trader. Moreover, the premium can be partitioned in such a way that the inventory-holding and adverse selection cost components can be identified and estimated. Indeed, the model is rich enough to identify the probability of an informed trade. The model is tested using three separate months of Nasdaq common stock data corresponding to three different tick size regimes (eighths in March 1996, sixteenths in April 1998, and decimal pricing in December 2001) and is strongly supported empirically.

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