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Asymmetric option price distribution and bid–ask quotes: consequences for implied volatility smiles[☆]

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Abstract

This study presents a model for estimating the asymmetry of option values with respect to option bid–ask spreads. The model does not require knowledge of the actual option value to evaluate the asymmetry. Using data from the Swedish equity options market, several interesting results emerge. First, there is evidence of asymmetry in call and put values, where values are closer to bid than to ask quotes. Second, in- and out-of-the-money calls and puts show a higher degree of asymmetry than at-the-money options. Third, taking asymmetry into account in the estimation of option-implied volatility, produces a less pronounced volatility smile.

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1. Introduction

Most of the market microstructure models developed to explain the presence of bid–ask spreads are designed primarily for stock markets, but should of course be relevant for options markets as well. Inventory models (see [Stoll, 1978](#); [Amihud and Mendelson, 1980, 1982](#); [Ho and Stoll, 1981](#)) motivate the spread as compensation for market makers for bearing the risk of holding undesired inventory. In asymmetric information models (see [Copeland and Galai, 1983](#); [Glosten and Milgrom, 1985](#); [Easley and O’Hara, 1987](#); [Foster and Viswanathan, 1994](#)), market makers have an informational disadvantage and have to quote spreads wide enough to compensate for losses from trading with informed traders. For options markets, [Cho and Engle \(1999\)](#) proposed a derivative hedge theory, according to which option bid–ask spreads are related to the liquidity, measured as spreads, of the underlying market. If options markets makers are able to perfectly hedge their option positions in the underlying market, they will not be exposed to inventory risk or informed trading in the options markets itself. Instead, option bid–ask spreads will arise from the illiquidity of the underlying market, and the width of option spreads will reflect the presence of informed trading in the underlying market.

At financial markets, asset bid–ask spreads are, to various degrees, readily observable—whereas, the corresponding actual asset values are not. In addition, the bid–ask spread is not necessarily symmetrically positioned around the value of the asset. In fact, several reasons for asymmetry can be found in the market microstructure literature. For instance, in the inventory models, a market maker changes the bid–ask spread relative the asset value in order to attract orders that would even out the inventory position of the market maker. Hence, if the market maker faces an excess of buy (sell) orders, the ask (bid) commission will be in excess of the bid (ask) commission, i.e. the asset value will be relatively closer to the bid (ask) quote. [Bossaerts and Hillion \(1991\)](#) show that in foreign exchange markets, possible government intervention gives rise to skewness in the future spot exchange rate distribution. Hence, bid–ask quotes at the currency forward market are not symmetric around the forward prices (values). Furthermore, [Bessembinder \(1994\)](#) reports that in foreign exchange markets, location of bid–ask quotes relative asset value is sensitive to dealer inventory-control variables. Another reason for asymmetry, given by [Anshuman and Kalay \(1998\)](#) with reference to the stock market, is discreteness of quotes.

[Chan and Chung \(1999\)](#) argue that there might be asymmetry in equity option quotes even though the underlying stock quotes are symmetric around stock values. Since option payoffs are asymmetric by nature, the adverse selection costs for an options markets maker are likely to be larger for buy orders than for sell orders. Hence, since market makers are relatively more vulnerable to incoming buy orders than to sell orders, they would have a tendency to position the bid–ask spread so that the option value is closer to the bid than to the ask quote. [Chan and Chung \(1999\)](#) find empirical evidence in favour of this idea; bid and ask quotes of CBOE equity options have a tendency to be asymmetric around the option values, and

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