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Spread determinants and the day-of-the-week effect

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ABSTRACT

In this paper, we examine the determinants of the dollar bid–ask spread for each day of the week over the period 1998–2008. Using a panel cointegration approach, we estimate the determinants of the spread in both the short-run and long-run. Our main findings suggest that: (1) there are day-of-the-week effects for certain groups of firms; (2) the panel error correction model also reveals day-of-the-week effects, and the speed of adjustment to equilibrium following a shock is faster on Fridays; and (3) the effects of volume and volatility on the spread are mixed, with only some sectors experiencing the day-of-the-week effect.

1. Introduction

There is a large body of literature on the determinants of bid–ask spreads. This branch of research has originated from the initial work of Demsetz (1968). The more recent contributions on the determinants of spreads are by Wei and Zheng (2010), and Brockman and Chung (2003). The main determinants of spreads considered by these studies are volume, share price, and share price volatility. These variables and their impact on spreads are crucial for traders, speculators, hedgers, and arbitrageurs since they use information from those variables to predict prices. Similarly, policymakers and regulators have an interest in the behavior of spreads and their determinants in order to understand how changes in the variables influence market activity, which also has implications for market regulations (see Wang & Yau, 2000).

The empirical literature has provided a consensus that volume has a negative effect on spreads; however, theoretical models differ on the expected relationship between volume and spreads. While Copeland and Galai (1983) show that volume has a negative effect on spreads, models proposed by Brock and Kleidon (1992) and Easley and O'Hara (1992) reveal a positive relationship. Moreover, Johnson (2008) shows that volume and spreads are weakly correlated. Similarly, the early literature has documented that volatility has a positive effect on spreads, consistent with the work of Tinic and West (1972). However, Chordia, Roll, and Subrahmanyam (2001) challenge these findings and reveal a negative effect of volatility on spreads. On the role of price, the literature has found mixed evidence; the positive relationship is consistent with the work of Demsetz (1968), while the negative effect is consistent with the work of McInish and Wood (1992).

The goal of this paper is to examine the determinants of the dollar bid–ask spread for 734 firms listed on the New York Stock Exchange (NYSE) using time series and panel data regression models over the period 1 January 1998–31 December 2008. Our study is different from the extant literature in three distinct ways. The novelty of our work can be summarized as follows.

First, in this study, we examine the determinants of spreads for every day of the week for each of the 734 firms. Our main motivation for estimating the determinants of spreads on each of the five trading days of the week stems from the calendar anomalies literature, which has shown that stock markets behave differently on different days of the week (see, *inter alia*, French, 1980). This stock market behavior has been termed the day-of-the-week effect. Therefore, if stock markets are characterized by a day-of-the-week effect one could expect bid–ask spreads to, at least theoretically, have a similar characterization. The expectation that bid–ask spreads should mimic stock returns emanates from the vast literature which has demonstrated the co-movement, and indeed the existence, of an empirical relationship between returns and bid–ask spreads. Amihud and Mendelson (1986), for instance, show that asset returns increase with bid–ask spreads. This relationship exists, they argue, because rational investors select assets

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to maximize their expected returns net of trading costs and, in equilibrium, higher-spread assets are allocated to investors with longer holding periods.

In addition, we also introduce the day-of-the-week effect on the determinants of spreads because a related branch of the literature has considered calendar anomalies by modeling bid–ask spreads. Bhardwaj and Brooks (1992), for instance, consider the January anomaly. Drawing on Ritter's (1988) finding that for small firm stocks there is selling pressure in December and buying pressure in January, they argue that small firm stocks have large turn-of-the-year bid–ask bias. It follows that if bid–ask spreads, like stock returns, are characterized by day-of-the-week effects then it is possible that factors, such as share price, share price volatility, and trading volume, will have different effects on bid–ask spreads on different days of the week. Should this be the case, the determinants of spreads will then be contingent on the day-of-the-week. To-date, the possibility of the existence of this type of behavior of spreads has not been tested on the stock markets.

Second, the literature is generally based on cross-sectional studies of the determinants of spreads. Lee, Mucklow, and Ready (1993) and Chordia et al. (2001), however, consider time series models of the determinants of spreads. They show that results obtained from time series models, at least with respect to the effects of volume and volatility on spreads, are different compared to cross-sectional models. Equally significantly, there are no studies of the determinants of spreads based on panel data. The use of a panel data model with a significant time component obviously allows one to extract information over time and across cross-sections. In our case, since we use time series data over the period 1998–2008 and employ a large number of firms, it allows us to capture the dynamic effects of price, volatility and volume on spreads. If spreads, price, volatility, and volume are panel non-stationary individually and share a cointegration (long-run) relationship when modeled together as a system, it allows us to extract not only the short-run effects of price, volatility, and volume on spreads but also the long-run effects. This is an important consideration when it comes to forecasting spreads. A common approach to forecasting spreads is to use a vector autoregressive (VAR) model (see Taylor, 2002). However, if spreads are cointegrated, one can forecast spreads using a vector error correction model (VECM), which is a relatively rich specification compared to a VAR model (see Engle & Yoo, 1987). More precisely, the richness of the data set allows us to apply panel unit root and panel cointegration techniques to estimate the determinants of spreads. As a result, we estimate both the short-run and long-run determinants of spreads on the NYSE. This modeling approach, because it allows us to capture the dynamic relationship between spreads and their determinants within an error correction framework, also allows us to estimate the speed of adjustment to equilibrium following a shock.

Third, we form sector-specific panels and apply panel unit root and panel cointegration modeling techniques to determine the effects of price, volatility, and volume on spreads. This approach of panel characterization based on sectors ensures that we have relatively more homogeneous panels. A common feature of cross-sectional models is cross-sectional dependence. This needs to be addressed. We use a formal statistical approach, namely, bootstrapped critical values, to deal with the problem of cross-sectional dependence. Moreover, panel data specification where stocks are simply categorized into sectors makes them relatively more homogeneous, thereby reducing the degree of cross-sectional dependence.

Against this background, we organize the rest of the paper as follows. In the next section, we explain the empirical model and theoretical motivation. In Section 3, we discuss the data and present the results. In the final section, we conclude with our key findings.

2. Empirical model and theoretical motivation

Drawing on the literature, as alluded to earlier, our focus is on the three core determinants of spreads, namely, share price, share price volatility, and trading volume. Given this, our panel data model takes the following form:

$$S_{i,t} = \alpha_0 + \alpha_1 P_{i,t} + \alpha_2 V_{i,t} + \alpha_3 PV_{i,t} + \varepsilon_{i,t} \quad (1)$$

Here, S is the dollar bid–ask spread, P is the share price, V is trading volume, and PV is price volatility. We use the measure of price volatility suggested by Garman and Klass (1980), which is computed as:

$$PV = 0.5[\ln(HP) - \ln(LP)]^2 - [2\ln 2 - 1][\ln(CP) - \ln(OP)]^2 \quad (2)$$

Here, HP, LP, CP, and OP represent high price, low price, closing price, and opening price, respectively.

Theory predicts that price can have either a positive or a negative effect on spreads. The idea was first explained by Demsetz (1968), who argued in favor of a positive relationship. His main argument was that spreads should increase in proportion to an increase in the price. This occurs in order to equalize the cost of transacting per dollar exchanged. By comparison, the work of McInish and Wood (1992) and Stoll (1978) suggests a negative relationship between price and spreads. McInish and Wood (1992), for instance, argue that the negative association is a result of economies of scale in trading.

There is no consensus on the relationship between trading volume and spreads, however, and the arguments are still evolving, beginning with Copeland and Galai (1983) and including Johnson (2008). Theoretically, it is argued that the impact of volume on spreads could be either negative (Benston & Hagerman, 1974; Copeland & Galai, 1983), positive (Lee et al., 1993), or have no effect (Johnson, 2008). Benston and Hagerman (1974) and Copeland and Galai (1983) argue that volume has a negative effect on spreads. However, there are two contrasting views on this negative relationship. The Copeland and Galai argument is based on the probability of information available to the next trader. Essentially, if the probability is higher for thinly traded stocks and if transaction size is constant, a negative effect of volume on spreads will result. On the other hand, the Benston and Hagerman argument is based on the inventory theory, and has roots in the idea that dealers hold fewer inventories per transaction, so spreads will be inversely related to volume.

However, contradicting this theoretically motivated negative relationship between volume and spreads, Brock and Kleidon (1992) argue that volume and spreads are positively correlated because of the increased liquidity demand at the open and close. Therefore, they show that spreads are U-shaped during the day. Moreover, Easley and O'Hara (1992) propose a model that shows that higher volume increases the market maker's belief that an information event has occurred; hence, volume has a positive relationship with spreads. In contrast to the proposed positive and negative relationships between volume and spreads, Johnson (2008) argues that volume is only weakly correlated with spreads.

Finally, on the relationship between volatility and spreads, again, theoretically there is no consensus. Tinic and West (1972) argue that volatility increases spreads because increasing price volatility will induce greater risk associated with the performance of dealership functions. Moreover, in support of a negative relationship between spreads and volatility, Chordia et al. (2001, p. 519) note: "It appears that sluggish trading following recent volatility allows dealers to reduce inventory imbalances, which then prompts them to reduce spreads". Actually, Tinic and West (1972) do recognize the ambiguity of this relationship, and conclude their