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An analysis of firm and market volatility

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ABSTRACT

In this paper, using time series data for the period 2 January 1998 to 31 December 2008 for 560 firms listed on the NYSE, we examine whether firm volatility is related to market volatility. The main contribution of this paper is that we develop an analytical framework motivating the firm-market volatility relationship. We present three new findings on volatility. First, we discover significant evidence of common volatility; for 12 out of 14 sectors, market volatility has a statistically significant effect on firm volatility for at least 50 percent of firms. Second, we discover significant evidence of size effects: for small-sized firms, there is weak evidence of commonality in volatility, while for large-sized firms there is high evidence (for as much as 75 percent of firms) of commonality in volatility. Third, we find that market volatility predicts firm volatility for firms belonging to five of the 14 sectors.

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1. Introduction

1.1. Background

Financial market volatility is undoubtedly one of the most intensively researched topics in financial economics. One strand of studies that considers the determinants of individual stock volatility has had a lasting impact on the discipline; for influential studies, see Harris (1989), Damodaran and Lim (1991), Neal (1988), and Nabar and Park (1988). Neal (1988) reports different volatilities for the S&P 500 index compared to the small firm index. Detemple and Jorion (1988) and Nabar and Park (1988) find that individual stock daily volatilities decrease after the introduction of equity options.

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There are important reasons as to why it is important to understand individual stock volatility. Essentially, there are some stylized facts about firm volatility which motivate an analysis of its behavior. First, Shleifer and Vishny (1997) argue that some stocks with high idiosyncratic variance may be mispriced, thus earning lower expected returns. Second, Campbell et al. (1997) explain that firm-level volatility in event studies is important in that the statistical significance of abnormal event-related returns is contingent on the individual stock volatility relative to the market or industry. Third, many investors hold significant individual stocks. For these investors, as argued by Campbell et al. (2001), changes in industry-level and idiosyncratic volatility matter as much as changes in market volatility. Fourth, firm-level risk also arises naturally from models of incomplete markets (see Constantinides and Duffie, 1996), where investors cannot perfectly diversify their risks; as a result, firm-level risk matters for asset pricing. A similar argument is made by Merton (1987): firms with higher volatility require higher average returns to compensate investors for holding imperfectly diversified portfolios (for a good discussion, see Arena et al., 2008). And because many investors hold poorly diversified portfolios, they might demand a premium on idiosyncratic risk, in addition to the market risk and liquidity risk premiums.

Generally, studies on individual stock volatilities are scarce compared to those on market volatilities. Damodaran and Lim (1991) examine volatility changes for a sample of 200 firms (listed on the Chicago Board of Options Exchange and the American Stock Exchange) immediately preceding and following the option listing dates. They find that during this period, volatility declines. Campbell et al. (2001) consider whether individual stocks have become more volatile. Using data for over 8000 stocks listed on the NYSE, AMEX, and NASDAQ, they find that firm-level volatility has increased relative to the market over the period July 1962 to December 1997. Harris (1989) compares volatilities of S&P 500 stocks by allowing for cross-sectional differences in firm attributes and finds no significant difference in volatility over the period 1975–1983.

Our study is different from the aforementioned studies in that we are concerned about whether or not market volatility has any impact on firm volatility. We consider the relationship between firm volatility and market volatility for 560 US firms listed on the NYSE. Our data is daily and spans the period 2 January 1998 to 31 December 2008.

1.2. Motivation

Our motivation for examining the relationship between firm volatility and market volatility is the literature that has documented that aggregate market volatility has been stable in recent times while the volatility of firms has increased (see Comin and Mulani, 2006; Campbell et al., 2001; Xu and Malkiel, 2003).

In Fig. 1, we plot the average of firm and market volatilities for the 560 firms over the period 2 January 1998 to 31 December 2008. The volatility is calculated based on Eq. (9) – see Section 3.1. Over this recent period, in contrast to the literature, we find that the behavior of firm and market volatilities is different. Some key features of these volatilities are as follows: (1) firm volatility has been consistently higher than market volatility; (2) over the period 1998–2001, while market volatility declined, firm volatility has been relatively stable; (3) around 2001, a sharp fall in both firm and market volatilities was noticed; and (4) from 2003 to 2007, both market and firm volatilities were fairly stable, but started increasing following the global financial crisis.

We also estimate the yearly correlation and covariance between firm volatility and market volatility. We notice that the correlation increased from 0.72 in 1998 to 0.93 in 2001, and has been fairly stable over the period 2002–2008, when correlation on average was around 0.95. However, we notice that the covariance of firm volatility and market volatility has risen sharply, from 0.03 in 2001 to 0.98 in 2008 (see Fig. 2). These features of the data imply that while over the 1998–2001 period volatilities behaved differently, in the post-2001 period, firm and market volatilities have co-moved. It is this co-movement which is of interest in this paper. We therefore search for any evidence of commonality in volatility.

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