

WHAT CAN WE LEARN FROM A CROSS-SECTION OF RETURNS?

AN INVESTIGATION OF IDIOSYNCRATIC VOLATILITY RANGE

Serguey Khovansky, Clark University*

Oleksandr Zhylyevskyy, Iowa State University

Detailed Abstract

In this paper, we investigate empirical properties of idiosyncratic volatility using cross-sections of stock returns in the standard framework of geometric Brownian motion price dynamics. Knowledge of the sign and magnitude of idiosyncratic volatility characteristics may help us better understand the role of idiosyncratic risk in asset pricing. This knowledge may also help practitioners devise innovative investment strategies to exploit profitable investment opportunities that have not been eliminated because of transaction costs, investment indivisibilities, incomplete information, or the presence of other non-diversifiable factors and market rigidities (see Ang et al., 2009).

This study includes a thorough econometric analysis that applies a novel generalized method of moments estimation strategy to a financial market setting in which individual stock return observations are affected by a common market shock in addition to idiosyncratic shocks. The common shock component of the model represents a priced, systematic risk factor. We refer to the new estimation method as “GMM CS.” Data requirements to estimate the financial market model by GMM CS comprise only a realization of a market index return and a cross-section of individual stock returns. From the econometric point of view, the presence of a common shock implies a strong form of data dependence in a cross-section of returns, which precludes the use of conventional asymptotically normal GMM estimators for weakly dependent data (e.g., Hansen, 1982; Conley, 1999). GMM CS overcomes the problem arising from the strong form of data dependence by, effectively, conditioning on a realization of the common stock. Importantly, the method enables consistent estimation and straightforward statistical inference on the parameters of the stock price process.

The new methodology differs from a popular estimation strategy of Fama and MacBeth (1973) and, to the best of our knowledge, from all estimation techniques presently used in the empirical finance literature on idiosyncratic risk (for a sample of recently used methods, see Ang et al., 2009; Fu, 2009; Huang et al., 2010). Specifically, it does not require an initial estimation of stock factor loadings (“betas”) and idiosyncratic volatilities from time-series data prior to performing a cross-sectional estimation step. Therefore, parameter estimates obtained by the new method should not suffer from a bias induced by the well-known errors-in-variables problem (see Miller and Scholes, 1972). Another important advantage of the new method is that its implementation requires only a cross-section of returns supplemented with a realization of a common shock rather than a long time-series data set.

To implement this approach, we extend a standard geometric Brownian motion model for the price dynamics of financial securities by imposing distributional assumptions on the cross-section of idiosyncratic volatilities. In particular, we specify that the volatilities have a uniform distribution with a

* Corresponding Author: Serguey Khovansky, Graduate School of Management, Clark University, 950 Main Street, Worcester, MA 01610-1477, USA. Telephone: 1-508-421-3852, fax: 1-508-793-8822, e-mail: skk9e@virginia.edu.

lower bound of 0 (since a stock idiosyncratic volatility cannot be negative) and an upper bound to be estimated from the data. A different distributional assumption (e.g., a gamma distribution) can easily be imposed on the volatilities, if so desired in practical work. We employ the uniform distribution for analytical convenience.

An empirical investigation of the financial market model is conducted using data from the Center for Research in Security Prices (CRSP) comprising stocks traded on the NYSE/Euronext, AMEX, and NASDAQ (approximately 5600 securities in total). Stock returns are computed from daily closing prices for regularly traded stocks of operating companies and from closing prices of American depositary receipts (ADRs). In practice, some companies issue shares of two or more classes (e.g., Berkshire Hathaway issues class “A” and class “B” shares), which are listed as distinct securities in the CRSP database. In line with our assumption about the independence of idiosyncratic risks (required for consistent GMM CS estimation), we use prices for only one security per company. In particular, we select a share class with the largest number of outstanding shares. The market index return and the risk-free rate are approximated using the S&P 500 index and four-week Treasury bill rate, respectively.

By applying the GMM CS methodology, we evaluate the range of the idiosyncratic volatility values over several overlapping time intervals from to the first two weeks of January 2008. In effect, we infer the term structure of the stock idiosyncratic volatility. A sample of the results is presented in Table 1.

Table 1

Term Structure of Idiosyncratic Volatility

Time Period	Jan 9 – Jan 10, 2008	Jan 8 – Jan 10, 2008	Jan 7 – Jan 10, 2008	Jan 4 – Jan 10, 2008	Jan 3 – Jan 10, 2008	Jan 2 – Jan 10, 2008
Estimate*	0.96	1.17	1.18	0.24	0.16	0.14
Wald statistic	1618.8	3274.2	5592.3	213.4	48.47	76.94
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note:

*An estimate of the upper bound of the range of the stock idiosyncratic volatilities (in annualized terms).

Over the time interval under consideration, the range of the stock idiosyncratic volatilities is found to be declining from approximately a unit level (for short periods of one or a couple trading days) to about one-seventh over a slightly longer time-interval of approximately two trading weeks.

Keywords:

Common shock, Systematic risk, Cross-sectional returns, Idiosyncratic volatility, Generalized method of moments

JEL Codes:

C21, C51, G10

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