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Have we solved the idiosyncratic volatility puzzle?[☆]

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ABSTRACT

We propose a simple methodology to evaluate a large number of potential explanations for the negative relation between idiosyncratic volatility and subsequent stock returns (the idiosyncratic volatility puzzle). Surprisingly, we find that many existing explanations explain less than 10% of the puzzle. On the other hand, explanations based on investors' lottery preferences and market frictions show some promise in explaining the puzzle. Together, all existing explanations account for 29–54% of the puzzle in individual stocks and 78–84% of the puzzle in idiosyncratic volatility-sorted portfolios. Our methodology can be applied to evaluate competing explanations for other asset pricing anomalies.

1. Introduction

Ang, Hodrick, Xing, and Zhang (2006), in a highly influential paper, document a negative relation between idiosyncratic volatility and subsequent stock returns. To the extent that realized idiosyncratic volatility proxies for expected idiosyncratic volatility, this result is very puzzling because traditional asset pricing theories either predict no relation between expected idiosyncratic volatility and expected returns under the assumptions that markets are complete and frictionless and investors are well-diversified, or predict a positive relation under the assumptions that markets are incomplete and investors face sizable frictions and hold poorly diversified portfolios (see, e.g., Merton, 1987; Hirshleifer, 1988). Consequently, many papers have been written trying to explain the puzzle, with each paper proposing a different economic mechanism linking idiosyncratic volatility to subsequent stock returns.[1]

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[1] The long list of candidate explanations includes those based on expected idiosyncratic skewness (Boyer, Mitton, and Vorkink, 2010), coskewness (Chabi-Yo and Yang, 2009), maximum daily return (Bali, Cakici, and Whitelaw, 2011), retail trading proportion (Han and Kumar, 2013), one-month return reversal (Fu, 2009; Huang, Liu, Rhee, and Zhang, 2009), illiquidity (Bali and Cakici, 2008; Han and Lesmond, 2011), uncertainty (Johnson, 2004), average variance beta (Chen and Petkova, 2012), and earnings surprises (Jiang, Xu, and Yao, 2009; Wong, 2011). In addition, several papers show that the idiosyncratic volatility puzzle is stronger among stocks with prices of at least five dollars (George and Hwang, 2011), low analyst coverage (Ang, Hodrick, Xing, and Zhang, 2009;

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However, to date there has been no comprehensive examination about which explanations best explain the puzzle. Further complicating this matter is the fact that existing studies typically differ in terms of empirical methodology and sample construction, thus making direct comparisons of their results difficult.

Motivated by these concerns, this paper provides a simple unified framework to evaluate a large number of candidate explanations of the puzzle. Most studies in this literature typically promote a new explanation of the puzzle while controlling for a limited number of existing explanations. We believe that our paper provides the most comprehensive examination of existing explanations to date. More importantly, our methodology allows us to quantify the fraction of the puzzle that is explained by each candidate explanation, either by itself or after controlling for other competing explanations.

To summarize our methodology, we start from Fama and MacBeth (1973) cross-sectional regressions of month t individual stock returns on month $t-1$ idiosyncratic volatility. We find, as many papers do, that the estimated regression coefficient, which we denote as γ_t, is on average negative and highly statistically significant. Next, we decompose the γ_t coefficient into one or more components, each related to a candidate explanation of the puzzle (e.g., skewness), and a residual component. The ratio of the component related to a particular candidate explanation to the original γ_t coefficient then measures the fraction of the idiosyncratic volatility puzzle that is captured by that explanation, and the ratio of the residual component to γ_t measures the fraction of the puzzle left unexplained by all candidate explanations considered. Our decomposition methodology ensures that the components related to the candidate explanations and the residual component add up to γ_t. This makes for intuitive interpretation and easy comparisons when we pit existing explanations against one another.

To guide our analysis, we break up existing explanations into three groups. The first group of explanations attributes the idiosyncratic volatility puzzle to lottery preferences of investors (they propose different proxies for the lottery feature of a stock, namely, skewness, coskewness, expected idiosyncratic skewness, maximum daily return, and retail trading proportion). The second group of explanations appeals to various forms of market frictions (one-month return reversal, the Amihud illiquidity measure, zero-return proportion, and bid-ask spread) to try to explain the puzzle. Explanations that do not fall naturally into the first two groups (uncertainty, average variance beta, and earnings surprises) are then included in the third group.

Using the sample of Center for Research in Security Prices (CRSP) common stocks from 1963–2012, we find that surprisingly many existing explanations, when evaluated alone, explain less than 10% of the idiosyncratic volatility puzzle. This is true for the explanations based on coskewness, illiquidity, zero-return proportion, uncertainty, and average variance beta. For example, coskewness and analyst dispersion (a proxy for uncertainty) can only explain 1.9% and 5.3%, respectively, of the puzzle. Or consider the Amihud illiquidity measure. Despite being highly correlated with idiosyncratic volatility, it also fails to capture more than 10% of the puzzle.

On the other hand, explanations based on skewness, expected idiosyncratic skewness, maximum daily return, retail trading proportion, one-month return reversal, bid-ask spread, and past earnings surprises show promise in explaining the puzzle. In particular, one-month return reversal alone can explain 33.7% of the puzzle, followed by bid-ask spread at 30.4%, retail trading proportion at 22.3%, expected idiosyncratic skewness at 14.7%, past earnings surprises at 10.9%, and skewness at 10.3%. For the maximum daily return variable proposed by Bali, Cakici, and Whitelaw (2011), it turns out that it can explain the entire puzzle. The problem, however, is that this variable is essentially a range-based measure of volatility and is close to being perfectly collinear with idiosyncratic volatility (correlation of about 0.90). It is therefore not surprising that an alternative proxy for volatility can capture the idiosyncratic volatility puzzle.

Finally, we include all explanations of the puzzle (excluding maximum daily return for reasons mentioned above) in a multivariate framework so that we can evaluate the marginal contribution of each explanation. We are also interested in the total fraction of the puzzle they can collectively explain. We find that after controlling for competing explanations, retail trading proportion explains only 0.2% of the puzzle. Among the other lottery preference-based explanations, expected idiosyncratic skewness explains 4–15%, coskewness explains 3–4%, and skewness explains 2–7% of the puzzle, depending on the specification. Together, the four lottery preference proxies capture a good 10–25% of the puzzle. Among the market friction-based explanations, one-month return reversal explains 1–22%, bid-ask spread explains 8%, the Amihud illiquidity measure explains up to 4%, and zero-return proportion explains less than 2% of the puzzle. Together, the market friction proxies account for 3–24% of the puzzle. Finally, analyst dispersion explains 3–6%, average variance beta explains less than 1%, and past earnings surprises explain 2–5% of the puzzle. Together, this group of explanations accounts for 5–10% of the puzzle in the multivariate analysis. Collectively, all the examined explanations account for 29–54% of the puzzle, with explanations based on lottery preferences and market frictions making the biggest contributions. However, a significant fraction (46–71%) of the puzzle remains unexplained.

In robustness tests, we repeat the multivariate analysis using subsamples of stocks with prices of at least five dollars, low analyst coverage, poor credit ratings, high short-sale constraints, high leverage, low institutional ownership, low book-to-market equity, non-NYSE listings, or for non-January months (which have been shown by previous studies to be associated with a stronger idiosyncratic

George and Hwang, 2011), low credit ratings (Avramov, Chordia, Jostova, and Philipov, 2013), high short-sale constraints (Boehme, Danielsen, Kumar, and Sorescu, 2009; George and Hwang, 2011; Stambaugh, Yu, and Yuan, 2015), high leverage (Johnson, 2004), low institutional ownership (Nagel, 2005), low book-to-market equity (Barinov, 2013), non-NYSE listings (Bali and Cakici, 2008), or for non-January months (George and Hwang, 2011; Doran, Jiang, and Peterson, 2012).