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New evidence on the impact of financial leverage on beta risk: A time-series approach

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Abstract

The traditional estimation of a project's cost of capital often requires leverage adjustments to beta. Several researchers have empirically investigated the relationship between the debt/equity ratio (*D*/*E*) and beta implied by such leverage adjustments. Typically, this has involved cross-sectional analysis of a sample of U.S. firms in selected industry classifications. The major contribution of the current study is to extend this evidence by investigating the relationship between financial leverage and beta using a time-series approach. This has several advantages over the cross-sectional approach. Our results reveal that while the estimated unlevered beta produced by the time-series approach is quite close to the theoretically implied unlevered beta, the mean difference between the two measures across our sample of 348 U.S. stocks is highly significant. The analysis also reveals that 30–40% of our full sample rejects a theoretical *D*/*E* restriction on the time-series model. Moreover, the results suggest that the restriction is much more likely to be rejected for stocks with high debt/equity ratios, which in general have low unlevered betas. Further, there is a considerable cross-sectional variation in the proportion of these rejections across industry groupings. Accordingly, these results suggest that due care needs to be applied when taking the traditional view of delevering beta risk.

JEL classification: G12

Keywords: Beta risk; Leverage adjustment; Time-series relationship

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1. Introduction

In the application of the capital asset pricing model (CAPM) to the estimation of a project's cost of capital, modern finance theory has been substantially influenced by the work of Hamada (1972), Bowman (1980), Conine (1980) and others, regarding the need to make leverage adjustments to beta, under certain circumstances.[1] In a recent paper, Marston and Perry (1996) empirically investigate the relationship between financial leverage and beta. Their approach involves a series of cross-sectional analyses across a sample of U.S. firms in selected two-digit and four-digit SIC industry classifications. They investigate three subperiods over the interval 1974–1988 and compare the regression results to those predicted by the Hamada (1972) leverage adjustment. Generally, their results indicate that the techniques which are commonly applied for the purposes of unlevering beta, tend to over-penalize beta when higher levels of financial leverage are being utilized.

The current study aims to extend the evidence contained in the existing literature by investigating the impact of financial leverage on beta using a time-series approach. This delivers several major advantages over the cross-sectional approach used in all previous work. First, and perhaps the primary advantage, is that the time-series approach provides a much stronger control for operating or business risk, as it avoids having to make a strong assumption of constant systematic business risk across a chosen industry grouping (see Marston & Perry, 1996). Instead, we make the more reasonable assumption that systematic operating or business risk is constant for a given firm (although even this assumption can be tested and relaxed if necessary).

A second important advantage of our time-series approach is that it delivers a level of statistical power not possible in the cross-sectional studies. As discussed later, our sample involves 348 stocks which represents a much larger sample than is allowed by industry regressions or by the matched-pair sample approach of Marston and Perry (1996), for example. Thus, with more observations, the current study has more power to reject the hypothesis that the difference between the empirical and the implied theoretical unlevered betas is equal to zero. Third, following on from the preceding point, our time-series approach allows the examination of a number of industries that would be precluded in the cross-sectional approach due to an insufficient number of firms within the industry.

A fourth advantage of our time-series methodology is that it allows for the time variation in debt/equity (D/E) ratios, which has been found to be quite substantial for most companies over certain periods in their life history. The notion that the time variation in the D/E ratio causes time variation in beta risk and risk generally, is widely cited in the finance literature (see, for example, Black, 1976; Christie, 1982). Indeed, the relatively recent proliferation of generalized autoregressive conditional heteroskedasticity (GARCH) model applications and, in particular, the popularity of the asymmetric variations thereof (for example, see Nelson, 1991; Glosten, Jagannathan, & Runkle, 1993; Engle & Ng, 1993) have invoked leverage arguments to explain their empirical success.

A fifth advantage is that, unlike Marston and Perry (1996) and others, financial firms can be validly included in this analysis, despite their extreme values of D/E, without compromising the homogeneity of the sample. This is so because the time-series approach means that the results of such extreme D/E ratio firms are produced independently of the results of firms with