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Diminishing marginal returns from R&D investment: evidence from manufacturing firms

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Abstract

This study analyses the association between R&D Investment (RDI) and growth opportunities and show that there exists diminishing marginal returns in manufacturing firms. Extant literature has found that besides R&D investment, systematic risk, financial leverage and complementary asset investment are also associated with growth opportunities. Accordingly, we employ structural equation modelling to simultaneously estimate both a direct influence of RDI as well as indirect influences of RDI on growth opportunities via these three mediating effects. We find that the direct effect of incremental RDI on growth opportunities is independent of R&D intensity. Instead, the heterogeneous effects of RDI on systematic risk, financial leverage and complementary asset investment across firms with different R&D intensity level accounts for the diminishing marginal returns to R&D investment. We specifically

observe that the greatest indirect effect is via the financial leverage of the firm. This study shows the importance of accounting for the interdependencies in R&D investment.

Keywords:

R&D investment | systematic risk | leverage | complementary assets | structural equation model

JEL Classification:

C33 | G14 | O32

Notes

[1] This multiplicative formulation derives from the use of SEM, which will be explained in the subsequent section.

[2] We use the AMOS (Arbuckle, 2005) software to run the SEM tests.

[3] Our study uses objective financial data sourced from the COMPUSTAT and CRSP databases. Thus, each variable is measured by a single item, in contrast to multiple items required for each subjective variable typically used in psychology and sociology research that employ SEM.

[4] It should be noted that we decide not to capitalize R&D expenditure since an economically credible amortization rate is difficult to obtain (Grabowski and Mueller, 1978; Hirschey and Weygandt, 1985; Lev and Sougiannis, 1996) because of the differing opinions concerning the appropriate economic lifespan of the R&D investment.

[5] Although we use two measures of GO, namely, MBASS and MBEQU, the results in this study are reported using only MBASS as the results are qualitatively similar between the two growth measures. The unreported results are available from the authors upon request.

[6] Details of the methodology are suppressed to conserve space, but are available from the first author upon request.

[7] Full details of the analysis are suppressed to conserve space, but are available from the first author upon request.

[8] The kurtosis of 101.5, 58.4 and 44.03 for Portfolios A, B and C, respectively, lead us to reject the null hypothesis of multivariate normality ($p < 0.01$). Multivariate nonnormality may cause the SEs of the path estimates to be underestimated. The remedy is to use the bootstrap approach where multiple samples, each containing the same number of observations as our dataset, are drawn with replacement from our original sample. The sampling distribution from the bootstrap procedure provides the data for empirical estimation of the variability of parameter estimates (Byrne, 2004, pp. 268–9). We ran the bootstrap procedure provided in AMOS for 500 bootstrap samples to obtain estimates of the SEs and the significance levels of the path coefficients.

[9] Insignificantly different from zero.