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R&D investment and internal finance: the cash flow effect

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Abstract

This paper investigates the cash flow effect on R&D investments for firms in Denmark. Evidence is found that internal funds are important in explaining R&D investments, indicating that R&D investment decisions are affected by credit market imperfections. Cash flow sensitivities are larger both for smaller firms and for firms with low debt relative to assets. Furthermore, this effect is also present after controlling for cash flow's potential role as a predictor of future profitability.

Keywords:

R&D | Cash flow | Internal finance | Financial constraints | Credit market imperfections

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Notes

Classical references are Akerlof (1970) and Stiglitz and Weiss (1981).

See, e.g. Holmstrom and Tirole (1997) and Townsend (1979).

Examples are Fazzari et al. (1988), Gilchrist and Himmelberg (1995).

Among them, Hao and Jaffe (1993), Himmelberg and Petersen (1994), Hall (1992), Mulkay et al. (2001), Boughaes et al. (2003). A review of literature on the financing of R&D can be found in Hall (2002).

See, e.g. Østrup (1994) and Andersen et al. (2001).

See, e.g. Østrup (1994).

Annual account data are from the Account Database from the Copenhagen Business School. Stock market data is obtained from the Danish Stock Database from the Center of Analytical Finance at the Aarhus School of Business. A more detailed description of the R&D data is given in the appendix.

See Kaplan and Zingales (1997, 2000) and the reply to their arguments in Fazzari et al. (2000). Schiantarelli (1996) and Hubbard (1998) contain general discussions of a number of the methodological issues concerning credit market imperfections and investment.

A firm was considered distressed if it had either a negative or very low cash flow to assets ratio.

These changes are not reported in the paper, though they can be obtained from the author.

Cash flow is defined as operating income before R&D expenditures, plus liquid assets.

More precisely, Q is calculated as the market value of equity plus the book value of long-term debt, divided by the book value of total assets.

That is, average Q, which empirical approximations are a proxy of, is equal to marginal Q. See Hayashi (1982).

Though, see Himmelberg and Petersen (1994).

See, e.g. Fazzari et al. (1988) and Hubbard (1998).

See also Cleary (1999).

That is, the expected value of Q in period $t+1$ based on information in period t.

As a reference, the market capitalization of the NYSE (source: NYSE's web site) was slightly higher than US GDP in 2001 (GDP data from OECD).

R&D among firms listed on the CSE amounts to a little under half of total private sector R&D in Denmark, which was DKK 21.9 billion. See Danish Centre for Studies in Research and Research Policy (2003).

See, e.g. Malerba and Orsenigo (1997).

Where, due to the number of observations, some sectors have been combined [industrials (20), materials (15) and utilities (55); consumer discretionary (25) and consumer staples (30); information technology (45) and telecommunications (50)].

The regression method used is least squares with dummy variables. Mulkay et al. (2001) also use a fixed effects estimator for similar reasons. In addition, fixed effects estimation is the most commonly used method for cash flow analyses using the Tobin's Q model (although GMM is often used for analysis using the Euler equation approach). Among these are Bougheas et al. (2003), Kaplan and Zingales (1997), Fazzari and Petersen (1993), Himmelberg and Petersen (1994), Cleary (1999) and Hao and Jaffe (1993). An exception is Gilchrist and Himmelberg (1995), who use GMM.

See Hausman and Taylor (1981). This approach involves estimation of a random effects model where instruments are used for those variables that are assumed to be correlated with the error term.

See Hausman (1978) or discussions in Hsiao (1986) and Greene (2003).

Coefficient estimates for sector dummies are not shown, though they are available on request from the author.

Where as larger firms, for example, may be able to issue their own bonds.

See Table AI.

Their classifications take into account other factors, among them management statements on liquidity positions in annual reports, though firms' cash positions are a central factor.