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

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Comments from Ebbe Graversen, the editor and two anonymous referees are gratefully acknowledged.

## 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

See [Kap](#) Fazzari et al. (2000). S of a

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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 model estimated by Fazzari et al. ([2001](#)) and Petersen ([1993](#)) is based on the Tobin's Q model (see Fazzari and Jaffe, 1988). The regression model is estimated using the following specification:

See Himmelberg and Petersen (1994) for a discussion of the Tobin's Q model and its empirical estimation.

correlation between the Tobin's Q ratio and the growth rate of sales.

See Himmelberg and Petersen (1994) for a discussion of the Tobin's Q model and its empirical estimation.

Coefficient estimates are available on request.

request



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

See [Table A1](#).

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.

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