

Stock Prices and Investment of Growth Companies:
Portfolio-, Equity Financing-, or Signal Processing
Channel - That is the Question

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Abstract

Changes of stock prices and corporate investment are correlated. In the tradition of Tobin, it is mostly assumed that stock prices incorporate expectations of future profitability, which influences investment. With respect to venture capital markets stock exchanges play a crucial role in a second way. They serve as exit channel and as source of additional finance. Empiric studies show that in effect stock prices play a larger role for small companies than for large ones, even though capital markets are likely to be less efficient for them. In this paper, we examine why investment of growth companies shows a high stock price sensitivity.

We examine three potential channels, through which stock prices may influence investment: Firstly, a *portfolio channel*, through which security holdings may serve as source of finance for growth companies. Secondly, an *equity financing channel*, through which growth companies may finance investment by issuing equity. Thirdly, growth companies may, due to their flexible organizational structure, have the ability to better respond to changes in expectations and invest accordingly (*signal processing channel*).

In spite of the relevance of security holdings for growth companies, we do not find evidence for the existence of a portfolio channel. While issuing equity - in particular in boom phases of the economy - plays a major role for growth companies, financially constrained companies do not, as we consequently expected, show a stronger investment stock-price sensitivity. We can show that growth companies respond to changing q in a more accurate way, if market valuations are realistic. Hence, high investment- q sensitivities of growth companies are probably caused by their ability to effectively process expectations and news and invest accordingly.

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1. INTRODUCTION AND APPROACH

In this paper, we link two questions which fundamentally concern the behavior of growth companies, with respect to the active and passive side of their balance sheets.

On the one hand, we examine investment behavior of growth companies. Even though investment accounts for only about 10 percent of the GDP,¹ gross investment in PPE (property, plant and equipment) is a crucial component of the economy. Its consequence on the productive capacity, its multiplicative effect on the construction and durable goods industry and its volatility in comparison to the more stable aggregate demand and supply make it a key factor for the development of an economy.²

On the other hand, we look at how growth companies finance investment. We thereby focus in particular on the role of stock exchanges, which are an important provider of finance and the prime exit channel for venture capital firms.³ IPOs are in effect the single most important driver of the development of venture capital markets.⁴ The role of a stock exchange for investment can be multiple. It serves as an indicator for management of how attractive the market considers investment opportunities to be and it is a crucial source of additional finance for growth companies.

By empirically testing the different impact of the four major drivers of investment on listed growth companies we will show, what role the stock exchange plays for growth companies.

Previous empiric studies by Kadapakkam et al. (1998) and us (Swoboda (2002)) show that small companies stronger respond to changes in q than their larger counterparts, even though one could expect that capital markets are more efficient for large caps, and hence, signals from capital markets to growth companies may be distorted.

¹ Taking the US as an example; Samuel (1996) p. 1.

² See Carruth (2000) p. 277.

³ According to Gompers (1999) in the US 30 percent of the exits are via a stock exchange.

⁴ See Jeng (2000) p. 285.

There are different ways of explaining this observations. Growth companies may be more dependent on the current valuation of their securities portfolio, which very likely is not independent of the valuation of its own stock (*portfolio channel*). "Hot" market periods could also pave the way to capital markets, as it may be easier to issue equity, if markets are optimistic and valuations are high. As a consequence, companies may take advantage of high prices and benefit from the additional capital they can obtain, in particular, if they otherwise were financially restricted (*equity financing channel*). Evidence therefore has been reported by inter alia Baker, Stein and Wurgler (2002). The third channel is based on the q-theory of investment developed by Tobin (1969) and Brainard and Tobin (1977). Stock exchange prices serve as indicator, whether a firm should invest or divest. The reason for the high q-investment sensitivity of growth companies may lie in the ability of growth companies to better respond to changing signals, due to their more flexible organizational structure (*signal processing channel*).

The exploration of the reasons behind the high sensitivity of growth companies to changes in stock prices is not only of academic interest, but has practical implications as well. A capital market, which works without frictions, is particularly important for the economy, if external equity is the prime source of finance and "fuels" the growth company via an equity financing channel.

The remainder of the document is structured as follows. In the next section, we will briefly discuss the current status of research on investment and its drivers. Thereby we will in particular discuss what role stock exchange prices and the there from derived q may play for a company. We will formulate hypotheses, which will allow us to distinguish between a stock exchange's role as indicators of investment for management and its role as provider of financial resources. In section 3 we will describe the data sample, which we will use in section 4 to test our hypotheses. Section 5 concludes with a summary of our findings.

2. THEORY OF INVESTMENT

We start our analysis of stock prices and investment of growth companies with a brief definition of investment and a discussion of its four major drivers. We will at first

describe the theoretic background behind output, cost of capital and liquidity and then discuss the q model, and other channels through which stock prices may influence investment in further detail.

2.1. Definition of Investment

Samuelson (1992) defines investment as "economic activity that forgoes consumption today with an eye to increasing output in the future". It includes tangible (e.g., structure, equipment, and inventories) and intangible capital (e.g., education or "human capital", R&D, brand equity). Net investment is the change in capital from period to period. Gross investment additionally includes replacement investment, which equals depreciation.⁵

In terms of accounting, investment typically results in the activation of assets, subject, however, to the respective accounting principles. Whereas tangible assets get activated on the balance sheet, putting intangible assets (i.e. R&D, patents, human capital, brands, customer) on the balance sheet is restricted according to the most common accounting principles.⁶

Total investment of a company, according to our definition is compound of changes in the activated assets on the balance sheet. Assets are divided in different ways according to different accounting standards. The overarching principles, however, are similar in the most important sets of standards. Assets are thereby divided into fixed and current assets. Fixed assets consist of tangible (i.e. PPE), intangible (e.g., goodwill, patents, licenses) and financial (i.e. long term investment) assets. Current assets include mainly inventories, receivables as well as cash and short term investments (available for sale).⁷ We do not cover prepayments, which are treated as a separate, albeit, much smaller group.⁸

⁵See Jorgenson (1971) p. 1112 and Samuelson (1992) p. 739.

⁶ See Swoboda (1999) pp 23f, Nobes (1995) pp. 192f, 212f, 249, 275, 297.

⁷ Bertl (1998) pp. 257f, Egger (1999) p. 316, OSIRIS Database.

⁸ For a more detailed discussion of investment in the different balance sheet items refer to Swoboda (2002).

To give a more accurate picture of investment we examine investment in two additional items. Human capital, which is - in spite of the crucial role it plays for a company - not activated on the balance sheet and immaterial assets, which consist of the amount of cash "burned" every year. Assuming a rational company, this money should either go into R&D or into marketing activities.⁹ Hence, we treat these expenses as a kind of investment and test, what role stock prices play for it.

2.2. Output, Cost of Capital and Liquidity as Drivers of Investment

Corporate investment is influenced by a number of different macro and micro economic forces. Four of them have in the past been identified as being the most important ones, even though according to most studies they account for only a quarter or a third of the volatility of investment. These drivers are output, cost of capital, liquidity and expectations.

As we emphasize on the role of the stock exchange, which regularly is used as proxy for expectations, we will discuss the respective theory in depth below. Before that, we will briefly review, why the other three play a role.

2.2.1. Output

Accelerator models motivate changes in capital spending by fluctuation or the absolute level of sales or other output measures. In addition, sales are regularly included into investment models on an ad hoc base without theoretical explanation.¹⁰

A simple accelerator model can be written as

$$\frac{I_t}{K_{t-1}} = a_1 + \frac{a_2}{K_{t-1}} + a_{3i} * \frac{\Delta Y_{t-1}}{K_{t-1}} + e_{it}$$

Equation 1: Accelerator investment function

⁹ Gugler (2000) p.13 argues in a similar way and includes R&D and marketing into his measure of total investment.

¹⁰ Inter alia Fazzari (1988) p. 173ff and Hoshi (1991) p. 45.

with I being investment, K being capital, ΔY being the change in expected output between t and $t-1$, and a_2 representing replacement investment. The use of ΔY between t and $t-1$ implies that the changes before $t-1$ are irrelevant for investment, and implies that investment is considered to be irreversible. The lag is not necessarily limited to one period. All variables are scaled by total capital in order to avoid heteroscedasticity.¹¹

2.2.2. *Cost of capital*

According to Modigliani-Miller's (1958) famous theorem on capital structure, under restrictive assumptions, investment decisions should be based on the expected return of possible projects and the cost of capital alone. Investment takes place as long as the marginal return for the shareholder exceeds the marginal cost of capital and hence the project has a positive net present value.¹²

The neoclassic school incorporates both, cost of capital and output into its models. Hence, the neoclassic model is an extension of the accelerator model described above, including a possible substitution between production factors (i.e. an elasticity not equal to zero).¹³

The model still requires a set of strong assumptions. In a neoclassical world, firms always produce with an optimal level of capital and labor. Therefore every change in factor prices (i.e. capital or labor) or in level of output instantaneously leads to positive or negative investment in capital goods. This is, as well as arbitrarily devisable investment, or the possibility to sell excess capital on a perfect second-hand market apparently not given in the real world.¹⁴

¹¹ See Behr (1998) p. 31 and Jenkinson (1981) p. 26.

¹² See Modigliani (1958) pp. 261f; see also inter alia Süchting (1995) p. 474ff, Swoboda (1996) p. 155ff, and Breal (2000) pp. 473ff.

¹³ See Carruth (2000) p. 284 and Chirinko (1993) p. 1878.

¹⁴ See Jenkinson (1981) p. 10.

Added to a model, cost of capital partly is found to be of statistical significance,¹⁵ empirical support is not particularly conclusive.¹⁶ One reason for the weak additional explanatory power may be that investment does not depend on the current return on interest, but rather on the prospective yield,¹⁷ which is difficult to measure. In addition availability and not the cost of capital often is the critical issue for a firm.¹⁸

A neoclassic investment function, based on a sales accelerator model augmented by cost of capital and implying a Cobb Douglas production function can be written as

$$\frac{I_{it}}{K_{it-1}} = a_1 + \frac{a_2}{K_{it-1}} + \sum_i a_{3i} * \Delta \frac{Y_{t-i}}{K_{t-i-1}} + e_{it}$$

Equation 2: Neoclassic investment function

with UC being cost of capital.¹⁹

2.2.3. *Liquidity*

Researchers regularly included proxies for liquidity into their equations, and thereby improved the results of their investment models, even though the theoretical basis for inserting respective variables into an investment model, has often been missing.²⁰ The unquestionable relevance of liquidity is supported by surveys. The Confederation of British Industry (CBI), for example, found out that up to a quarter of the companies report their investment to actually be constrained by the availability of internal finance.²¹

¹⁵ Elliott (1980) pp. 982ff.

¹⁶ See Jenkinson (1981) p. 10 and Valderrama (2001) p. 16.

¹⁷ See Keynes (1936) pp. 141f.

¹⁸ See Carruth (2000) p. 277; for a theoretic discussion of why this is the case see Stiglitz (1981) p. 394 and Greenwald (1984) pp. 195.

¹⁹ See inter alia Behr (1998) p. 30f.

²⁰ See Chirinko (1993) p. 1902.

²¹ See Carruth (2000) p. 277.

In the past decades, substantial theoretic and empiric evidence for the relevance of liquidity has been collected.²² The basic assumption thereby is that capital markets are not perfect. Even though this thought has been already brought up in the 1950s, its empiric renaissance took place only in the 1980s, triggered by a groundbreaking paper of Fazzari, Hubbard and Peterson (1988), which entailed a considerable number of comparable studies.²³

To test for the impact of liquidity an equation in the general form of

$$\frac{I_{it}}{K_{it}} = \int \frac{X_{it}}{K_{it}} + \mathbf{a}_1 * \frac{CF_{it}}{K_{it}} + \mathbf{e}_{it}$$

Equation 3: Cash flow model

is used, where X represents a vector of current and lagged control variables (e.g., proxies for output or expectations as explained above).²⁴ By doing so, one can avoid to simply measure accelerator effects or future investment opportunities.²⁵

Empiric results show that it is undisputable that liquidity is an important driver for investment. The reason therefore, however, is uncertain. There are a number of capital market inefficiencies, which may be responsible for the role liquidity plays for investment. The most prominent ones are principal-agent conflicts, information asymmetries, transaction costs and taxes. For an extensive survey of the respective literature refer to Swoboda (2003).

2.3. Stock Prices and Investment

In this section we will derive different ways, in which stock prices influence investment. We will discuss three possible relations between stock prices and investment. To begin with, we will examine the classic theory on how stock prices influence investment via the

²² See inter alia Jensen (1976), Stiglitz (1981), and Myers (1984).

²³ For a survey of the literature refer to inter alia Hubbard (1998) pp. 198f and 202ff - 204.

²⁴ See Fazzari (1988) p. 163f.

²⁵ See Whited (1992) p. 1426 and Hoshi (1991) p. 35 and Devereux (1989) p. 22.

q model and a there from derived signal processing channel. Secondly, there may be a portfolio channel, through which raising stock markets increase the capital available for investment by valorizing a firm's security holdings. A third effect could be, an equity financing channel, through which the provision of additional capital via a stock exchange may facilitate investment.

2.3.1. *The Q Theory and the Signal Processing Channel*

Q-models base on the work of Tobin (1969) and Brainard and Tobin (1977). However, the idea to link investment and expectations goes back to John Maynard Keynes' General Theory of Employment, Interest and Money.²⁶ Grunfeld (1960) was the first to directly relate investment and market value.²⁷

2.3.1.1. *Theoretic Discussion of the Q-Model*

Tobin's q is the comparison of two valuations of the same asset.²⁸ According to Tobin, "the rate of investment - the speed at which investors wish to increase the capital stock - should be related, if to anything, to q, the value of capital relative to its replacement cost".²⁹ Tobin illustrates this rationale with a simple example. An increase in the market valuation of houses, with the cost of construction remaining constant, will undoubtedly lead to the construction of additional homes, until this disequilibrium between market price and reproduction costs is wiped out.³⁰

It is obvious that investment should directly depend on the value of q. A rational company will invest whenever the expected market value of an invested euro will exceed its nominal value, which equals replacement cost at the moment of the acquisition of the asset. In other words when the (discounted) profit streams from an investment (i.e. a

²⁶ Keynes refers to the ratio of the prospective yield of an investment over the replacement cost of capital as the marginal efficiency of capital. However, he rejects the hypothesis that investment is driven thereby, based on, among others, the impossibility to correctly measure a firms earning-capacity value (Keynes (1936) pp. 135ff).

²⁷ See Samuel (1996) p. 5.

²⁸ Q is sometimes referred to as "valuation ratio".

²⁹ Tobin (1969) p. 21.

³⁰ See Brainard (1977) p. 236.

company's market value) exceed the cost of investment, or whenever marginal q is greater than unity.³¹

The relevant driver for investment is marginal q, the ratio of the market value to replacement value of every single project, which in practice unfortunately is unobservable. Under restrictive conditions, first derived by Hayashi (1982), average instead of marginal q can be used. These conditions include perfect capital markets, a constant return-to-scale technology, linear and homogeneous production and adjustment cost technologies, the firm must not have market power (i.e. competitive markets with the firm being a price taker), and investment decisions are largely separated from other real and financial decisions.³² Even though these restrictions do not always hold in reality, the majority of authors relies on average q, as driver of investment.

Tobin's (average) q can be written as

$$q = \frac{E_{(MV)} + De_{(MV)}}{A_{(r)}}$$

Equation 4: Tobin's q

with $E_{(MV)}$ being the market value of equity, $De_{(MV)}$ the market value of debt and $A(r)$ the replacement value of total assets.³³

The according investment equation³⁴ then is

$$\left(\frac{I}{K}\right)_{it} = a_1 + a_{2i} * q_{it} + e_{it}$$

Equation 5: Q investment model

From a theoretical point of view, Equation 5 does not contain any additional variables, as the forward looking variable q should capture all information available, hence also all financial constraints, future tax changes or market frictions, which may have a positive or

³¹ See Samuel (1996) p. 2.

³² See inter alia Hayashi (1982) pp. 214f and Chirinko (1993) p. 1888.

³³ See Gehrke (1994) p. 144.

³⁴ For example Fazzari (1988) p. 165.

negative impact on investment. However, the model also assumes instantaneous adjustment, which obviously is impossible in the real world. As a consequence, despite theoretic criticism of acting on an ad hoc base, some authors additionally introduce other variables or lags of q into their investment models.³⁵

Conceptually the q model and the neoclassic model are closely related. Both assume that capital accumulation of a firm is a function of its strive for profit maximization. In a very simple model, in fact, the two approaches should deliver the same results, but the q model, includes the capital market view of a firm's value, adding expected future profitability to the model. Therefore, the q model does not need to rely on the same restrictive assumptions as the neoclassic theory.³⁶

Besides the technical limits measuring q , which we will describe when we operationalize our variables in section 3.1.2., there is also a conceptual boundary. "Real q " (q^*), the actual expected present value of future cash flows may substantially differ, from what capital markets believe it to be.³⁷ Stock markets may merely be a "sideshow", with little effect on investment.³⁸ As a consequence managers should, in particular if market sentiments get irrational and differ from the one of the management, rather act upon their own valuation. If the signal processing channel works and managers invest according to changing expectations, the q model may help to predict investment. However, there would be no causal relationship between investment and stock prices, despite of a possible correlation. The actual driver of investment would be expectations, which are - whether they are rational or not - embodied in stock prices.

2.3.1.2. *Empiric Evidence for the q -Model*

Investment models which include q typically pursue one of two possible goals. On the one hand to control for expectations in models which test other drivers, and on the other hand to test the significance of q as such.

³⁵ See Chirinko (1993) pp. 1903, 1891f and Jenkinson (1981) p. 21.

³⁶ See Jenkinson (1981) p. 12.

³⁷ See Blanchard (1993) p. 124.

Examples for the first group are Fazzari, Hubbard, and Peterson (1988) or Hoshi (1991). In these studies q is regularly significant, but the explanatory power is often small.

With respect to the second approach there are a number of studies, which focus on different countries, different groups of companies, or different proxies for expectations. Even though the results often show that the explanatory power of q is weak,³⁹ there is nevertheless also evidence for the contrary. Alonso-Borrego and Bentolila (1994) find that q is significant for Spanish firms (together with liquidity, whereas sales is not), Jenkinson (1981) shows the relevance of expectations for the UK. Behr and Bellgardt (2000) test the explanatory power of different proxies for q for mesoeconomic data in Germany. Using stock market indices is the most promising approach, however, the explanatory power remains limited. Devereux and Schiantarelli (1989) demonstrate that in general q does play a significant albeit small role for investment, however, not for small firms. Kadapakkam, Kumar and Riddick (1998) compare the q -sensitivity of companies from different countries. Q thereby generally is less relevant than liquidity. With respect to firm size, q is clearly less important for large firms.

The empiric literature clearly shows that the q model - at least partly - can explain investment behavior.

2.3.2. *The Portfolio Channel*

Stock prices may, however, not only show the compound expectations of all market participants, but also influence the value of a company securities holdings, which are a potential source of finance. Raising stock prices may lead to an increase in wealth. This could allow a company to pursue investments, which it otherwise could not afford.

³⁸ See Bosworth (1975) p. 290.

³⁹ See inter alia Oliner (1995) and Samuel (1996); as a consequence of the sometimes poor performance of q measured as market value to replacement costs a number of alternative proxies for market value instead of stock prices have been developed: Bond (2001) for example successfully uses the net present value of analysts' earnings forecasts, Gugler (2000) calculates marginal q by dividing a firms annual return (i.e. its change in market value plus its depreciation) by the change in its assets (i.e. annual investment), Gilchrist (1995) uses a set of vector auto regression forecasting equations.

Cash windfalls from other sources (e.g., settled law suits⁴⁰ or sudden profits from other, non-related business units in the same company⁴¹) clearly increase investment. Gains from a rise in stock market prices, which increase the value of the security portfolio of a company could have the same effect and allow a company to sell securities from their portfolio as a source of finance.

There are examinations in the context of consumer spending. A marginal propensity to consume out of stock market wealth of 0.03 to 0.07 was found. Unfortunately, it is unclear whether even this moderate effect is a causal one, or whether the stock market simply acts as a passive predictor of information.⁴² In any case it is difficult to transfer findings from personal consumption to business fixed investment, as the vast majority of stocks is held by very few (rich) people. Any effect of a change in value of private stock holdings on the economy is consequently hard to measure.⁴³

As we are not aware of an empiric study of this hypothesis in the corporate environment, we are willing to close this gap with our paper.

2.3.3. *The Equity Financing Channel*

The third causal relation is the existence of an equity financing channel. Companies access equity markets to get additional finance and use these resources to finance investment. They do so, preferably, when stock prices are high.

The equity channel is composed of two causal relationships: Firstly, external equity is a potential source of finance for investment, and, secondly, stock prices influence the ability of a firm to issue equity.

With respect to the first argument, previous studies give little support. In general, even in well developed market based economies like the US and the UK, share issues account

⁴⁰ See Blanchard (1994) pp. 358f.

⁴¹ See Lamont (1996) p. 22.

⁴² See Starr-McCluer (1998) p. 4.

⁴³ See Barry (1975) p. 261.

only for a limited amount of finance of between less than 5 (US)⁴⁴ and 12 to 15 percent (UK)⁴⁵. More than 70 percent (according to some studies even more than 90 percent) of investment is funded from internal sources (i.e. retained earnings).⁴⁶ The influence of stock prices may be reinforced, as potential lenders use the information the stock market conveys to determine, whether they are willing to give funds or not. As a consequence, stock prices may also influence the price and the availability of debt capital.⁴⁷

In general, the relevance of equity finance for investment seems to be low, however, as we will discuss in section 2.4., external equity finance should play a special role for growth companies.

The second argument is based on the assumption that companies issue equity rather when valuations are high. In their famous article from 1984, Myers and Majluf argue that - based on Akerlof's (1970) lemon principle - equity issues are independent of the level of stock prices. Because of information asymmetries, equity will always be issued with a discount. As managers will avoid to issue stocks if a company is undervalued, the market will always assume that any issuing company is overvalued and, consequently, perceive an equity issue as a negative signal.

Empirically, it is a widely recognized phenomenon that stock issues follow abnormal positive stock returns, so-called hot market periods.⁴⁸ For the US excess returns of 30 to 70 percent, depending on the market, can be found in the 500 days prior to an issue announcement.⁴⁹

From a theoretical point of view it is not even clear, whether management of a firm, which acts in the interest of its shareholders, should issue shares, if q is greater than 1.⁵⁰

⁴⁴ See Whited (1992) p. 1426.

⁴⁵ See Devereux (1989) p. 12.

⁴⁶ See Carruth (2000) p. 277.

⁴⁷ See Morck (1990) p. 167.

⁴⁸ See Gron (1995) p. 8 and Gugler (2000) p. 23.

⁴⁹ See Korajczyk (1990) p. 257.

⁵⁰ See Samuel (1995) p. 2.

One could argue that, independent of whether the ratio of the fair valuation and the respective replacement costs, q^* , is below or above 1, management should take in new equity and invest it, as long as the market is willing to pay that price.⁵¹ However, if the valuation of the market is irrational (i.e. if $q^* > q$), management does not act on behalf of all its shareholders. Issuing overpriced shares only leads to a transfer from new shareholders to old shareholders. At the time, when the market price comes down to a realistic level in the future, management will be responsible to both, old and new shareholders. Hence, only managers with a short horizon may exploit the equity financing channel in an environment of exuberating market sentiments.⁵²

Abnormal returns prior to seasoned equity issues may be evidence for an adverse selection problem, indicating that management in its own interest is reluctant to issue equity if prices are low.⁵³ There are a number of reasons why this may be the case. A lower leverage may give the company higher flexibility. The resulting higher rating may be prestigious, and management may put emphasis on accounting numbers as a low book value per share may result in higher scrutiny by the board or in lower bonuses.⁵⁴

Alternatively, the fact that the number of equity issues increases, after a rise in stock prices could also be explained by the q-theory of investment. Management might simply perceive rising prices as a signal to invest more and consequently get additional capital from the financial markets.

Baker et al. (2002) support the idea of an equity financing channel. They report that in their sample financially constrained firms, which they expect to be particular dependent on equity, show three times higher q-investment sensitivities, than the comparison group, which has enough funds at hand. Goyal and Yamada (2000) demonstrate as well that in some situations the stock market is not a side show, but that investment is sensitive to fundamental and non-fundamental components of stock prices.

⁵¹ See Fischer (1984) p. 39.

⁵² See Blanchard (1993) pp. 118f.

⁵³ See Hovakimian (2001) p. 31 and Dow (1995) p. 6 ⁵⁴ See Hovakimian (2001) pp. 15f.

Other empiric studies of the equity financing channel, however, show that in general it seems to be weak. Blanchard, Rhee, and Summers (1993) find evidence for the fact that stock prices exercise a smaller influence than fundamentals. Morck, Shleifer, and Vishny (1990) confirm this result and additionally show that the respective influence is mainly a redistribution of investment over time.

Exhibit 1 summarizes the three possible relations, based on the three channels, between changes in stock prices and investment behavior. In the next section we will discuss the role of the three channels for growth companies and then test which of the channels explain q-investment sensitivities.

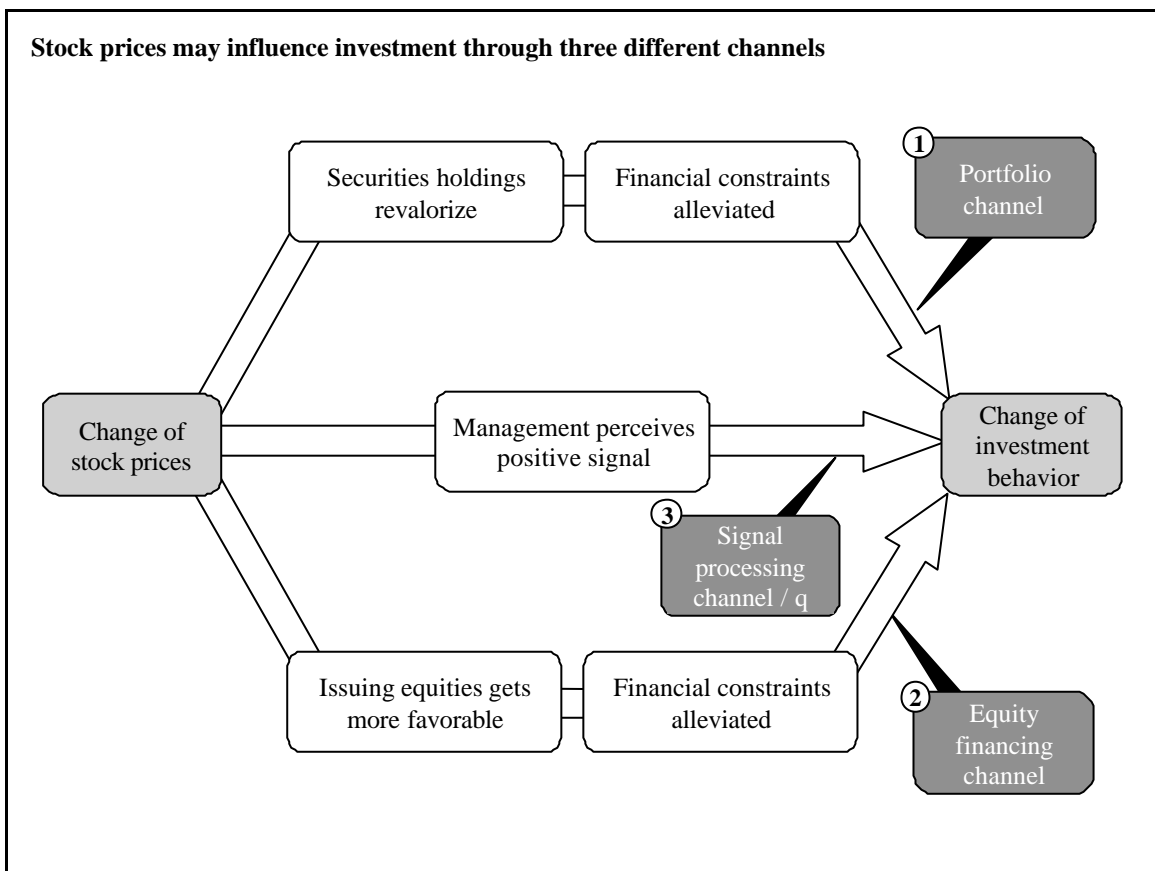


Exhibit 1: Possible influence channels between stock prices and investment behavior

2.4. Investment of Growth Companies and Stock Exchange Prices

There are a number of arguments, why growth companies should react in a different way to stock prices than other firms: They may face different capital market conditions, they

may be more responsive to changes in expectations or opportunities, and they may depend on equity finance to a larger extent.

There is some support for the hypothesis that capital markets may be less efficient for smaller firms. A lower level of information exchange between firms and investors, less intense analyst coverage, higher bid-ask spreads,⁵⁵ and lower turnovers which lead to exaggerating prices are some of the reasons, which may lead to distortions in the signals coming from the stock market. Q could for this reason play a lesser role for small firms.⁵⁶

However, there is also evidence that growth companies depend on stock prices in a stronger way than large caps. The reason therefore may lie in the existence of a portfolio channel, an equity financing channel, or a signal processing channel according to the q theory.

It may appear counterintuitive, that security holdings are more relevant for growth companies, in fact it is likely that growth companies hold a higher percentage of cash and securities. They often get financed with a large chunk of capital at a certain point in time, by a venture capitalist, a private equity donor or through an IPO.

The other ways of influence are more obvious. Smaller and newer firms may not be able to raise all the funds they could profitably invest through borrowing and may hence be more dependent on equity finance.⁵⁷ Alternative sources of finance like banks are often not accessible. For regulatory reasons, banks may shy away from taking risky loans to growth companies, with few collateralizable assets and significant uncertainty on their books. In addition, banks often lack the knowledge to effectively monitor such firms. Even, if banks are willing to pursue such an investment, the rates they would need to charge to be compensated for the risk appropriately are probably restrictively high for the borrowing firms.⁵⁸ Internal equity finance through retained earnings is only a solution

⁵⁵ Minton (1999) uses these two criteria to explain higher cash flow sensitivity.

⁵⁶ See Lamont (1996) p. 3.

⁵⁷ See Morck (1990) p. 167.

⁵⁸ See Gompers (2000) pp. 131f.

for a limited number of firms, as growth companies regularly do not have large earnings at their disposal. This leaves external equity as the prime source of finance.

However, not only the equity financing and the portfolio channel, but also the signal processing channel according to the q-theory can explain the higher relevance of stock prices for growth firms. They may simply be more responsive to changes in investment opportunities than the more mature ones. Small companies could be better capable to respond to news, changing expectations and new business opportunities, as they are less bureaucratic and hierarchical than their large counterparts.⁵⁹

2.5. Hypotheses on Influence of Stock Prices on Investment of Growth Companies

From the discussion of the role of stock prices for investment and the particularities of growth companies we can derive a set of testable hypotheses.

Based on the finding that q is more relevant for small companies, which we demonstrated based on the same panel already in Swoboda (2002), we will test the three possible explanations derived above, the signal processing-, the portfolio- and an equity financing channel, for the role stock prices play for the investment activity of growth companies.

We start with the portfolio channel. We expect that growth companies face a stronger exposure to stock prices, because *cash and security holdings are larger for growth companies (hypothesis 1a)*.

It is difficult to directly test the remainder of the first line of reason that capital gains, which a company has made on the stock exchange, drive investment, as unrealized capital gains are not reported according to most accounting schemes.⁶⁰ Consequently, we

⁵⁹ See Kadapakkam (1998) p. 307.

⁶⁰ According to for example the German HGB any price increase above its initial price cannot be reported prior to selling the security. According to internationally accepted accounting principles (e.g. IAS, US GAAP), such gains can increase equity, if the securities are classified as available for sale, a classification, which underlies a large interpretation leeway. Unrealized gains are, however, not reported in the profit and loss account. (Swoboda (1999) p. 44ff .

need to choose a different approach. We follow the prominent literature on cash-flow sensitivities of investment, and we will adopt the approach used there. When testing, whether cash flow influences investment, the standard approach chosen by most authors is to split the sample *ex ante* into different groups, which are expected to react in a different way to changes in the driver.⁶¹

We hence assume that, if soaring stock prices influence investment via a portfolio channel, cash holdings would be a significant determinant of investment, however, only, if overall stock prices are high, which leads to the generation of a relevant cash windfall.

We test this effect with **hypothesis 1b**: *If (overall) q's are high, holdings of securities should be a relevant driver of investment. If q's are low the relationship should be weaker.*

The second line of reason is, whether equity finance actually is more important for investment of growth companies than it is for large caps. We test this hypothesis with a three step approach. We will compare the share of finance of external equity, debt capital and retained earnings for large caps and growth companies (hypothesis 2a). Secondly, we analyze, whether growth companies actually issue equity rather when *q* is high (hypothesis 2b), and thirdly we examine the differences in investment - *q* sensitivities between financially constrained companies and their unconstrained counterparts (hypothesis 2c).

Hypothesis 2a deals with external equity financing and growth companies. It is not possible to directly relate investment and inflowing funds to determine how investment is financed. We can, however, decompose a firm's inflows in its components retained earnings, debt and equity issues to see, whether *investment of growth companies is financed to a larger extent by external equity, whereas debt capital and retained earnings play a lesser role.*

⁶¹ See inter alia Fazzari (1988) and Chapman (1996) who use pay-out ratios to identify financially constrained companies, or Hoshi (1991) and Shin (1999) who distinguish between firms with and without links to a conglomerate.

The second precondition is that equity issues rather take place if valuations are high, otherwise prices would, in spite of the importance of equity finance, not directly influence investment. Consequently **hypothesis 2b** postulates that *growth companies issue equity, rather when stock prices and respective q's are high than when they are low.*

An additional indicator for the role of the stock exchange as source of finance is again based on the typical approach with respect to cash flow-investment sensitivities described above. We assume that financially constrained firms depend on equity finance to a larger extent than unconstrained companies and there from derive **hypothesis 2c**: *For a group of financially constrained companies, q should play a more important role as driver of investment, than for the control group of not constrained firms.*

To identify financial constraints, we chose a similar approach as the comprehensive literature on cash flow-sensitivity of investment, which selects firms without financial slack. We therefore chose two different variables, which have also been used by comparable studies: The amount of cash, which we adjust for differences in size and in asset intensity by dividing it by fixed assets,⁶² and the amount of working capital, which is the ratio of cash and stocks divided by current liabilities, and shows whether short term liabilities are backed by short term liquidity. The worse these ratios get, the higher are the chances that a company faces liquidity constraints and possibly financial distress.⁶³

A parallel approach is to measure a firm's gearing, based on the assumption that a higher leverage serves as indicator for financial constraints. We calculate two respective ratios: The equity ratio simply measures how much debt a firm has already taken on its books,⁶⁴ whereas the coverage ratio ((non-current liabilities + shareholders' funds) / fixed assets) shows the long term flexibility with respect to debt policy.⁶⁵

⁶² See also Behr (2000) p. 268, who uses the ratio of (cash + securities available for sale)/fixed assets.

⁶³ See Vermeulen (2000) p. 14 and Behr (2000) p. 267.

⁶⁴ Vermeulen (2000) p. 14 argues in a similar way and uses the debt to total assets ratio to determine companies with a weak balance sheet, which he expects to be financially constrained, Hu (1995) p. 477 follows a similar logic and uses a debt to market value ratio.

⁶⁵ See Behr (2000) p. 267.

An additional popular proxy for financial constraints is the dividend pay-out ratio. As growth companies typically do not pay out dividends, we will not rely on it.⁶⁶

The higher impact of q on growth companies may not be driven by liquidity effects, but based on the signal processing channel coming from a better ability of growth firms to respond to changes in q . It is difficult to explicitly test this ability. However, we found two indirect ways to test the effect. Firstly, the ability of a firm to adapt to changes may decrease with an increase in size, as the organization may lose its flexibility. There from we derive **hypothesis 3a**: *If growth companies are able to better respond to changes in q , we expect that they are likely to lose this ability while growing. Hence, larger growth companies should be less sensitive to q than their yet smaller peers.*

Secondly, following the q theory and assuming that growth companies react in a superior way only to changes in rational expectations, the increased q -sensitivity of investment should only be observable as long as expectations are reasonable. In phases of an irrational exuberance, when stock prices soar beyond rational expectations the sensitivity should be weaker, whereas according to the equity financing and portfolio channel irrational valuations should be exploited, as well, in phases of exaggeration. The corresponding **hypothesis 3b** is: *If growth companies respond to rational expectations, the q -sensitivity of investment should decrease in periods, when expectations become irrational.* For the respective test, we split the firm years in our panel in two groups, depending on whether the year is assigned to a rational or an irrational phase.

Exhibit 2 below summarizes the hypotheses and the respective tests.

⁶⁶ See Kaplan (2000) pp. 709f, who also uses this fact as a theoretic argument against the validity of pay out ratios as measure of financial constraints.

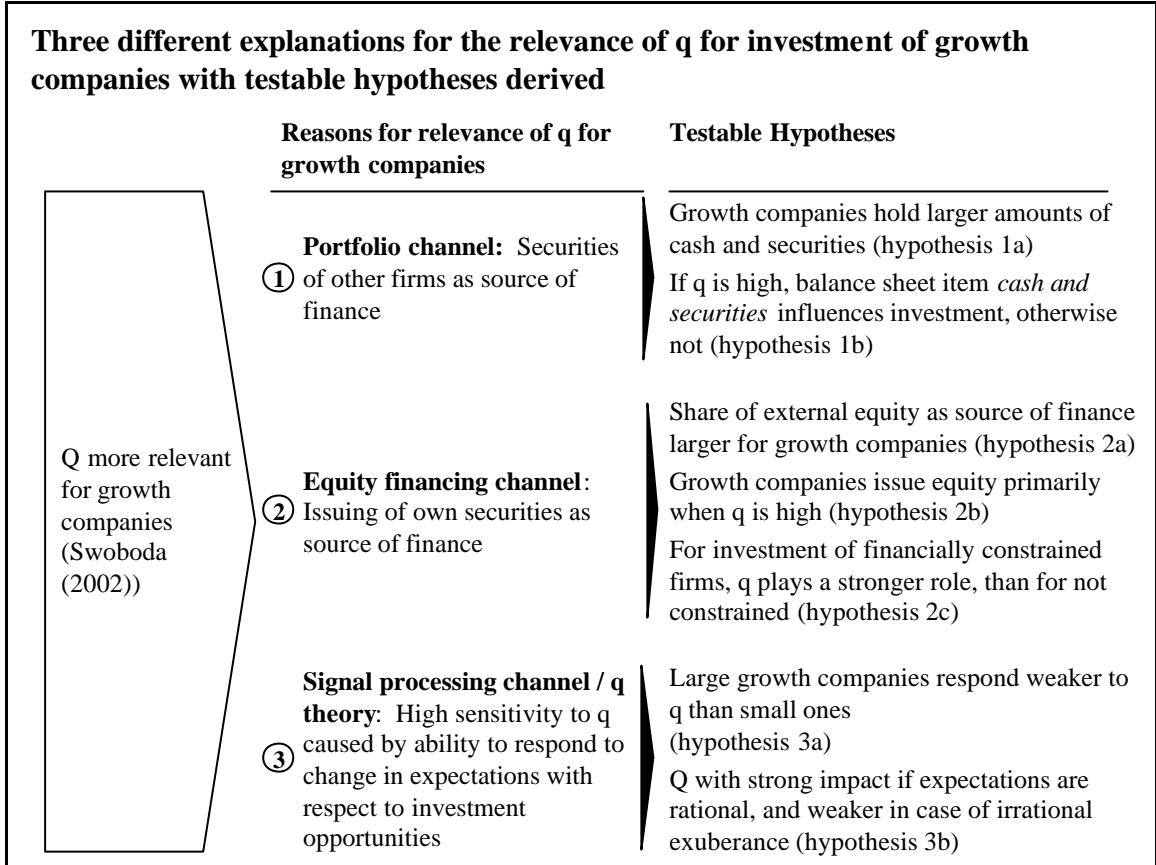


Exhibit 2: Hypothesis on stock prices and investment of growth companies

3. DESCRIPTION OF DATA SAMPLE

Before we report the results of our regressions, we briefly describe our panel of growth companies and the control group of large caps.

We use the same set of companies as Swoboda (2002), where a more detailed description of the sample can be found. The data we use is mostly taken from OSIRIS, which is a database of listed corporates, banks and insurance companies around the world. In addition to income statement, balance sheet, cash flow and business ratios it contains

news, ownership information, ratings, earnings estimates and stock data. According to its self-definition, it is the most complete global listed company database available.⁶⁷

From that database, we selected listed growth companies from the growth markets of the leading stock exchange indices from five European countries (*Neuer Markt* in Germany, the UK *Tech Market*, the *Nouveau Marché* in France, the *Nuovo Mercato* in Italy, and the *Nuovo Mercado* in Spain).

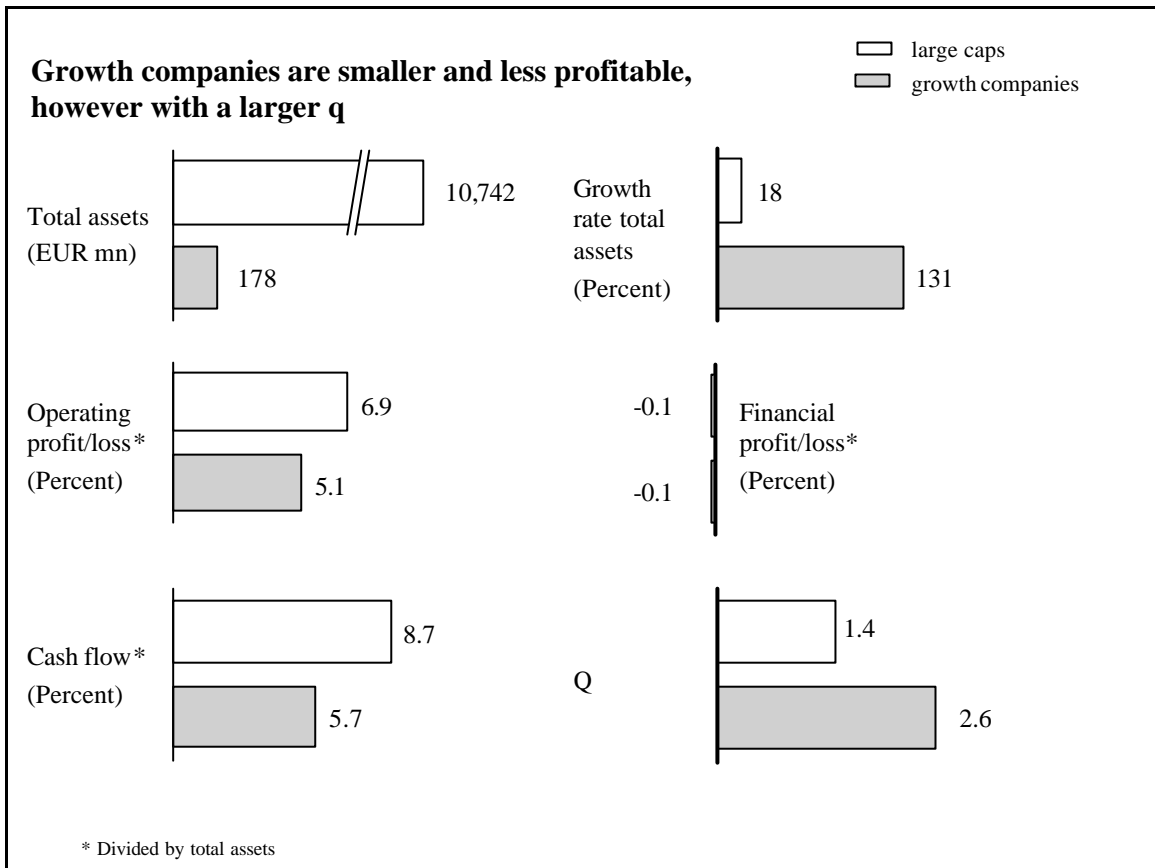


Exhibit 3: Key ratios of sub samples

We use a sample of large caps from the same database, which is composed of companies from lead indices of the five countries as comparison group. The selected indices

⁶⁷<http://www.osiris.bvdep.com/cgi/template.dll?freetpl=frame.tpl&product=20&page=SuiteProductPage.asp&productname=OSIRIS>.

account for approximately 75-80 percent of the market capitalization of the respective countries.⁶⁸

Financial firms are excluded from both samples to avoid a distortion of the results, due to differences in their balance sheet structure.⁶⁹ Exhibit 3 summarizes some key ratios of both sub samples.

3.1. Operationalization of Variables

In the following, we describe, how we operationalized investment, and its four drivers.

3.1.1. Dependent Variables

Investment undertaken by a company in a certain year equals the difference of total assets between t and t-1 plus the depreciations in period t. If the replacement investment falls short of depreciation, investment of period t is negative. The same logic applies to the various sub-categories (tangible and intangible fixed assets,⁷⁰ current assets (inventories, receivables, and liquidity), human capital, immaterial assets).⁷¹ The scope of the different categories of investment is chosen according to the definitions in Swoboda (2002).

As it is estimated that roughly one half of investment is replacement investment⁷² or that replacement investment even predominates total investment expenditures at the aggregate level,⁷³ we measure investment in fixed assets as gross investment, i.e. including depreciation.⁷⁴ For all other kinds of investment, including off-balance items we use a net investment rate, as information on depreciation of the respective balance or even off-

⁶⁸ Weighted average according to total market capitalization of stock exchange.

⁶⁹ Similar approaches have been taken by inter alia Fama (1999) and Hovakimian (2001).

⁷⁰ For some companies OSIRIS additionally includes "other fixed assets", which we do not include into our study.

⁷¹ A similar approach is chosen by Demirgüç-Kunt (1996), who distinguishes between long-term and short-term investment (p. 3).

⁷² See Feldstein (1980) p. 13.

⁷³ See Kuznets (1961) quoted after Jorgenson (1971) p. 1112.

⁷⁴ Inter alia Oliner (1995), Hoshi (1991), Funke (1998), Behr (2000).

balance sheet items is not available.⁷⁵ To account for differences in size and for inflation over time and to avoid heteroscedasticity we divide change in assets by the respective item at the beginning of the period.

$$I_t = \frac{K_t - K_{t-1}}{K_{t-1}} \text{ and } I_{FA_t} = \frac{K_{FA_t} - K_{FA_{t-1}} + d}{K_{FA_{t-1}}}$$

Equation 6: Operationalization of investment

with $K_t - K_{t-1}$ being the change in the capital stock in period t and d being depreciation.

With respect to human capital, the approach is different. We simply measure changes in the number of employees (FTE), as reported from the OSIRIS database.

3.1.2. Independent variables

Besides q , which is our key variable, we include output, cost of capital, and liquidity in our regressions to control for the respective effects. We use the same operationalization as Swoboda (2002). In addition we introduce the variables "cash and security holdings", which we need to test hypothesis 1. We will take the respective balance sheet item "cash and securities" from Osiris and divide it by total assets to adjust for differences in size and to avoid heteroscedasticity.

The main focus, however, lies on stock exchange prices and expectations. Expectations ideally would be measured by marginal q . The reason for marginal q to be unobservable is already described in section 2.3.1.1. In contrast to few other authors, who use general proxies for Tobin's q (e.g., stock index divided by price index, return on capital divided by cost of capital,⁷⁶ return on invested capital divided by cost of capital,⁷⁷ econometric forecasts⁷⁸), we follow the majority, who calculate q explicitly, based on proxies for

⁷⁵ A similar approach is chosen by inter alia Chapman (1996) and Kadapakkam (1998), an alternative suggested by inter alia Nadiri (1993) is to calculate depreciation rates.

⁷⁶ See Behr (2000) p. 264f or Gugler (2000) pp. 6ff .

⁷⁷ See Jenkinson (1981) p. 52.

⁷⁸ See Abel (1986) pp. 252ff.

market value and book value at replacement costs as shown in Equation 4 taken from chapter 2.

$$q = \frac{E_{(MV)} + De_{(MV)}}{A_{(r)}}$$

Equation 4: Tobin's q

The numerator consists of the sum of the market values of debt and equity.⁷⁹ Alternative possibilities are to rely on analysts' forecasts,⁸⁰ or on dividends and dividend payout ratios.⁸¹ Market value of equity thereby is compound of the market value of common stock plus the market value of preferred stock. Whereas the value of common stock is simply the number of outstanding shares multiplied by its year-end price, preferred stock by some authors is valued by capitalizing its dividend as a perpetuity.⁸²

We use upon availability the compound market value of equity and debt at the beginning of the fiscal year, which is published by Bloomberg or alternatively the beginning of year market value of equity from Datastream and add the value of long term debt. One might argue that by taking the valuation of a single day at the beginning of the fiscal year, high level of noise could be included.⁸³ Previous results nevertheless suggest that using time averaged market valuations does not radically improve the results.⁸⁴

As market value of debt is considerably harder to obtain and on the other hand is less volatile than the one of equity, we use book value of debt from the OSIRIS database as a

⁷⁹ See Brainard (1977) p. 249; an alternative formulation leading to the same result was introduced by Kaplan (1997): He uses the book value of assets plus the market value of common equity less the sum of the book value of common equity. Another approach is to calculate q based only on market and book value of equity (see Gehrke (1994) p. 127.

⁸⁰ See Bond (2001) p. 28.

⁸¹ See Barro (1990) p. 120.

⁸² See Whited (1992) pp. 1456f and Fazzari (1988) pp. 192ff.

⁸³ The respective market valuation is actually taken from the last day of the previous fiscal year of the company, which is December 31st in most, but not in all cases; by selecting this value we avoid possible endogeneity problems.

⁸⁴ See Alonso-Borrego (1994) pp. 59.

proxy for market value of debt, when total market value is not available.⁸⁵ Some authors further adjust book value. Fazzari (1988) for example adjusts long term debt for differences in coupon payment between the companies and Baa risk, however, do not find that this changes their results.⁸⁶ Examining a US sample, Klock (1991) finds q at book value to differ from q at market value. However, even in this more sophisticated calculation of market value based q , bank loans, floating-rate notes, and commercial paper are taken at book value.⁸⁷ Given the fact that European companies in comparison to US firms have a much lower share of issued, not to speak of publicly held debt, we will follow Gehrke (1994) and take debt at book value.

A part of the literature adjusts for future tax allowances related to investment already made.⁸⁸ Due to the fact that investment is not very responsive to tax policy,⁸⁹ and due to a lack of comprehensive data we follow the other group of authors, who does not explicitly correct for the net present value of future tax reductions due to depreciation.⁹⁰

The denominator of Equation 4 consists of the replacement cost of assets. Liquid securities, inventories, and accounts receivable are regularly accounted for at a market value.⁹¹ In some cases those assets are not a part of the denominator, but rather are deducted from the amount of debt in the numerator.⁹² For assets such as goodwill or

⁸⁵ Kathuria (1995) chooses the same approach and argues that experiments with estimated market values regressed on book values yielded coefficients of 1.0 with R^2 s of 99 percent (p. 231); Barro (1990) for example finds that the fluctuation of q is dominated by the growth rate of the market value of equity, in comparison to fluctuations in market value of debt are minor (p. 120); alternative approaches are to adjust book value of debt by the method of Bernanke and Campbell (1988) (see Whited (1992) p. 1457) or calculate its market value by dividing the reported interest expenses by a market interest. (inter alia, Hoshi (1991) pp. 44f).

⁸⁶ See Fazzari (1988) p. 192.

⁸⁷ See Klock (1991) p. 245.

⁸⁸ Inter alia Kaplan (1997) p. 177, Alonso-Borrego (1994) p. 51, Fazzari (1988) p. 194.

⁸⁹ See Chirinko (1993a) p. 1893.

⁹⁰ Inter alia Hoshi (1991) p. 45, Hu (1998) p. 491, Cuthbertson (1995) p. 939, Barro (1990) p. 118, and Devereux (1989) p. 8.

⁹¹ See Behr (1998) p. 41ff.

⁹² Inter alia Barro (1990) p. 120.

patents other than book values are hardly available.⁹³ The value of physical capital can be adjusted by using a recursion technique, but there are a number of uncertainties within the respective calculations, which are likely to rather decrease than increase the accuracy of the calculation.⁹⁴ In addition, the rather short time series of our panel and the low inflation rate in the 1990s would only lead to a limited adjustment.

Structural shifts like the rise in energy prices in the 1970s may lead to a faster devaluation of existing assets. However, empiric studies find little evidence for this "capital mismeasurement" hypothesis.⁹⁵ As all improvements obtained from these more involved computations of q are fairly limited,⁹⁶ we take the book values taken from OSIRIS.

For a practical reason, we use the same q for all different kinds of investment. As it is not possible to divide the market value among different balance sheet items we have to live with this shortcoming. Given the long list of problems associated with q , starting by the unobservability of marginal q , we expect to be this uniform q to be an acceptable proxy for the different equations.

4. EMPIRIC RESULTS

This section contains a brief description of the methodology of the regression, followed by a detailed report of our results.

⁹³ See Hoshi (1991) p. 45.

⁹⁴ See Gehrke (1994) p. 52.

⁹⁵ See Chirinko (1993) p. 1890.

⁹⁶ Inter alia Kaplan (1997) p. 177 and Fazzari (1988) p. 166; additionally we want to emphasize that a systematic bias of q across the whole sample (e.g., due to the prohibition to take certain items onto the balance sheet) should not change result of our regression.

4.1. Methodology of Regression

To test whether different groups of companies behave in different ways, we split the panel into sub samples along the variables derived above and separately perform ordinary least square (OLS) regressions for the groups. This is the standard approach, also chosen by most authors.⁹⁷

The tested equation includes all four variables defined above (? sales and cash flow (both divided by the beginning of period), capital stock, cost of capital and q, as well as an error term):

$$\frac{I_{it}}{K_{it}} = \mathbf{a}_1 + \mathbf{a}_2 * \frac{\Delta Sa_{it}}{K_{it}} + \mathbf{a}_3 * \frac{CF_{it}}{K_{it}} + \mathbf{a}_4 * UC_{it} + \mathbf{a}_5 * q_{it} + \mathbf{e}_{it}$$

Equation 7: General investment model

For the test of hypothesis 1b we additionally include "securities and cash holdings" (s+c) into the equation (Equation 8).

$$\frac{I_{it}}{K_{it}} = \mathbf{a}_1 + \mathbf{a}_2 * \frac{\Delta Sa_{it}}{K_{it}} + \mathbf{a}_3 * \frac{CF_{it}}{K_{it}} + \mathbf{a}_4 * UC_{it} + \mathbf{a}_5 * q_{it} + \mathbf{a}_6 * (s+c)_{it} + \mathbf{e}_{it}$$

Equation 8: Investment model for hypothesis 1b

The data sample has been cleaned of outliers which are not within one standard deviation. This approach has two advantages: Firstly, it excludes extreme outliers for example caused by bankruptcy or enormous growth rates in the first year(s) in the life cycle of a company, which may distort the regression. Secondly large mergers and acquisitions, which may alter the result, are automatically omitted. We decided to not further truncate the sample by excluding all acquisition activities,⁹⁸ as we regard the acquisition (and consolidation) of a company as merely a different way of capital investment.

⁹⁷ See inter alia Fazzari (1988) or Hoshi (1991).

⁹⁸ For an alternative approach see Whited (1990).

A potential bias within our sample could originate from the fact that we are pooling observations from different firms and different periods. Investment could vary systematically independent from the variables we selected and hence be different for our two sub samples. The length of our time series unfortunately does not allow alternatively suggested approaches, as the "heterogeneous panel estimator" in which equations are independently calculated for each company or the within-estimator approach.⁹⁹ To avoid this effect we follow Chapman (1996) and others by scaling cash flow, sales and investment with total assets.

As we showed in Swoboda (2002) the model is not affected by serial correlation or collinearity. Neither are the results distorted by the inclusion of time or sector dummies.¹⁰⁰

In order to insure comparability among the coefficients of different variables, we report the z-transformed betas instead of the unstandardized coefficients for all equations, which are available from the authors upon request. The significance of the coefficients is indicated by *** for a 99 percent, by ** for a 95 percent, by * for a 90 percent, and by + for an 85 percent confidence interval. The exact t-values and standard errors are available from the authors upon request.

To enhance the readability of the results, we mark the sub sample which shows the stronger and significant correlation with the expected sign (i.e. positive for sales, cash flow and q, negative for interest) with a dark shade and a weaker, albeit significant correlation with the expected sign with a lighter shade.

4.2. Empiric Test of the Portfolio Channel

The first test we conduct is, whether securities of other firms serve as source of finance. According to hypothesis 1a, growth companies have larger cash and securities holdings at their disposal. Exhibit 4 shows that this is the case with respect to the average, for which

⁹⁹ Inter alia Kadapakkam (1998)p. 302.

¹⁰⁰ See Swoboda (2002) p. 41.

the hypothesis of identical means is clearly rejected, as well as for the median of the respective balance sheet item.

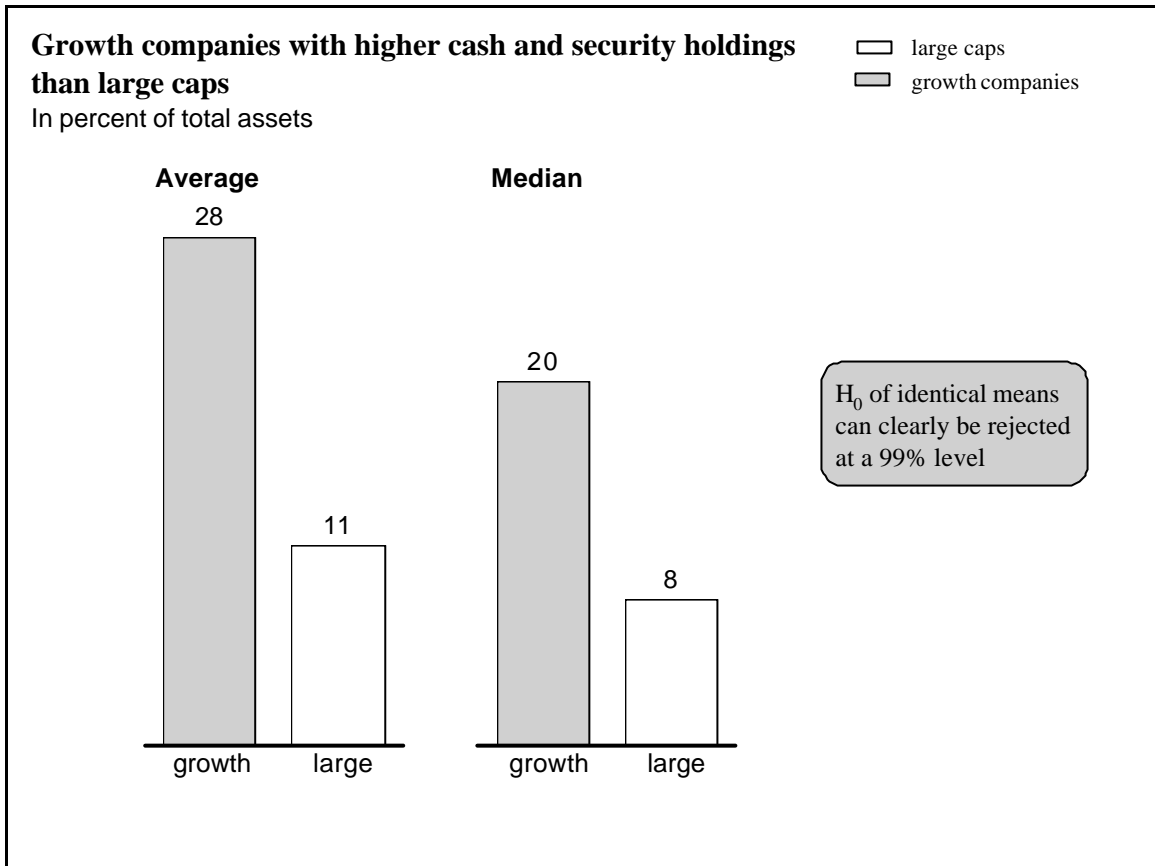


Exhibit 4: Cash and security holdings of growth companies and large caps

Hypothesis 1b states that *If (overall) q's are high, holdings of securities should be a relevant driver of investment. If q's are low the relationship should be weaker.*

We therefore segregate our sample into two groups: Firm years with an - on average - high q, and firm years for which q is lower. The three years with the highest q of more than 2.5 are 1997 to 1999.¹⁰¹ Observations from these three years, which cover about half of our firm years, are marked as high q years, whereas all other observations (i.e. 1991 to 1996 and 2000) are considered low q.

¹⁰¹ Q-Values of growth companies are generally higher, q of large caps of the control group is between 0.9 and 1.6, for a more detailed description of the data sample and a comparison with the q-values from other studies refer to Swoboda (2002).

Little influence of security holdings in both high- and low-q years

Standardized coefficients (beta)

		Total Assets	Fixed Assets	Tangible Fixed Assets	Intangible Fixed Assets	Current Assets	Stocks	Debtors	Cash	Employees	Immat Assets
high q	securities	0.024	-0.116	0.035	-0.039	0.128 +	-0.301 ***	-0.096	0.387 ***	-0.021	0.029
	? Sales	0.380 ***	0.097	0.197 *	0.192 +	0.460 ***	0.139	0.482 ***	0.281 ***	-0.101	-0.151
	CF	0.217 **	0.035 **	-0.148 +	0.242 **	0.287 ***	0.093	0.168 **	0.324 ***	0.243 *	0.489 **
	Interest	-0.227 ***	-0.187 *	0.037	-0.055	-0.206 **	-0.223 **	-0.275 ***	-0.092	-0.215 *	0.138
	Q	0.190 **	0.172	0.239 **	0.243 **	0.084	0.071	0.217 ***	-0.020	0.261 **	-0.066
	n	110	108	109	77	110	96	108	110	64	31
low q	securities	0.019	-0.189 **	0.023	-0.179 *	0.368 ***	-0.049	0.122	0.444 ***	-0.185 +	0.105
	? Sales	0.271 ***	0.074	0.304 ***	0.077	0.333 ***	0.212 **	0.277 ***	0.267 ***	-0.110	0.306 **
	CF	-0.093	0.164 **	-0.188 **	0.035	0.051	0.249 ***	0.039	0.048	-0.165	0.466 ***
	Interest	-0.033	-0.264 ***	0.030	-0.029	0.011	-0.397 ***	-0.007	0.058	0.039	0.160
	Q	0.285 ***	0.275 ***	0.342 ***	0.307 ***	0.067	0.079	0.148 +	-0.014	0.221 *	0.149
	n	153	145	151	114	153	125	151	153	76	54

xyz Sign as expected (i.e. positive for securities) and stronger than comparison group
 xyz Sign as expected

Explanation

- Firm years split into two groups, depending on whether average q of growth companies is above or below 2.5
- Balance sheet item "cash and securities" with little explanatory power for investment, with on exception: Companies with large cash holdings seem to pile up even more cash
- Little difference between high- and low-q years leads to rejection of hypothesis 1

+ 85% confidence interval
 * 90% confidence interval

** 95% confidence interval
 *** 99% confidence interval

Exhibit 5: Regression results for impact of security holdings on investment of growth companies in years with high and low q

We then perform separate regressions for the two samples, in which we include the four traditional drivers of investment, output, cost of capital, expectations and liquidity to control for the respective effects, as well as the variable for cash and securities on the balance sheet. To support hypothesis 1, the impact of cash and security holdings should be significant, however, only in the firm years with a high q. The results are summarized in Exhibit 5.

We do not find support for hypothesis 1b. Neither do we find significant impact of cash and security holdings on investment in general, nor do we find different patterns in high- and low-q years. Consequently, we reject hypothesis 1b that stock prices influence investment via a portfolio channel as an additional source of finance.

4.3. Empiric Test of the Equity Financing Channel

To test hypothesis 2, if q influences investment through an equity financing channel, we conduct the three step approach laid out in section 2.5..

We expect growth companies to stronger depend on external equity capital, than large caps. A first look at the respective equity to debt ratios supports this idea. The capital of growth companies is to 45 percent composed of equity, whereas large caps have only 35 percent of equity on their books. However, only a more thorough analysis reveals the full strength of the dependency of growth companies from equity and whether we find support for hypothesis 2a that *investment of growth companies is financed to a larger extent by external equity, whereas debt capital and retained earnings play a lesser role.*

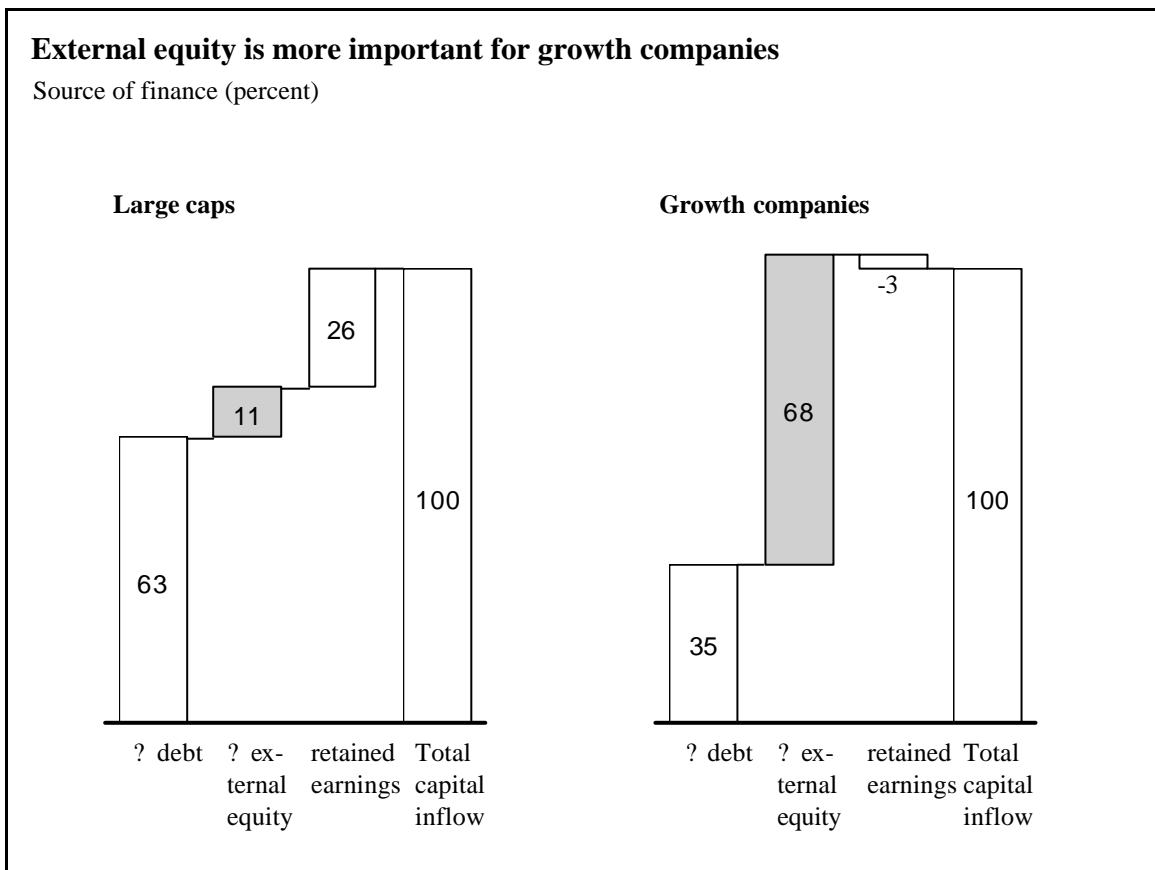


Exhibit 6: Decomposition of sources of finance into changes of debt, external equity and retained earnings

Therefore we decompose the sources of finance, which the company uses to finance its investment. For pure arithmetic reasons, the amount of capital a company invests in

balance sheet items in one period must equal the amount it takes in as either external equity, external debt or keeps as not distributed earnings. We calculate these three numbers from the balance sheets of every company for every year in our sample. Changes in debt, thereby is composed of the changes in current and non-current liabilities, retained earnings is profit/loss less possible dividends, and changes in equity is changes in shareholders' capital less retained earnings.

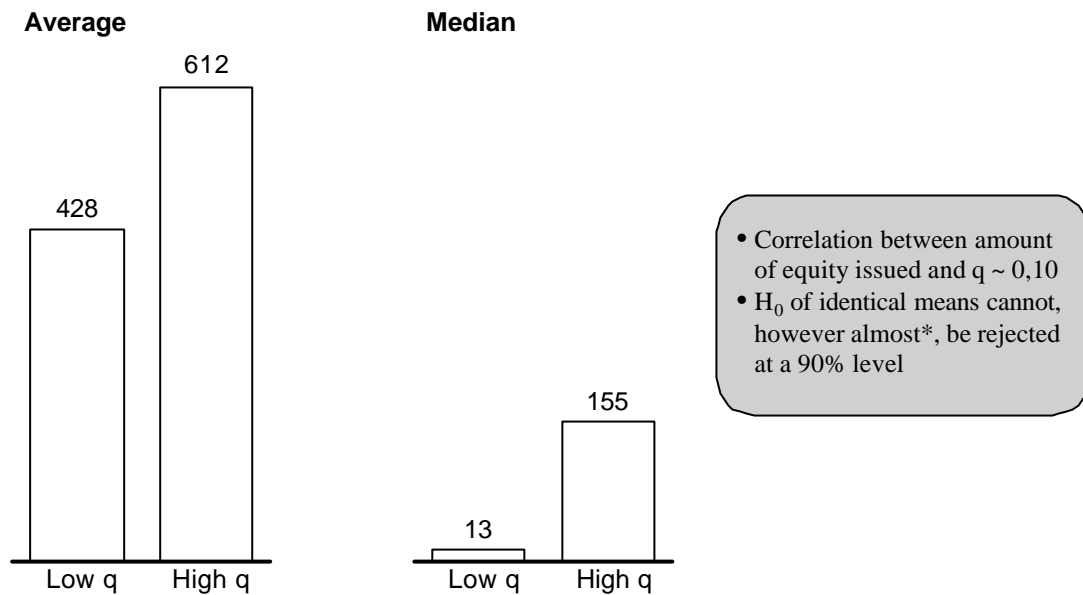
As Exhibit 6 shows, growth companies rely much more on external equity than the comparison group. Whereas in accordance with previous studies, large caps mostly use debt capital and retained earnings and in average take in only 11 percent of the required capital as external equity, the situation is different with respect to growth companies. In contrast to large caps, which rely for two thirds of their additional finance volume on debt, growth companies bring down this number to less than one third. Whereas large caps retain earnings which sum up to about one quarter of the required capital, growth companies actually have negative (sic!) retained earnings. That means that the (debt and equity) capital they take up in average is "burned" and no profit can be used to strengthen the capital bases.¹⁰²

However, even if issuing equity is crucial for investment of a growth company, there can only be a causal relationship between q and investment for this reason, if a high q facilitates the issuance of equity, as formulated in hypothesis 2b: *Growth companies issue equity, rather when stock prices and respective q 's are high than when they are low.* To find out whether this is the case, we analyze in a second step, whether firms actually do issue equity if valuations are high. The evidence we find is ambiguous. By comparing the amount of equity issued from companies with a high q and the ones with a low q we do find a wedge between the two.

¹⁰² From an arithmetic point of view, the second possible explanation would be that companies would distribute dividends, which are higher than the respective profits. This is not only prohibited by law, but can also be ruled out as explanation for growth companies, as the vast majority does not pay out any dividend.

Firms with high q issue more equity than firms with low q, respective correlation coefficient nevertheless small

In percent of equity at beginning of year



* Actually at the 89% level

Exhibit 7: Equity issuance of companies with high and low q

As Exhibit 7 shows, the support we find is only significant to a limited extent. Companies with a higher q do issue more equity, both measured as the arithmetic average and as the median, which is much lower in both cases. This is caused by the fact that, if a firm initially issues equity, the change calculated as percent of prior equity naturally is large. When we test the hypothesis of identical means, we cannot reject it on a 90 percent level, but the p -value gets very close to that. The correlation between the amount of equity issued and q thereby is about 0.10.

Summarizing, we can say that although we do find indications, there is no clear evidence, in support of hypothesis 2b that companies with a higher q are more likely to issue equity than companies with a lower one.

Investment of companies without financial slack not with higher q-sensitivity

Sign as expected (i.e. positive for q), significant and stronger than comparison group
 xyz Sign as expected

Standardized coefficients (beta)

	Total Assets	Fixed Assets	Tangible Fixed Assets	Intangible Fixed Assets	Current Assets	Stocks	Debtors	Cash	Employees	Immat Assets
Cash / fixed assets										
Restricted Q	0.250 ***	0.218 **	0.384 ***	0.264 **	0.108	0.028	0.259 ***	-0.145 +	0.189	0.097
Sales	0.200 **	0.065	0.330 ***	0.080	0.401 ***	-0.036	0.357 ***	0.141 +	-0.089	0.240 *
CF	-0.109	0.165 *	-0.204 **	0.031	0.159 **	0.250 ***	0.055	0.200 **	-0.184	0.528 ***
Interest	-0.179 *	-0.289 ***	-0.045	-0.094	-0.275 ***	-0.330 ***	-0.235 ***	-0.085	-0.106	0.083
n	126	117	123	109	126	111	122	126	60	42
Not restricted										
Q	0.211 **	0.248 ***	0.182 *	0.318 ***	0.149 *	0.123	0.107	0.149 *	0.214 *	0.198
Sales	0.384 ***	0.021	0.116	0.197 *	0.388 ***	0.415 ***	0.304 ***	0.359 ***	-0.149	0.225
CF	0.010	0.060	-0.149 *	0.334 ***	-0.044	0.150 +	0.065	-0.102	0.289 ***	0.298 **
Interest	0.028	-0.031	0.194 **	0.000	0.057	-0.264 ***	0.033	0.088	0.073	0.235 +
n	137	136	137	82	137	110	137	137	81	43
(Cash + stocks) / current liabilities										
Restricted Q	0.263 **	0.157 +	0.424 ***	0.260 **	0.043	-0.197 *	0.112	-0.042	0.134	0.294
Sales	0.163 +	0.239 **	0.152	0.047	0.459 ***	0.115	0.501 ***	0.141	-0.189	0.256
CF	0.138	0.111	0.151 +	0.045	0.356 ***	0.033	0.212 **	0.340 ***	-0.044	0.363 *
Interest	-0.135	-0.336 ***	0.030	-0.052	-0.231 **	0.354 ***	-0.286 ***	-0.043	0.192	0.274
n	95	89	94	81	95	87	92	95	34	27
Not restricted										
Q	0.300 ***	0.226 **	0.329 ***	0.318 ***	0.206 **	0.413 ***	0.271 ***	0.127	0.235 **	0.146
Sales	0.220 ***	-0.086	0.192 **	0.089	0.230 **	0.030	0.008	0.200 **	-0.026	0.220 +
CF	-0.161 **	0.207 **	-0.293 ***	0.116	0.021	0.245 ***	0.090	0.009	0.030	0.531 ***
Interest	-0.173 **	-0.223 **	0.018	-0.102	-0.122	0.164 *	-0.146 +	-0.029	-0.174 +	0.034
n	144	141	142	96	144	132	143	144	88	48

Explanation

- Firm years split into two groups, depending on availability of financial slack
- Hypothesis 3c that investment of restricted companies (without financial slack) are more responsive to q not supported

+ 85% confidence interval
 * 90% confidence interval

** 95% confidence interval
 *** 99% confidence interval

Exhibit 8: Investment-q-sensitivities of sub samples according to financial slack

Hypothesis 2c finally postulates that the q-sensitivity of investment should be stronger for companies with financial constraints: *For a group of financially constrained companies, q should play a more important role as driver of investment, than for the control group of not constrained firms.*

We therefore split the sample into two groups according to whether we expect them to face financial constraints, along the variables from section 2.5.: Two proxies for financial slack (the amount of cash divided by fixed assets and the amount of working capital) and two proxies for gearing (the equity, and the coverage ratio). Exhibit 8 and Exhibit 9 contain the respective regression results.

Investment of companies with high gearing not with higher q-sensitivity

xyz Sign as expected (i.e. positive for sales, CF and q, negative for interest); significant and stronger than comparison group
 xyz Sign as expected

Standardized coefficients (beta)

		Total Assets	Fixed Assets	Tangible Fixed Assets	Intangible Fixed Assets	Current Assets	Stocks	Debtors	Cash	Employees	Immat Assets
Equity ratio											
Low equity share	Q	0.186 *	0.065	0.199 *	0.339 **	-0.032	0.077	0.025	-0.105	0.347 **	-0.101
	Sales	0.188 *	0.068	0.143 +	0.062	0.273 ***	-0.143	0.246 **	0.281 ***	-0.282 *	0.450 ***
	CF	-0.027	0.111	-0.198 **	0.085	-0.051	0.193 *	-0.044	-0.067	0.114	0.457 ***
	Interest	-0.112	-0.337 ***	0.033	-0.012	-0.034	-0.354 ***	-0.052	0.035	-0.098	-0.016
	n	108	104	106	78	108	94	106	108	45	38
High equity share											
Q	0.343 ***	0.292 ***	0.380 ***	0.303 ***	0.217 **	0.066	0.381 ***	0.086	0.247 **	0.287 *	
Sales	0.322 ***	0.102	0.297 ***	0.146 +	0.315 ***	0.177 *	0.353 ***	0.171 **	-0.009	0.148	
CF	-0.082 **	0.185 **	-0.180 **	0.090	0.108	0.276 ***	0.176 **	0.059	-0.023	0.414 ***	
Interest	-0.119	-0.222 **	0.077	-0.103	-0.072	-0.274 ***	-0.151 *	0.009	0.020	0.208	
	n	153	147	188	111	153	126	187	153	93	47
Coverage ratio											
Restricted											
Q	0.240 **	0.122	0.384 ***	0.262 **	0.105	0.130	0.249 ***	-0.077	0.013	0.243	
Sales	0.269 ***	0.069	0.264 ***	0.099	0.540 ***	-0.004	0.486 ***	0.304 ***	-0.176	0.494 **	
CF	-0.037	0.273 **	-0.173 *	0.064	0.242 ***	0.360 ***	0.102	0.291 ***	-0.180	0.368 **	
Interest	-0.153	-0.226 **	0.057	-0.084	-0.170 *	-0.129	-0.175 **	-0.068	0.078	0.004	
	n	92	82	89	79	92	82	89	92	45	27
Not restricted											
Q	0.185 **	0.351 ***	0.188 **	0.250 **	0.123 +	0.014	0.098	0.091	0.332 ***	0.082	
Sales	0.277 ***	0.027	0.184 **	-0.089	0.305 ***	0.282 ***	0.221 ***	0.265 ***	-0.102	0.048	
CF	-0.068	0.062	-0.170 **	0.151 +	-0.084	0.166 **	0.032	-0.131 *	0.258 **	0.393 ***	
Interest	0.002	-0.193 **	0.085	-0.149 +	0.042	-0.425 ***	0.000	0.101	-0.043	0.311 **	
	n	170	170	170	111	170	139	169	170	95	58

Explanation

- Firm years split into two groups, depending on equity and coverage ratio
- Hypothesis 3c that investment of restricted companies (with high gearing) are more responsive to q not supported

+ 85% confidence interval
 * 90% confidence interval

** 95% confidence interval
 *** 99% confidence interval

Exhibit 9: Investment-q-sensitivities of sub samples according to gearing

With respect to both proxies we find a similar pattern. Both groups, restricted and not restricted depend on q, however, we do not find evidence for the fact that the absence of financial slack or that a high gearing leads to a higher q-sensitivity of investment.¹⁰³ We hence need to reject hypothesis 2c.

Summing up the results of hypothesis 3a to c, we have to conclude that even though we find evidence for a strong external equity dependence of growth companies, and even though respective issue activity seems to be influenced by the level of q, we cannot verify the existence of an equity financing channel. In spite of the circumstantial evidence, we need to leave this question unanswered.

¹⁰³ We also sorted the companies according to whether they were constrained in the previous year and conducted the same test, however, again the test rejected hypothesis 3c.

As we predicted, the q-sensitivity of investment decreases, when q potentially is a victim of irrational exuberance. We find this effect with respect to total assets, fixed assets, (and both its sub items tangible and intangible fixed assets), whereas investment in debtors and human capital are stronger influenced by q in "bubble"-years. This indicates that growth companies actually respond to changing (rational) expectations. If q-sensitivities were due to liquidity constraints, which could be eased by issuing additional equity, the effect should not change during a bubble.

5. CONCLUSION

In this paper, we examined the influence of stock prices on investment activity of growth companies through three different channels. Exhibit 1 summarizes the results. While we found support for the hypotheses that growth companies hold large amount of securities and that they rely on issuing equity to finance their growth, in particular when stock prices are high, we need to reject the hypothesis with respect to the existence of a portfolio or an equity financing channel, which would help financially constrained companies to overcome their restrictions.

The higher impact of q seems to be based on a signal processing channel. We found evidence for the hypothesis that growth companies have an increased ability to react to changes in expectations. Even though we do not find evidence that growth companies lose their ability to act accordingly, while they grow, we can show that growth companies respond to changes in q, only if expectations are rational. This indicates that managers do not exploit exuberating stock markets, as they would if they relied on the portfolio or the equity financing channel. Managers of growth companies seem to be able to better respond to rational changes, than the executives of their larger counterparts, which may face more bureaucratic and hierarchical barriers.

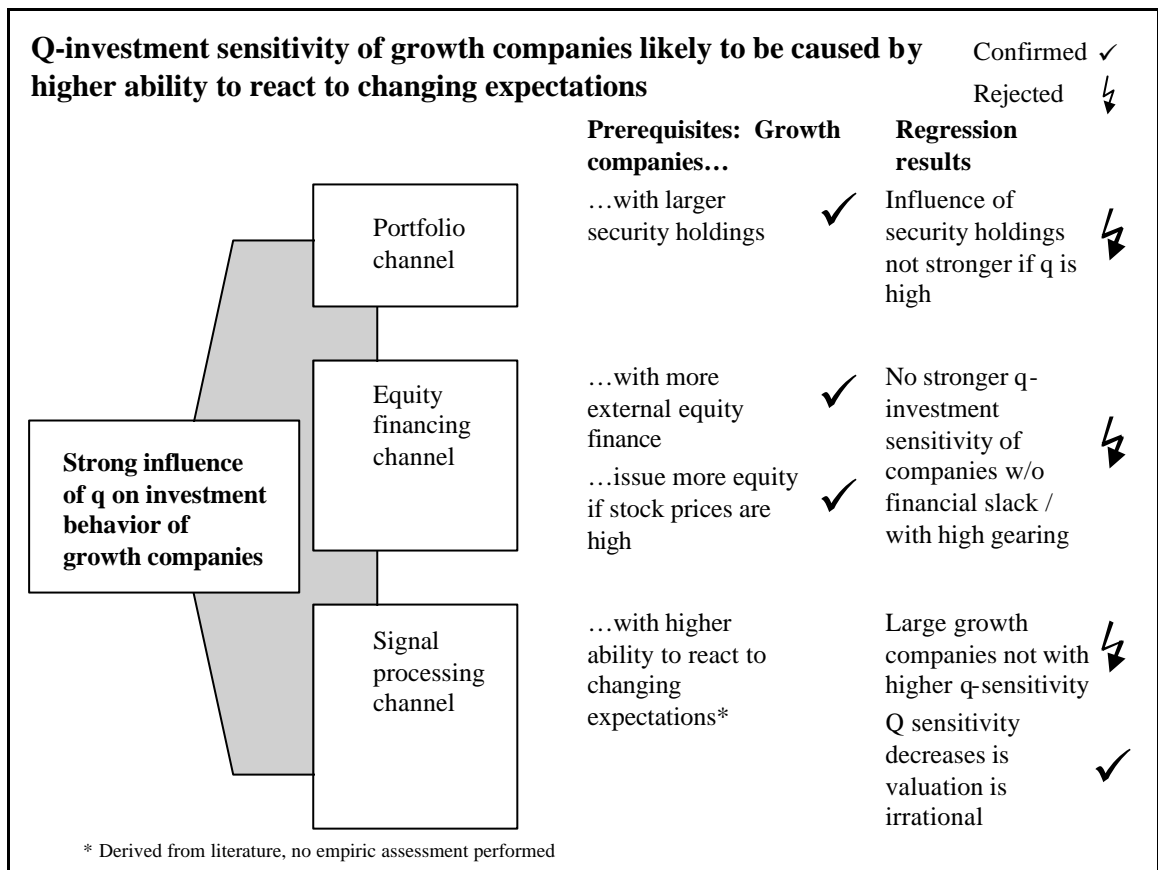


Exhibit 12: Summary of results

These findings imply that in spite of the principal relevance of stock markets for the economy in general and for growth companies in particular, their role as critical provider of financial resources should not be overestimated. Secondly, fears with respect to spill overs of market exaggerations into the real economy may be exaggerated, as managers act according to changing prices only as long as they seem reasonable. Beyond that point, they seem to rely on their own assessment and not on irrational market sentiments.

Appendix A: Abbreviations

δ	Depreciation Rate
$D_{e(MV)}$	Market Value of Debt
$E_{(MV)}$	Market Value of Equity
FTE	Full Time Equivalents (=number of employees)
GDP	Gross Domestic Product
i	Interest Payments
I	Investment
IAS	International Accounting Standards
I_{FA}	Investment in Fixed Assets
IPO	Initial Public Offering
K	Capital Stock (= total assets)
$K_{(R)}$	Capital Stock at Replacement Cost
L	Liquidity
M&A	Merger and Acquisition
PPE	Property, Plant, and Equipment
q	Tobin's q
q^*	"real" q , the unobservable ratio of real value of a firm and the replacement costs of its assets
R&D	Research and Development
$s+c$	Securities and Cash Holdings"
UC	User Cost of Capital
US GAAP	United States (of America) Generally Accepted Accounting Principles

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References

Agresti, Alan and Finlay, Barbara (1986): *Statistical Methods for the Social Sciences*, Dellen Publishing Company, 1996, San Francisco.

Akerlof, George A. (1970): The Market for "Lemons": Quality Uncertainty and the Market Mechanism, in: *Quarterly Journal of Economics*, 84, 1970, pp. 488-500.

Alonso-Borrego, César and Bentolila, Samuel (1994): Investment and Q in Spanish Manufacturing Firms, in: *Oxford Bulletin of Economic and Statistics*, 56, 1, 1994, pp. 49-65.

Baker, Malcolm and Stein, Jeremy C. and Wurgler, Jeffrey (2002): When Does the Market Matter? Stock Prices and the Investment of Equity-Dependent Firms, NBER Working Paper 8750, Cambridge MA, 2002.

Behr, Andreas and Bellgardt, Egon (1998): Sektorale Investitionsentwicklung und Liquiditätseinfluß, in: *Kredit und Kapital* 1/1998, pp. 28-62.

Behr, Andreas and Bellgardt, Egon (2000): Investitionsverhalten und Liquiditätsrestringiertheit, in: *Jahrbücher f. Nationalökonomie u. Statistik* Bd. 220/3, pp. 257-283.

Bertl, Romuald and Deutsch, Eva and Hirschler, Klaus (1998): *Buchhaltungs- und Bilanzierungshandbuch*, Orac Verlag, Wien, 1998, 2nd edition.

Blanchard, Olivier and Lopez-de-Silanes, Florencio and Shleifer, Andrei (1994): What do Firms do with Cash Windfalls?, in: *Journal of Financial Economics*, Vol. 36, 1994, pp. 337-360.

Bond, Stephen R. and Cummins, Jason G. (2001): Noisy Share Prices and the Q-Model of Investment, Working Paper, 2001.

Bosworth, Barry (1975): The Stock Market and the Economy, in: *Brookings Papers on Economic Activity*, Volume 1975, Issue 2, pp. 257-290.

Brainard, William C. and Tobin, James (1977): *Asset Markets and the Cost of Capital*, Cowles Foundation Paper 440, Reprinted from *Private Values and Public Policy*, Essays in Honor of William Fellner, North-Holland, 1977.

Brealy, Richard A. and Myers, Stewart C. (2000): Principles of Corporate Finance, 6th edition, Boston, 2000.

Carruth, Alan and Dickerson, Andrew and Henley, Andrew (2000): Econometric Modeling of UK Aggregate Investment: The Role of Profits and Uncertainty, in: The Manchester School, Vol. 68, No. 3, June 2000, pp. 276-300.

Chapman, D. R. and Junor, C. W. and Stegman, T. R.: Cash Flow Constraints and Firm's Investment Behavior, in: Applied Economics, 1996, 28, pp. 1037 - 1044.

Chirinko, Robert S. (1993): Business Fixed Investment Spending: Modeling Strategies, Empirical Results, and Policy Implications, in: Journal of Economic Literature, Vol. XXXI (December 1993), pp. 1875-1911.

Demirgüç-Kunt, Asli and Maksimovic, Vojislav (1996): Financial Constraints, Uses of Funds, and Firm Growth - An International Comparison, World Bank Policy Research Working Paper 1671.

Devereux, Michael and Schiantarelli, Fabio (1989): Investment, Financial Factors and Cash Flow: Evidence from UK Panel Data, NBER Working Paper No. 3116, Cambridge MA, 1989.

Dow, James and Gorton, Gary (1995): Stock Market Efficiency and Economic Efficiency: Is There a Connection?, NBER Working Paper No. 5233, Cambridge MA, 1995.

Egger, Anton and Samer, Helmut (1999): Der Jahresabschluss nach dem Handelsgesetzbuch - Der Einzelabschluss: Erstellung und Analyse mit Grundzügen der International Accounting Standards, Linde Verlag, Wien, 1999, 7th edition.

Elliott, J. Walter (1980): The Cost of Capital and U.S. Capital Investment: A Test of Alternative Concepts, in: The Journal of Finance, Vol. XXXV, No. 4, September 1980, pp. 981-999.

Fahrmeir, Ludwig and Kaufmann, Heinz and Kredler, Christian (1996): Regressionsanalyse, in: Multivariate statistische Verfahren, Fahrmeir, Ludwig and Hamerle, Alfred and Tutz, Gerhard (ed.), Berlin, New York, 1996, 2nd edition, p. 93-168.

Fama, Eugene F. and French, Kenneth R. (1999): The Corporate Cost of Capital and the Return on Corporate Investment, in: The Journal of Finance, Cambridge, Vol. LIV, No. 6, December 1999, pp. 1939-1967.

Fazzari, Steven M.; Hubbard, R. Glenn; Petersen, Bruce C. (1988): Financing Constraints and Corporate Investment; in Brookings Papers on Economic Activity, 1: 1988 pp. 141-206.

Feldstein, Martin (1980): Inflation, Tax Rules, and Investment: Some Econometric Evidence, NBER Working Paper 577, 1980.

Fischer, Stanley and Merton, Robert C. (1984): Macroeconomics and Finance: The Role of the Stock Market, NBER Working Paper 1291, Cambridge, 1984 (also published as Carnegie Rochester Conference Series on Public Policy, XXI., 1984, pp.57-108).

Funke, Michael; Maurer, Wolf; Siddiqui, Sikandar; Strulik, Holger (Investment): Investment under Financial Constraints: Theory and Tests with German Micro Data, Working Paper Series Universität Hamburg, No. 2/1998.

Gehrke, Norman (1994): Tobins q, Gabler Verlag, Wiesbaden, 1994.

Gilchrist, Simon and Himmelberg, Charles P. (1995): Evidence on the role of cash flow for investment, in: Journal of Monetary Economics 36, 1995, pp. 541-572.

Gilchrist, Simon and Himmelberg, Charles (1998): Investment, Fundamentals and Finance, NBER Working Paper 6652, Cambridge MA, 1998.

Gompers, P. and Lerner, Josh (2000) The Venture Capital Cycle, Cambridge, 1999.

Goyal, Vidhan K. and Yamada, Takeshi (2000), Asset Price Bubbles, Investment, and Liquidity: Evidence from Japan, Working Paper, Department of Finance, University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong, 2000.

Gron, Anne and Lucas, Deborah (1995): External Financing and Insurance Cycles, NBER Working Paper No. 5229, Cambridge, 1995.

Gugler, Klaus and Mueller, Dennis C. and Yurtoglu, B. Burcin (2000): Marginal Q, Tobin's Q, Cash Flow and Investment, Working Paper, Department of Economics, University of Vienna.

Hayashi, Fumio (1982): Tobin's Marginal q and Average q: A Neoclassical Interpretation, in: *Econometrica*, Vol. 50, No. 1 (January, 1982), pp. 213-225.

Hoshi, Takeo; Kashyap, Anil; Scharfstein, David (1991): Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups, in: *The Quarterly Journal of Economics*, February 1991, pp. 33-60.

Hovakimian, Armen and Opler, Tim and Titman, Sheridan (2001): The Debt-Equity Choice, in: *Journal of Financial and Quantitative Analysis*, Vol. 36 No. 1 March 2001, pp. 1-24.

Hu, Xiaoqiang and Schiantarelli, Fabio (1998): Investment and Capital Market Imperfections: A Switching Regression Approach Using U.S. Firm Panel Data, in: *The Review of Economics and Statistics*, 1998, pp. 466-479.

Hubbard, R. Glenn (1998): Capital-Market Imperfections and Investment, in: *Journal of Economic Literature*, Vol. XXXVI (March 1998), p. 193-225.

Jeng, Leslie A.; Wells, Philippe C. (Determinants) The determinants of venture capital funding: evidence across countries, in: *Journal of Corporate Finance* 6, 2000, p. 241-289.

Jenkinson, N. H. (1981): Investment, profitability and valuation ratio, Discussion Paper No. 17, Bank of England, September 1981.

Jensen, Michael C. and Meckling, William H. (1976): Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, in: *Journal of Financial Economics* 3 (1976), pp. 305-360.

Jorgenson, Dale W. (1971): Econometric Studies of Investment Behavior: A Survey, *Journal of Economic Literature*, Vol. 9, Dec. 1971, pp. 1111-1147.

Kadapakkam, Palani-Rajan and Kumar P.C. and Riddick, Leigh A. (1998): The Impact of Cash Flows and Firm Size on Investment: The International Evidence, in: *Journal of Banking and Finance* 22, 1998, pp. 223-320.

Kaplan, Steven N. and Zingales, Luigi (1997): Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?, in: *The Quarterly Journal of Economics*, February 1997, pp. 169-217.

Kaplan, Steven N. and Zingales, Luigi (2000): Investment-Cash Flow Sensitivities are Not Valid Measures of Financing Constraints, in: *The Quarterly Journal of Economics*, May 2000.

Kathuria, Rajat and Mueller, Dennis (1995): Investment and Cash Flow: Asymmetric Information or Managerial Discretion, in: *Empirica* 22, 1995, pp. 211-234.

Keynes, John Maynard (1936): *The General Theory of Employment, Interest and Money*, McMillan and Co. Ltd, London, 1936.

Klock, Mark and Thies, Clifford F., Baum, Christopher F. (1991): Tobin's q , and Measurement Error: Caveat Investigator, in: *Journal of Economics and Business*, 1991, pp. 241-252.

Korajczyk, Robert A. and Lucas, Deborah and McDonald, Robert L. (1990): Understanding Stock Price Behavior around the Time of Equity Issues, in: *Asymmetric Information, Corporate Finance, and Investment*, ed. Hubbard, R. Glenn, Chicago, 1990.

Kuznets, Simon (1961): *Capital in the American Economy Its Formation and Financing*, National Bureau of Economic Research Studies in Capital Formation and Financing, Number 9, 1961, Princeton University Press, Princeton NJ, quoted after Jorgenson (1971).

Lamont, Owen (1996): *Cash Flow and Investment: Evidence from Internal Capital Markets*, NBER Working Paper 6652, Cambridge MA, 1996.

Minton, Bernadette A. and Schrand, Catherine (1999): The Impact of Cash Flow Volatility on Discretionary Investment and the Costs of Debt and Equity Financing, in *Journal of Financial Economics* 54, 1999, 423-460.

- Modigliani, Franco and Miller, Merton H. (1958): The cost of capital, corporation finance and the theory of investment, in: *American Economic Review*, vol. 48, 1958, pp. 261-297.
- Morck, Randall and Shleifer, Andrei and Vishny, Robert W. (1990): The Stock Market and Investment: Is the Market a Sideshow?, in: *Brooking Papers on Economic Activity*, 2, 1990.
- Myers, Steward C. and Majluf, Nicholas S. (1984): Corporate Financing and Investment Decisions when Firms Have Information that Investors do not Have, in: *Journal of Financial Economics* 13, 1984, pp. 419-453.
- Nadiri, Ishaq M. and Rucha, Ingmar R. (1993): Estimation of the Depreciation Rate of Physical and R&D Capital in the US Total Manufacturing Sector, NBER Working Paper 4591, Cambridge MA, 1993.
- Nobes, Christopher and Parker, Robert (1995): *Comparative International Accounting*, New York, 1995 (4th edition).
- Oliner, Stephen and Rudebusch, Glenn and Sichel, Daniel (1995): New and Old Models of Business Investment: A Comparison of Forecasting Performance, in: *Journal of Money, Credit and Banking*, Vol. 27, No. 3, August 1995, p. 806-826.
- Samuel, Cherian (1996): The Investment Decision - A Re-Examination of Competing Theories Using Panel Data, World Bank Policy Research Working Paper 1656, Washington, 1996.
- Samuelson, Paul A. and Nordhaus, William D. (1992): *Economics*, New York, 1992 (14th edition).
- Shin, Hyun-Han and Park, Young, S.(1999): Financing constraints and internal capital markets: Evidence from Korean 'chaebols', in: *Journal of Corporate Finance* 5 (1999) pp. 169-191.
- Sirkin, Mark R. (1995): *Statistics for the social sciences*, SAGE Publications, Inc, 1995, Thousand Oaks/London/New Dehli.

- Starr-McCluer, Martha (1998): Stock Market Wealth and Consumer Spending, Federal Reserve Board of Governors, April 1998.
- Stiglitz, Joseph E. and Weiss, Andrew (1981): Credit Rationing in Markets with Imperfect Information, in: The American Economic Review, Volume 71, Issue 3 (June, 1981), 393-410.
- Süchting, Joachim: Finanzmanagement, Wiesbaden, 1995 (6th edition).
- Swoboda, Alexander M. (1999): Internationale Rechnungslegung nach den IAS und US Gaap in Österreich, Wirtschaftsuniversität Wien, 1999.
- Swoboda, Alexander M. (2002): Investment of Large Caps and Growth Companies in the 1990s, working paper, 2002.
- Swoboda, Alexander M. (2003): Cash Flow-Investment Sensitivities of European Companies in the 1990s: Evidence for Empire Building and Costly External Finance, working paper, 2003.
- Swoboda, Peter (1996): Investition und Finanzierung, München, 1996 (5th edition).
- Tobin, James (1969): A General Equilibrium Approach to Monetary Theory, in Journal of Money, Credit and Banking, Volume 1, Issue 1, Feb., 1969, pp. 15-29.
- Valderrama, Maria (2001): Credit Channel and Investment Behavior in Austria: A Micro-Economic Approach, ECB Working Paper No. 108, December 2001.
- Vermeulen, Philip (2000): Business Fixed Investment: Evidence of a Financial Accelerator in Europe, ECB Working Paper No. 37, November 2000.
- Whited, Toni M. (1992): Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data, The Journal of Finance, Vol. XLVII No. 4, September 1992, pp. 1425-1460.