Aalto University
School of Economics

Firm leverage and its effects on future growth

Finance

Master's thesis

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Abstract
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PURPOSE OF THE STUDY

The purpose of this thesis is to give contribution to the discussion of firm leverage and its effect on firm growth measured in employment and capital expenditures growth, and net investment. Moreover, the effect of anticipated growth opportunities (Tobin's q) on this relation is studied. The study aims to reveal and describe the possible differences in the leverage-growth relation not only based on growth opportunities, but also based on economic cycles. This study follows closely the settings of an earlier study by Lang *et al.* (1996).

DATA

Data covers the U.S. companies from base years 1990-2008 with one billion or more dollar sales measured in 1990's dollars. All data was obtained from Thomson ONE Banker. To avoid regulation effects the sample was restricted to industrial companies under SIC codes 2000-3999. Final sample consist of 4,816 firm-years. Growth is measured by three different ways; net investment, growth rate of real capital expenditures, and growth rate of employment. The relation between growth and book leverage is studied with linear regression. In addition to book leverage, sales growth, capital expenditures, cash flow and Tobin's q are controlled as independent variables. Besides, the effect of anticipated growth opportunities to this leverage-growth relation is studied. Regressions are repeated for subperiods of normal intermediate years (1991-1996, 2002-2005) and abnormal years (1990, 1997-2001, 2006-2008) as well as periods of economic boom and recession.

RESULTS

At the level of whole time period, there is a statistically significant relation between leverage and firm future growth within all growth measures. After letting the anticipated growth opportunities affect regression coefficient, this relation is seen with low-q firms between leverage and employment growth and capital expenditures growth. High-q firms show the same negative relation for investment and capital expenditures growth.

These results do not hold at subperiod level. Results indicate that firms with low anticipated growth opportunities (low-q) experience negative relation between leverage and growth over different economic cycles, while high-q firms suffer from the negative effects of debt only during the intermediate years after recession. Within high-q firms only net investment are limited by debt during economic bubbles. Similarly, exception within low-q firms is that they do not show negative relation between leverage and one-year capital expenditures during intermediate years.

Thus, it appears that high-q firms are in general able to utilize their growth opportunities over the abnormal years regardless their capital structure, while the low-q firms are relatively efficiently limited from overinvesting by debt over different economic cylces.

KEYWORDS

Leverage, debt, firm growth, economic cycles, Tobin's q, growth opportunities

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VELKARAHOITUKSEN VAIKUTUKSET YRITYKSEN TULEVAAN KASVUUN

TUTKIELMAN TAVOITTEET

Tutkimuksen tavoitteena on tutkia yhtiön pääomarakenteen, erityisesti velan määrän, vaikutusta yrityksen kasvuun mitattuna nettoinvestointeina sekä työntekijöiden ja pääomakulujen muutoksena. Lisäksi tarkastellaan yhtiön odotettujen kasvumahdollisuuksien (Tobinin q) vaikutusta tähän suhteeseen. Tutkimus pyrkii myös tuomaan esiin uusia näkökulmia taloussyklien vaikutuksesta yrityksen velan ja kasvun suhteeseen. Tutkimus seuraa asetelmiltaan pitkälti Lang *et al.*:n tutkimusta (1996).

LÄHDEAINEISTO

Aineistona on USA:ssa toimivat yritykset perusvuosilta 1990-2008, joiden liikevaihto on vähintään miljardi dollaria mitattuna vuoden 1990 hintatasolla kunakin perusvuonna, jona yhtiö sisällytetään aineistoon. Aineisto kerätään Thompson ONE Banker tietokannasta. Toimialakohtaisten sääntelyiden välttämiseksi otos rajataan teollisuusyrityksiin SIC-koodeilla 2000-3999. Lopullisen aineiston otoskoko on 4,816. Kasvua mitataan kolmella eri tavalla: nettoinvestoinneilla sekä työntekijöiden määrän ja pääomamenojen (CapEx) kasvulla. Pääomarakennetta ja velkaisuutta kuvataan yrityksen suhteellisen velan määrällä käyttäen tasearvoja. Velan ja kasvun suhdetta tutkitaan lineaarisen regression avulla. Lisäksi kontrolloidaan myynnin kasvua, pääomakuluja, kassavirtaa sekä Tobinin q:ta. Odotettujen kasvumahdollisuuksien vaikutusta tutkitaan jakamalla aineisto Tobinin q:n perusteella alhaisen ja korkean kasvun yrityksiin. Regressioanalyysi toistetaan lisäksi erikseen normaaleille, niin sanotuille välivuosille (1991-1996, 2002-2005), poikkeaville vuosille (1990, 1997-2001, 2006-2008) sekä lama- ja nousukausille.

TULOKSET

Aikavälillä 1990-2008 velkaisuuden ja kasvun välillä nähdään tilastollisesti merkitsevä negatiivinen riippuvuus kaikkien kasvumittarien suhteen. Kun kasvuodotukset otetaan huomioon, vain alhaisen Tobinin q:n yhtiöillä nähdään negatiivinen riippuvuus velan ja työntekijöiden sekä pääomamenojen kasvun välillä. Korkean q:n yrityksillä negatiivinen riippuvuus on vain velkaisuuden ja investointien sekä pääomakulujen välillä.

Tutkittaessa aineistoa eri taloussyklien tasolla, pääasiassa vain alhaisen q:n yhtiöt kokevat negatiivisen riippuvuuden velkaisuuden ja kasvun välillä. Korkean kasvun yhtiöillä tämä riippuvuus näkyy vain niin sanottujen välivuosien aikana. Vain investoinnit ovat nousukausien aikana negatiivisesti riippuvia suhteellisesta velan määrästä korkean q:n yrityksillä.

Tulosten perusteella korkean Tobinin q:n yhtiöt kykenevät paremmin hyödyntämään kasvumahdollisuutensa riippumatta pääomarakenteesta. Alhaisen Tobinin q:n yhtiöt puolestaan kokevat velan rajoittavan vaikutuksen vallitsevasta taloussyklin vaiheesta riippumatta.

AVAINSANAT

Rahoitusrakenne, velka, yrityksen kasvu, taloussyklit, kasvuodotukset, Tobinin q

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Abbreviations

BV	book value
CapEx	capital expenditures
CPI	Consumer Price Index
Empl	employment (number of employees)
FA	fixed assets
Inv	investment
MM	Modigliani and Miller
MV	market value
MWW	Mann-Whitney-Wilcoxon (test for medians)
OLS	ordinary least square
SSE	sum of squared residuals
TA	total assets

β	regression parameter
ε_i	error term of observation i in linear regression
e_i	residual in linear regression
q, Q	Tobin's q
s_x	sample standard deviation of X
r_{XZ}	sample correlation of variables X and Z
X, x	general denotation of a variable or its value
$\bar{x}$	sample mean of X
y_i	dependent variable in linear regression
Z, z	general denotation of a variable or its value

1 Introduction

Firm's management faces the question of optimal debt level many times during firm life span. Although Modigliani and Miller's (MM's) work (Modigliani and Miller, 1958; Modigliani and Miller, 1963) suggest irrelevance of capital structure, the relaxations to their assumptions required in the real world bring in many questions about capital structure and its effects on firm. One of the core questions without unambiguous answer is the relation between firm leverage and future growth. If this relation exists, it is expected to be negative – high leverage slowing down firm growth. Empirical studies give support to this (e.g. Lang *et al.*, 1996). Findings also suggest that the relation is not simple, but is related to other firm specific factors, such as anticipated growth opportunities (Tobin's q), but possibly also to external factors e.g. economic cycles.

The economical importance of understanding better the relation between firm growth and capital structure should not be underestimated. All stakeholders would benefit, if firm management, and/or owners, could be directed already from beginning towards more efficient decisions between different sources of funding. Also theoretical and practical interest should be directed in understanding if leverage really is affecting negatively growth in some circumstances, or is this, possibly existing, relation only reflecting some other factors, e.g. managerial decision making and inside information.

The purpose of this thesis is to give contribution to the discussion of firm leverage and its effect on firm growth measured in employment and capital expenditures growth, and net investment. Moreover, the effect of anticipated growth opportunities (Tobin's q) on this relation is studied. Data covers the U.S. companies from base years 1990-2008 with one billion dollar sales measured in 1990's dollars. The study follows closely the settings in Lang *et al.* (1996), who study the same relationships using the U.S. data from years 1970-1989. Besides, as the period includes two extremely interesting and globally spread stock market booms, namely the dot-com bubble 1997-2000 and the subprime crisis of 2007, data was studied also at subperiod level (boom-recession and early economic expansion). Moreover, the boom-recession subperiod was further divided into economic boom and recession.

Results suggest that high-q firms experience negative relation between leverage and growth during the periods of early expansion and economic recovery (right after recession), but during the bubble years and recession this relation disappears. Low-q firms on the other hand face the limiting effects of debt during both periods. This holds also when recession and bubble are studied separately. During the intermediate, early expansion years, only one-year capital expenditures growth does not indicate any relation to leverage for low-q firms. In addition, median and mean comparison shows that high-q firms have statistically significant lower median leverage during the both subperiods and experience higher growth. Results support earlier findings in general, but add in a new aspect to discuss more in future, as the leverage-growth relation seems to differ clearly between different phases of economic cycle.

Chapter 2 gives a general introduction to and literature review of capital structure theories and empirical results on capital structure and growth. Chapter 3 describes shortly the economic environment during the studied period of 1990-2008, focusing on the two stock market bubbles. Chapter 4 introduces the data and methods, while the results are presented in chapter 5. Chapter 6 is dedicated for open discussion on results and linking them to earlier findings, and chapter 7 concludes shortly.

2 Literature review

Capital structure, and hence the firm leverage, has been largely discussed issue in finance papers during the past century. Starting from Modigliani and Miller's (MM's) (see chapter 2.1) theory regarding the irrelevance of capital structure, researchers have presented different models and theories describing optimal capital structures and explaining firms' choices of capital structure and its relevance and effects on firms' operation and performance, not to forget the economic relevance. Besides theoretical work, also empirical results are prolific. Still, there are left more unanswered questions than fully accepted truths. Already the shortness off recorded history alone gives a reason for more detailed studies to understand firm behaviour and performance from capital structure's point of view.

This chapter reviews published literature on theories of capital structure and empirical results. Although this study focuses on the effects of capital structure choices (relative amount of debt financing), rather than on the determination of optimal capital structure, certain noteworthy works and publications, as well as general approaches to the problem, shall be covered as these different theories of capital structure form the base for understanding and interpreting the results. In no circumstances, an all-embracing presentation can be provided within this thesis. The chapter division is based loosely on different, most used, determinants of capital structure.

2.1 Modigliani and Miller and the beginning of modern capital structure theory

During the last quarters of 1900's one of the most disputed issues in the field of finance has been the theory of capital structure. The beginning of this debate and of the modern theory of capital structure dates back to MM's seminal research (particularly Modigliani and Miller, 1958; Modigliani and Miller, 1963). MM set the framework for the view that under certain conditions a firm's capital structure is irrelevant. Based on the MM theorem a firm's value is not affected by its capital structure, in other words is the firm financed by raising equity or by issuing debt and in which proportions. Although the MM theorem still forms the basis of finance research and teaching, it has also faced criticism. It can be argued that the approaches basing on MM's world do not pay enough attention to the capital market imperfections or to the risks and limitations that for example increased leverage brings along. Notwithstanding all

the criticisms, it has to be noted that the value of MM theorem is not in the result itself, but in the understanding the violation of the made assumptions and the following implications of these relaxations.

After MM's celebrated paper (1958) the literature and research has largely followed the path they set. Current theories on capital structure attempt to define the factors affecting a firm's choice of capital structure and the optimal choice between equity and debt, when the MM assumptions are relaxed. Capital structure can be approached from numerous angles. Theories build on agency costs, corporate governance or control, information asymmetry, tax effects or product-market interactions considerations, just to mention few.

For example Harris and Raviv (1991) provide an extensive review on different theories and empirical results, focusing on papers dealing with the relative amount of debt and equity. They suggest four different categories of factors affecting the capital structure. First, capital structure is determined based on the desire to decrease conflicts of interest among all different groups with various claims to the firm's resources. This setting forms the foundation for different problems studied in agency approach of capital structure. Secondly, the problem of asymmetric information, i.e. the different availability of information to separate stakeholder groups, creates wish, for example, to bring private information to capital markets and to try to decrease unfavourable selection effects. Third, the firms want to influence the product and input market. And last, in addition to the before mentioned factors, the competition for the corporate control affects the capital structure choice. (Harris and Raviv, 1991)

2.2 Pecking order theory and asymmetric information

"Pecking order" theory (Donaldson, 1961; Myers, 1984; Myers and Majluf, 1984) is one of the basic theories about capital structure. Pecking order rises from the existing information asymmetry between investors and insiders, and the possibility of equity mispricing as a result of this inadequate information. If a firm would raise equity to finance a new project, the equity underpricing due to this asymmetric information could result in net loss for existing shareholders. Thus a positive net present value project could be rejected, resulting in underinvestment. On the other hand, internal funds and riskless (or relatively less risky) debt involve no or negligible undervaluation. (Donaldson, 1961; Myers, 1984; Myers and Majluf, 1984)

As a result, based on pecking order theory, managers prefer to use retained earnings rather than external financing for new investment, but when they need to use external financing, debt is preferred to equity (Donaldson, 1961; Myers, 1984; Myers and Majluf, 1984). This implies that when firms are profitable they accumulate retained earnings and become less leveraged, and vice versa, when unprofitable they accumulate debt becoming more leveraged (Hovakimian *et al.*, 2001).

In consistent with the pecking order theory, empirical data suggest a negative relationship between profitability and leverage. Firms tend to use their surplus retained earnings to pay back debt and also have tendency to issue equity when firm's stock price is high, implying that good performance is followed with reduction in firm's leverage. But when the long-run behavior of firms is studied, the pecking order seems to affect firm leverage only in short-term, while the long-term financing decisions move firms towards target debt ratios that are consistent with traditional capital structure tradeoff models. (Hovakimian *et al.*, 2001) Tradeoff models suggest that companies set a target debt-to-equity ratio and gradually move toward it (Myers, 1984). For more detailed discussion about pecking order and static tradeoff models see e.g. Myers (1984).

Linked to the current study on hand, Hovakimian *et al.* (2001) consider that the tendency to issue equity after an increase in share price could imply that firms with high growth opportunities prefer to issue equity (and lower their leverage this way), if the relative stock price would proxy for firm's growth opportunities. They also state that "firms should use relatively more debt to finance assets in place and relatively more equity to finance growth opportunities". (Hovakimian *et al.*, 2001) Pecking order theory itself predicts that high-growth firms with large financial needs would end up with high leverage, if they cannot finance the growth with internal funds. But, findings of e.g. Smith and Watts (1992) and Barclay *et al.* (2006) show that high-growth firms tend to be less leveraged. Barclay *et al.* (2006) show that increase in firm value with new growth opportunities results also in decline in optimal debt level. These findings imply a negative relation between book leverage and growth options (Barclay *et al.*, 2006).

Pecking order theory has been questioned on theoretical side also by e.g. Brennan and Kraus (1987), Noe (1988) and Constantinides and Grundy (1989). They show that the adverse selection and underinvestment problems can be overcome with financial policy, and that a

firm may not prefer straight debt to equity, if a wider set of financing options that allow signaling (e.g. convertible bond) is available and/or the insiders have imperfect information on firm's cash flow. Frank and Goyal (2003) present with data from years 1971-1998 that, while large firms show some aspects of pecking order theory, it is not fully supported in larger scale or by evidence from 1990's. Especially small, high-growth firms do not follow the pecking order theory. The data shows that the raised external finance is heavily used and it exceeds firms' investments. Within the data, equity issues are, on average, larger than debt issues. Surprisingly, considering the pecking order theory, equity issues track well the financing deficit, while the net debt does not. (Frank and Goyal, 2003)

On the other hand, several studies, at least with older data than in Frank and Goyal (2003), show that share issues account less than 5% of total new external finance, giving support to the importance of debt as marginal source of external financing (reviewed in Whited, 1992). Also asymmetric information theory implies that especially small firms, that are more likely to lack sufficient collateral, have more limited access to debt financing and thus may be forced to limit their use of debt (Whited, 1992).

As noted above, companies can signal insider information with their financing policy, but also with the debt-to-equity ratio. For example, a model by Ross (1977) suggests that investors take large leverage as a signal of high quality. Managers gain from high market valuation, but they have to avoid bankruptcy. On the other side, the marginal expected bankruptcy costs are higher for low quality firm with any debt level, thus these firms do not benefit from increasing leverage. This implies a positive relation between firm leverage, value/profitability and bankruptcy probability. (Ross, 1977; Harris and Raviv, 1991)

2.3 Conflicting interests and takeover threads

Jensen and Meckling (1976) model capital structure basing on agency costs. Debt gives equityholders an incentive to invest suboptimally, as they may benefit even from investing on value-decreasing, risky projects. This raises conflicts between the equityholders and debtholders, and decreases the value of debt. If the debtholders anticipate this type of future behavior, the cost of investing to "bad" projects is borne by equityholders. This *asset substitution effect* is one agency cost of debt financing. (Jensen and Meckling, 1976)

Conflicts can rise also between managers and equityholders. Managers do not receive themselves all the gain they bring to the firm, but they bear the entire cost of these activities. Managers may be able to use firm resources to their own benefit, e.g. consuming perquisites and building empires, in relatively larger amounts than would be optimal in maximizing firm value. Jensen and Meckling suggest that increasing the amount of firm owned by the manager could reduce this inefficiency. Thus, if the manager's absolute investment in the firm is kept unchanged, an increase in the firm's debt-to-equity ratio increases manager's stake of equity. The increased ownership of firm's equity mitigates the conflicts between other shareholders and the manager, thus constituting the benefit of debt financing. (Jensen and Meckling, 1976, Jensen, 1986)

The implications of Jensen and Meckling's theory include that debtholders would prefer to have restrictions for preventing asset substitution. And similarly, the leverage would likely be higher in industries with limited opportunities for asset substitution. This would include for example industries with high regulations or mature industries with only few growth opportunities. Moreover, firms that have high operating cash flow, and at the same time find slow or negative growth optimal, should have high amount of debt. In these circumstances, the increased leverage prevents overinvesting and e.g. managerial empire building, as well as increases the manager's ownership. (Jensen and Meckling, 1976; Harris and Raviv, 1991)

The conflict between equityholders and managers has been studied also by other authors. Managers often prefer to continue operations even if liquidation of the firm would be optimal for the investors (Harris and Raviv, 1990). Managers have incentive to grow the firm beyond the optimal size, as the growth increases the resources under their control. Also managers' compensation is often related to the firm growth. Thus it is expected that managers want to invest all available funds instead of distributing them in cash to investors. (Jensen, 1986; Stulz, 1990) This problem of investing to value-decreasing projects is limited with debt payments. Thus, based on this approach, capital structure is determined by the balance between these benefits and cost of debt. Cost of debt appears as *underinvestment* (Stulz, 1990) or as investigation costs, in e.g. liquidation decision (Harris and Raviv, 1990). This implies that to prevent *overinvestment*, mature, slow-growth firms should be highly leveraged compared to firms with many good investment opportunities. (Jensen, 1986; Stulz, 1990) Also firms with higher liquidation value (e.g. tangible assets, low cost of investigation) should carry more debt, and hence be more likely to default, but also have higher market value,

ceteris paribus, than similar firms. The results also suggest that higher leverage is associated with higher debt level relative to expected income. (Harris and Raviv, 1990)

Besides, Stulz (1990) also suggests that firms having higher probability to experience takeover are likely to have higher leverage. He bases this to the finding that although managers are reluctant to implement the optimal capital structure in general, they are willing to do that if facing a threat of takeover (Stulz, 1990). Takeover threat increases also managers' concern about their own reputation (see below chapter 2.4) and the firm is, *ceteris paribus*, more likely to have more debt (Hirshleifer and Thakor, 1992).

On the other side of the coin, Myers (1977) suggests that growth opportunities are subject to underinvestment due to the lower collateral value. High leverage on the other hand worsens the underinvestment. Thus highly levered firms are more likely to reject good investment opportunities, and, hence, firms with anticipated high future growth (high Tobin's q) should prefer equity finance. (Myers, 1977) It shall be noted that, theories basing on takeover thread, or other corporate control consideration, study short-term changes in capital structure responding to immediate takeover threats. Although interesting, these theories have relatively little to add in discussion about the long-term capital structure choices made by firms.

2.4 Reputation

Reputational considerations give rise to conflicts between managers, equityholders and debtholders. Managers or firm are temped to choose safer projects that assure debt repayment aiming to maintain their reputation. Especially older, more established firms, with acquired reputation, are likely to prefer relatively safe project and hence mitigate asset substitution problem, to avoid losing their reputation. On the other hand, in absence of reputation effects, young firms with short history and little reputation to lose may be more eager to take the riskier project. At the same time, lenders base their lending decision and loan terms on the firm's default history and firm's assurance about the use of new money. (Diamond, 1989)

In addition to firm's reputation, managers have their own reputation to concern. Manager's reputation is depended on a project's failure versus success, rather than the expected value for shareholders. Thus a manager is more likely to choose a project with higher probability of success rather than a high-risk–high-return project with higher expected value for other

equityholders. This behavior opposes the traditional approach to agency problem of debt as now managers execute conservative behavior instead of shareholders wish for risky choices. Hence, if firm's conservative decisions are due to managers' concern of reputation, shareholders may be better off by increasing the leverage (and thus also manager's relative share of equity) and this way redirecting management's behavior. (Hirshleifer and Thakor, 1992)

2.5 Debt as a strategic tool

Financial research on the relation of capital structure and strategy bases on that managers typically prefer to maximize the value of equity instead of total value or profits. Debt level can be used to change the return on equity and by this way change the optimal product strategy. One of the pioneering papers (Brander and Lewis, 1986) presents a model suggesting that in an oligopoly market a firm that chooses more aggressive strategy prefers higher leverage. Leverage limits equityholders liability, creating an incentive for increased output, and this way reduce competitors' output. At the same time, monopolies or firms in competitive industries have less debt. (Brander and Lewis, 1986)

Firms that are dependent on reputation of good quality products or produce unique items are expected to have more equity. Smaller firms tend to use noteworthy more short-term debt than larger firms. (Titman, 1984; Titman and Wessel, 1988; Maksimovic and Titman, 1991) These findings, among many others, help partly explain some of the industrial differences in debt usage, and rationalize the need for controlling the industry effects in research.

2.6 Financial distress

The possibility of financial distress is important in determining company's optimal capital structure. Its seen costly because during financial distress firms tend to do decisions that damage debtholders' and non-financial stakeholders' interests. As a result, conflicting interests between firm and different stakeholders make the access to credit more difficult and increase the cost of different stakeholder relationships (e.g. Stulz, 1990; Maksimovic and Titman, 1991; Gilson and Vetsuypens, 1993). The consensus on the effects of financial distress on corporate performance has not been reached. It is argued that high leverage and financial distress forces managers to make the difficult decisions required for value

maximizing, i.e. increasing the stakeholders control and governance over management (e.g. Jensen, 1989). On the other hand, for example Opler and Titman (1994) study the relationship of leverage and market share during market downturns. They find evidence on that more highly leveraged firms lose substantially larger market share and suffer from lower operating income and sales growth than more conservatively financed competitors in industry downturns. Financial distress can also result in aggressive competition, or predation, by stronger and more conservatively financed competitors trying to gain market share (e.g. Bolton and Scharfstein, 1990).

2.7 Other notes on theories and empirical support

Capital structure theories do suggest that there should be a relation between leverage and growth. More detailed understanding of the nature of this relation is important, because highly leveraged firms may not be able to growth optimally due to their debt burden. Growth in terms of additional investment and empire building is not desirable for all firms. Thus, at the same time managers of poor growth opportunity firms should be prevented from directing cash flows to value increasing projects. Research has paid relatively little attention to leverage, but prefer other proxies for liquidity (e.g. cash flow, liquid assets), in spite of the fact that increased leverage both decreases available current funds for investment, but also makes it more difficult to raise new funding (Lang *et al.*, 1996).

In general, there is some level of consensus that leverage is positively associated with fixed assets, firm size, non-debt tax shields and firm value, and negatively associated with volatility, advertising expenditures, profitability and the probability of bankruptcy (reviewed in Harris and Raviv, 1991). Many models indicate that leverage is negatively correlated with growth opportunities (e.g. Jensen and Meckling, 1976; Stulz, 1990). McConnell and Servaes (1995) find that for "high-growth" firms the firm value decreases when leverage increases, whereas for "low-growth" firms the corporate value increases with leverage. This supports their hypothesis that for firms with low growth opportunities, the positive effect of debt should predominate, because debt prevents managers from taking on poor investment projects (prevents overinvestment). And, similarly for high-growth firms the negative effects of debt predominate as debt repayments ties up funds and results in underinvestment. (McConnell and Servaes, 1995) Their result also indicates that there might be a different relationship of leverage and real growth depending on firms recognized growth opportunities (or Tobin's q).

Lang *et al.* (1996) show a negative relationship between growth and leverage, but find it strongly significant only for firms with low anticipated growth (see table 2.1). These results highlight the positive effects of debt financing with low-growth firms, while the negative "underinvestment" effect is not seen clearly with the data set. They show that the results hold within and across industries, for different book value based leverage measures, for different measures of investment opportunities, and also for small firms (random sample of firms with $20 million - $1 billion sales in 1989-dollars).

Table 2.1: *Summary of the results by Lang et al. (1996). Relation is stated as "Negative"/"Positive" (5%-level significance), or "No" (no significance in regression), weak (10%-level) relation is stated separately. "Low-q" ("high-q") firms are firms with q <1 (q > 1) or q < industry median (q > industry median) of the whole time period 1970-1989. Chapter 5.4 sums up the corresponding results of the study on hand.*

Data 1970-1989	**Investment**	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditures growth**	**3-year capital expenditures growth**
Overall *Book leverage*	Negative	Negative	Negative	Negative	Negative
Industry-adjusted leverage	Negative	Negative	Negative	Negative	Negative
Low-q *Book leverage*	Negative	Negative	Negative	Negative	Negative
Industry-adjusted leverage	Negative	Negative	Negative	Negative	Negative
High-q *Book leverage*	No	No	No	Negative	No
Industry-adjusted leverage	No	No	No	Weak negative	No

The data in Lang *et al.* spans the years 1979 to 1989 and is restricted to all Compustat firms with revenue of $1 billion or more in 1989-dollars in each base year they are incorporated in to the sample. Lang *et al.* (1996) use same variables and growth measures for the regression as in this study. They also investigate other growth measures as well as leverage measures, and show that the used setting with book leverage and growth determined as net investment, number of employees and capital expenditures is well justified for the study of interrelationship between leverage and growth.

Also other empirical results support negative relationship between firms leverage and growth. High leverage limits firm's liquidity and thus reduces its ability to finance growth (see e.g. Bernanke *et al.* (1996) for review). Sharpe (1994) studies the relationship between firm's

leverage and employment. He finds evidence that a high degree of leverage results in quicker layoff of employees in a recession, but not in quicker hiring during an expansion. (Sharpe, 1994) This supports the argument that high leverage reduces the management-related agency costs by forcing managers behave efficiently and to favour the interests of firm's owners during recession (Sharpe, 1994), but also indicates that highly leveraged firms may grow slower. Similarly, Cantor (1990) finds a positive correlation between firm's leverage and the volatility of employment and investment. In addition, both employment and investment seem to be more sensitive for cash flow within the more leveraged firms (Cantor, 1990; Whited, 1992). On the other side, for example Titman and Wessel (1988) find no evidence on the relation of leverage to firm's expected growth, volatility, collateral value of assets or non-debt tax shield. Their finds give some support to that profitable firms have less debt relative to the market value of equity. (Titman and Wessel, 1988)

As a conclusion, although the empirical results so far suggest that there is at least at some level a negative relation of (book) leverage to growth, this relationship is not unambiguous or well known if examined at more detailed level. Theories and empirical support suggest that if this relation is to exist, it could be different for different types of firms, or just to be seen within certain types of firms (as shown for example between high-q and low-q firms in Lang *et al.* (1996)). Firm size and age, anticipated growth opportunities, economic environment and changes, industry specific factors and prevailing ownership structure, just to mention few, are potential factors differencing this relation between groups of firms. Understanding also the effect of these kinds of dividing factors more detailed is in utmost importance, and could also help to explain large scale or economic wide results better - thus not to undervalue the importance of studying long timescales and large entities as whole.

Altogether, there is a need for additional empirical results, even repetition studies with new data as this one. Besides, the past decades have shown strong economic changes as discussed more detailed in chapter 3. Cycles are not strange phenomenon as such, but combined with the overall change in the stock markets during the past decades as a result of for example increased market capitalization, globalisation, year after year more common exchange and stock market investments by the masses, and ever more complex instruments, make this period relatively interesting for studying something foundational in the field of financial theories.

3 Financial markets in the U.S. during 1990-2009

This chapter aims to shortly describe the U.S. economic environment from stock market and financial markets point of view. Focus is maintained in large picture to give reader a general view of the economic environment the firms have experienced during 1990-2009, and to explain the used subperiods in the study. Chapter 3.1 collects tightly the events that have shaped the era and presents the historical interest rates and stock market development in long-term as well as during the studied period of 1990-2008. Chapter 3.2 sums up the periods of first full stock market bubble and recession, namely the late 1990's dot-com bubble. Last chapter 3.3 describes the born and development of subprime mortgage crisis with the understanding of it in the early 2010.

3.1 General economic and stock market development 1990-2009

The era of 1990s to the present date of early 21st century is often called as the period of New Economy in the U.S.. The period does not include noteworthy changes in governmental regulation or deregulation but is rather symbolized by the global rise of Internet. The rise and collapse of dot-com stocks in the late 90's as well as the subprime crisis of 2007 are probably the best-remembered and largest economic events.

The New Economy was preceded by an economic recession in 1990-1991. Stock market downturn started as Down Jones Industrial Average dropped 22,6% on Black Monday in October 1987. Although the stock market collapse was larger than in 1929, the market first seemed to recover relatively quickly. The recovery was only delusion and by 1990 the economy was in recession.

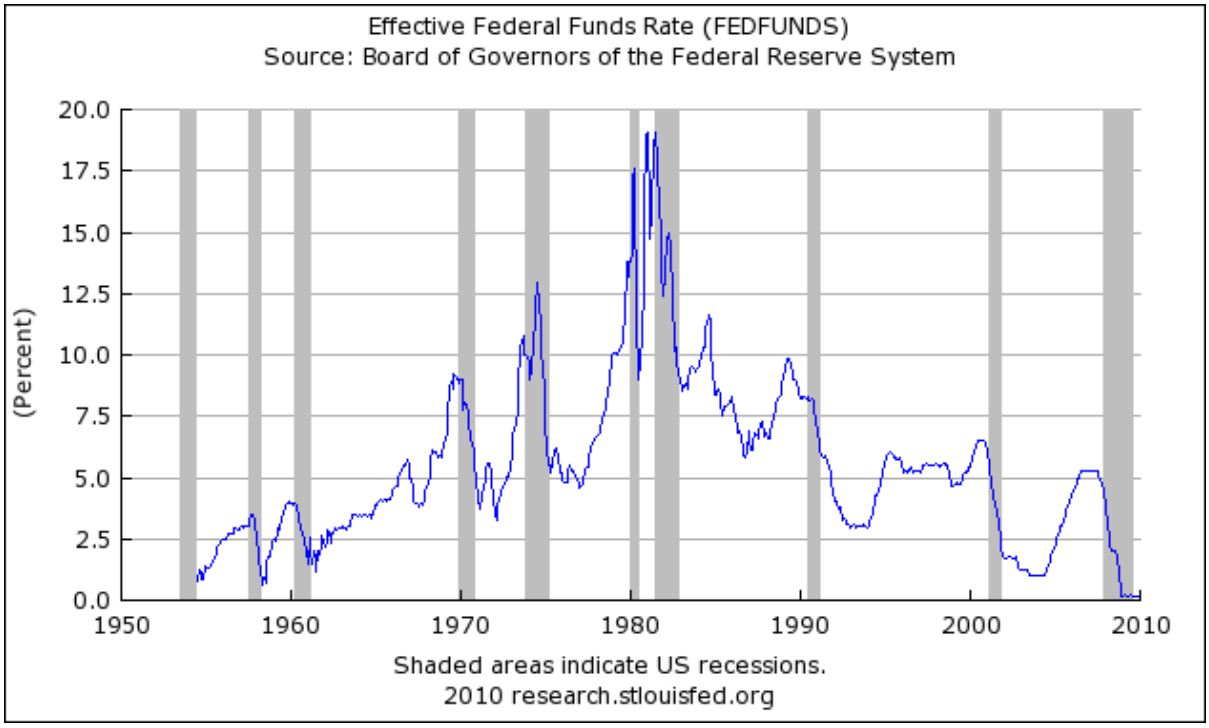
The late 1990's and early 21st century were shaped by and best remembered from Bill Clinton's ascendancy, dot-com boom (see chapter 3.2 for more detailed presentation) and the 9/11 terrorists attacks in 2001. During the 1990's the U.S. public debt nearly doubled (U.S. Treasury, 2010), inflation adjusted GDP by 37% (BEA, 2010) and the market capitalization tripled (World Bank, 2010).

The 21st century was marked by G.W. Bush's period, Iraq war, and the global subprime mortgage crisis. After recovering from the dot-com bubble, the U.S. economy experienced few stabile years before the subprime crisis around 2007-2008 (see chapter 3.3 for more detailed presentation). During the early 21st century, up to 2008, the U.S. public debt grew nearly 80% (U.S. Treasury, 2010), inflation adjusted GDP by less than 20% (BEA, 2010) and the market capitalization halved (World Bank, 2010).

The interest rates have been relatively low, without drastic increases, during the 1990-2009. The Federal Funds has adjusted rates according the economic environment (see figure 3.1). A clear difference from the preceding decades can be seen in the figure 3.1, as the Federal Funds rate achieves the historical low and experiences only relatively conservative changes.

Stock market development is illustrated in figures 3.2 and 3.3, with both Down Jones Industrial Average and NASDAQ Composite to give comprehensive view to the both booms as well as to the overall market development in terms of stock prices. As it can be seen from the figures 3.2 and 3.3, the dot-com bubble was more focused on IT-markets although the boom is seen also in Down Jones Industrial Average. Both indexes reacted strongly to the subprime crisis.

a)



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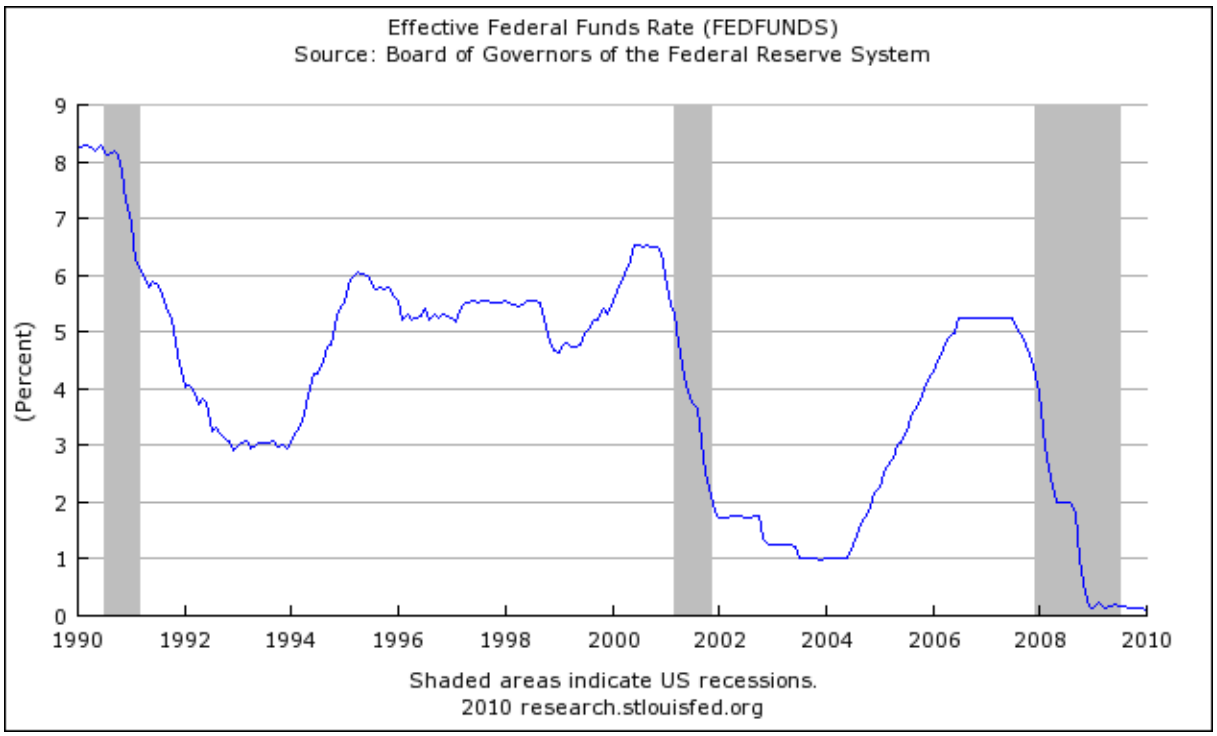
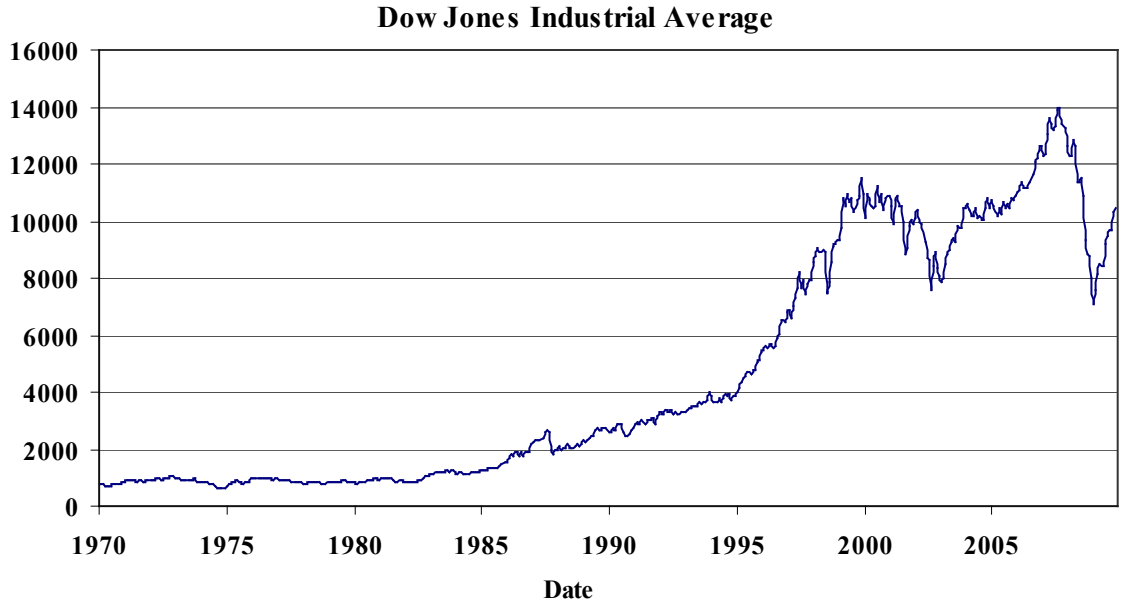


Figure 3.1: *Historical level of the U.S. Federal Reserve Fed Funds rate.* ***a)*** *Long-term history and* ***b)*** *the rates in 1990-2009. The period of 1990-2009 differs clearly from the preceded 20 years (1970-1989). Grey areas indicate recession in the U.S.. (Federal Reserve, 2010)*

a)



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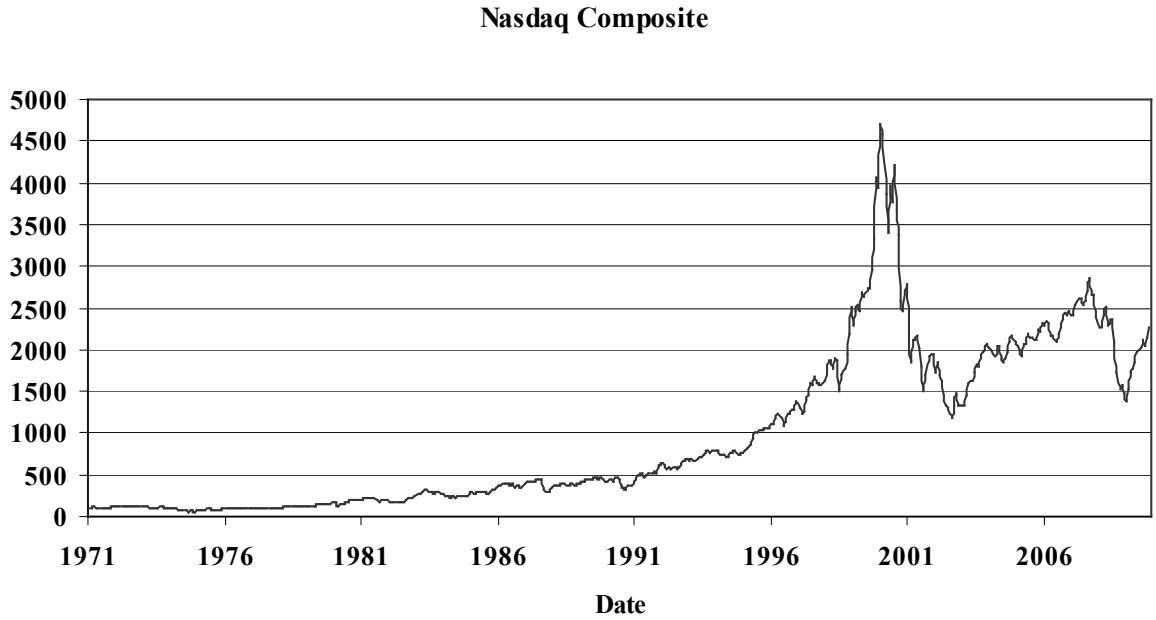
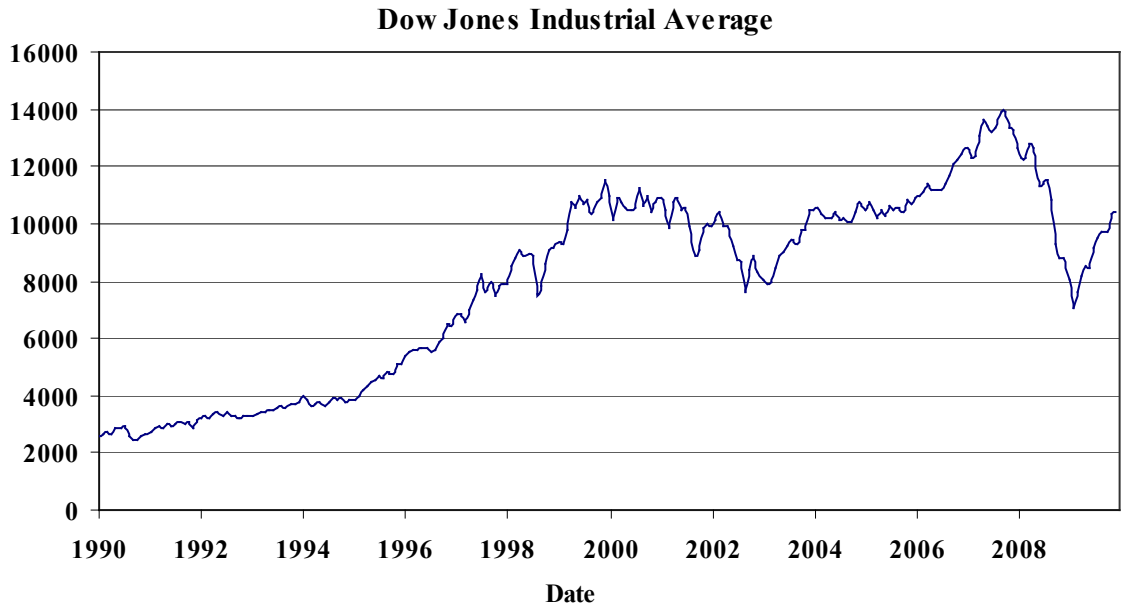


Figure 3.2: *Development of the U.S stock market during 1970-2009, monthly prices. The latest 20 years differ clearly from the 1970's and 1980's stock market index. Stock indexes have risen relatively steadily until the end of 20th century. Especially the two booms in late 1990's and 2007 add volatility and drastic changes.* ***a)*** *Historical prices of Dow Jones.* ***b)*** *Historical prices of Nasdaq Composite since 1971. Nasdaq differs from Dow Jones among others by not including financial companies but contains firms incorporated outside the U.S. (Yahoo! Finance, 2010)*

a)



b)

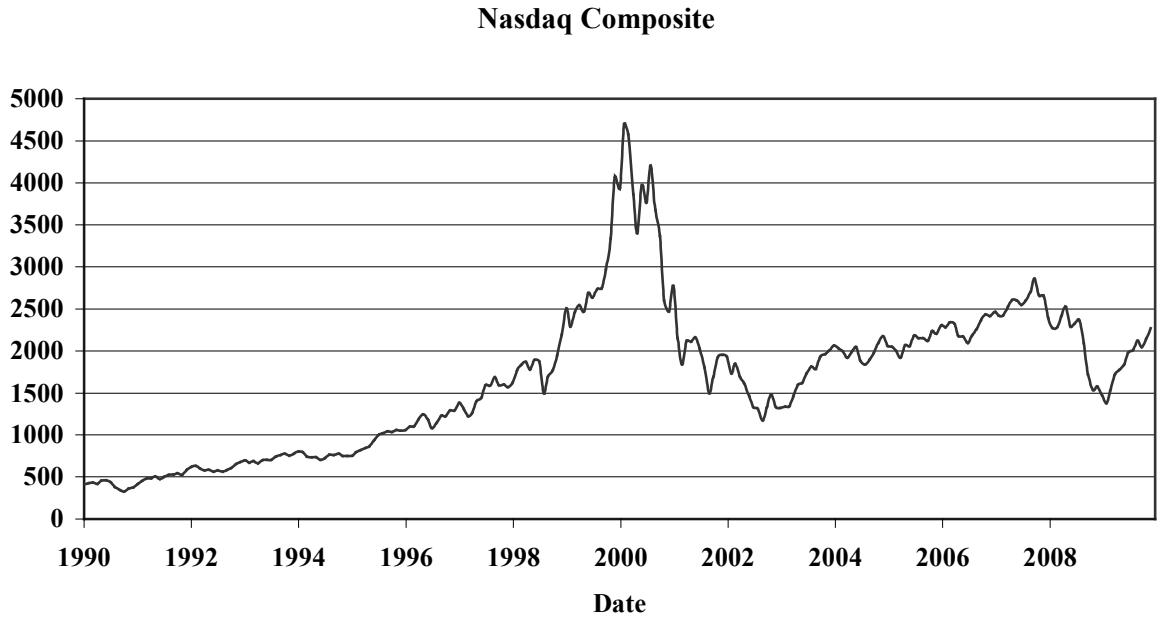


Figure 3.3: *Development of the U.S stock market during 1990-2009, monthly prices. Stock indexes have risen relatively steadily after the dot-com crash until the drop starting in mid 2007. Historical prices of* ***a)*** *Dow Jones and* ***b*** *Nasdaq Composite. Nasdaq is technology-weighted index that differs from Dow Jones among others by not including financial companies but contains firms incorporated outside the U.S. (Yahoo! Finance, 2010)*

3.2 Dot-com bubble 1995-2001

During 1990-2009 the Western world went through two economic crises, the first one being so-called “dot-com bubble” (also known as IT-bubble) roughly in the 1995-2001. The bubble peaked on March, 2000 when Nasdaq Composite hit historical high at 5132,52 (10th March, intra-day). This was the beginning of a downturn after several years increase in stock prices. By 2001 the prices were falling at full speed. (Internet A, 2010; Internet B, 2010; Yahoo! Finance, 2010)

The late 1990’s was a period of founding new Internet-based companies. These were often referred as dot-coms, giving the name for the boom. The dot-com bubble was related especially to the growth of dot-com and other related technology industries, but was reflected on other industries as well. There were several factors affecting and accelerating the born and development of the dot-com bubble. The amount of Internet users experienced a major jump in the mid 1990’s. These users were seen as new potential consumers, resulting in new business models and start-ups. The Internet based exchange enabled business models that largely differed from the traditional view of making money, but also approaches not tested in real life before. (Internet A, 2010)

Besides, investors and venture capitalists reacted to the rise in stock valuations of these companies, and made investments faster and probably with less caution than normally. In addition, the interest rates were low in 1998-1999, further easing the availability of capital for firms and investors. Markets were confident that the firms would redeem the growth expectations. As the stock price increase and bull market become evident for the masses, the rising prices were already good enough reason for many investors to start speculate in and invest in stocks. Moreover, in consequence of all this, many investors overlook some of the traditional measures used in stock valuation (e.g. Tobin’s q, P/E), thus again accelerating and building up the self-perpetuating growth. (Internet A, 2010; Internet B, 2010)

The interest rates were increased during 1999 and the early 2000. On March, 2000, Nasdaq Composite achieved the peak value of 5132,52, a double to the about 2500 a year before. Markets reacted to this with slight drop and subsequent correction movements, followed by the actual bubble burst and bear market later in 2000. The burst of the bubble and the Nasdaq collapse may have been related to the United States v. Microsoft–case, declaring Microsoft a

monopoly, massive sell orders processed just by change after March 10, and poor results by many Internet companies especially in the new millennium, among others. (Internet A, 2010; Internet B, 2010; Yahoo! Finance, 2010)

Substantial bear market was seen during the subsequent years. Down Jones Industrial Average and Nasdaq both reached the period's lowest level in 2002, after which the economical recovery started – towards the new crisis in 2007. The interest rates were dropped after the onset of bear market and recession in the U.S., and the economy experienced a period of lowest interest rates in decades during 2002-2005. (Internet A, 2010; Internet B, 2010, Federal Reserve, 2010)

3.3 Financial crisis of 2007-2009 – Subprime mortgages

The latest financial crisis in the western world, so-called subprime mortgage crisis, became evident in 2007. After the 2000-2001 economical crash (a.k.a. dot-com bubble and crisis, chapter 3.2) the U.S., and the world, economy enjoyed a few years period of historically low interest rates. This was followed by a two years rising policy of interest rates before the new financial crisis starting in mid 2007 (see Figure 3.1). The first crisis of 21st century was a result of several factors, the abnormally low interest rates being just one reason among others. Other causes include major changes in regulation, loose regulatory oversight, and relaxation of normal standards of conservative lending in financing and banking industry. (Bordo, 2008; Cecchetti, 2008*,* Federal Reserve, 2010*)*

The crisis started around February 2007, when large subprime mortgage lenders started to report losses. The bond credit spreads (risky vs. risk-free) began widening in July 2007. In summer 2007, the U.S. and global financial markets realized the existence of a potential financial crisis where financial institutions would experience huge losses from their exposure to subprime mortgage market loans, not to mention the losses for other industries due to direct and indirect consequences. The default on subprime mortgages diffused around the world via different derivatives to the balance sheets of other financial institutions intermediating between mortgages and other asset-backed commercial paper and long-term securities. (Bordo, 2008; Cecchetti, 2008)

The final trigger came on August 9, 2007 when the large French bank BNP Paribas informed that it was not able to reliable value the assets backed by U.S. subprime mortgage debt and temporarily halted redemptions from the related funds. The uncertainty spread over the financial markets, and led to the freezing of the interbank lending market in August 2007 followed by notably liquidity injections by central banks, including the Federal Reserve. In March 2008 the crisis worsened while Bear Stearns, a global investment bank, collapsed and was sold to JPMorgan. Next turn to worse took place in September 2008 when the U.S. Treasury and Fed allowed the investment bank Lehman Brothers to go bankrupt. Subsequently, the liquidity crisis expanded to a full-scale global credit crunch and stock market crash. (Bordo, 2008; Cecchetti, 2008)

Figure 3.1 shows the historical development of the Federal Funds rate and figure 3.3 illustrates the U.S. stock market during 1990-2009. The stock markets reacted strongly measured with both Nasdaq Composite and Down Jones Industrial Average indexes, and the pre-crisis levels have not be reached by late 2009. By the early 2010 the economy showed clear recovery from the subprime crisis in the U.S. But, as the end of 2010 closes in, Europe for example is still lacking behind and the full effects of the crisis are only starting to unveil in many countries. In addition, the latest news from the U.S. indicate also drawback in the revival.

4 Data and methodology

The used data and its characteristics are described in chapter 4.1. Chapter 4.2 presents the utilized methodology.

4.1 Data

Study is conducted with companies based and operating in the U.S. The data consist of large sized industrial firms. This choice was made for several reasons. First, Lang *et al.* (1996) focus on large industrial firms with one billion or more dollars in sales measured in 1989 dollars. This gives a justified definition for a "large" firm. Besides, to maintain good comparability with their study gives reason to use closely same sample selection criteria. Second, it is reasonable to expect that if there was a relation between growth and leverage, it would be weaker for large more established firms. It would be more convincing if the results by Lang *et al.* (1996) can be repeated with large firms, without possible biases by smallest companies. Third, the needed data is more easily available for large firms, thus focusing to large companies can reduce the selection bias resulting from inadequate data.

Data spans the base years 1990 to 2008. Three-year growth regressions span base years 1990-2006, because the last year with available data is 2009 at the moment of conducting the study. The sample for each base year is restricted to firms with 1 billion dollars or more in sales in 1990 dollars. The growth is measured from the base year (year 0) for companies that meet the said size criterion on that base year, thus no sample selection bias is induced due to this size criterion. All data is obtained from Thomson ONE Banker. All firms must have data on sales, cash flow, leverage, assets, market value, and capital expenditures required to calculate the explanatory variables. In addition each firm must have the needed data on e.g. number of employees, capital expenditures and depreciations, required for the depended variables in regression. To avoid regulation effects the sample is restricted to industrial companies under SIC codes 2000-3999. These SIC codes include for example groceries, beverages, textiles, chemicals, medical instruments and different machinery industries. Excluded SIC codes cover for example transportation, telephone communication, cable TV, gas, electric, oil, and mining industries.

Final sample consists of 4,816 firm-years. Out of this sample set the requirements for regression to explain net investments is met with 4,814 firm-years, for 1-year employment growth with 4,804 and for 3-year employment growth with 4,011 firm-years, similarly for 1-year and 3-year capital expenditures growth the requirements are met with 4,815 and 4,017 firm-years. Table 4.1 presents the general features of the data. As expected, the dot-com bubble affects the market valuations of most of the companies, resulting especially upward biased mean Tobin's q values. Data also shows typical positive skewness (mass of distribution on low values with long tail on right side). Thus the median, as a robust measure, is preferred in analysis.

Table 4.1: *General features of the data set. The sample period spans years 1990-2008 and includes firms with $1 billion or more in sales in 1990 dollars in a base year. All data is obtained from Thomson ONE Banker. Net investment is defined as capital expenditures minus depreciations in year +1. Cash flow is gross of interest expenses. Leverage is book debt divided by total assets for year 0.*

	Mean (t-statistic)	**25th percentile**	**Median**	**75th percentile**	**Standard deviation**	**# of firm-years**
Net investment (1) / fixed assets (0)	0,82% (3,22)	-4,12%	0,30%	5,58%	17,78%	4814
1-year employment growth	2,93% (7,82)	-5,00%	0,00%	6,61%	25,94%	4804
3-year employment growth	10,41% (13,51)	-11,21%	2,78%	20,57%	48,81%	4011
1-year capital expenditures growth	5,64% (8,81)	-16,90%	0,37%	20,87%	44,45%	4815
3-year capital expenditures growth	19,21% (14,67)	-29,51%	3,46%	44,18%	82,98%	4017
Cash flow (0) / total assets (-1)	13,17% (95,90)	9,34%	12,86%	16,82%	9,53%	4816
Tobin's q	1,45 (69,34)	0,71	1,04	1,66	1,45	4816
Leverage	26,14% (116,29)	15,91%	24,72%	34,95%	15,60%	4816

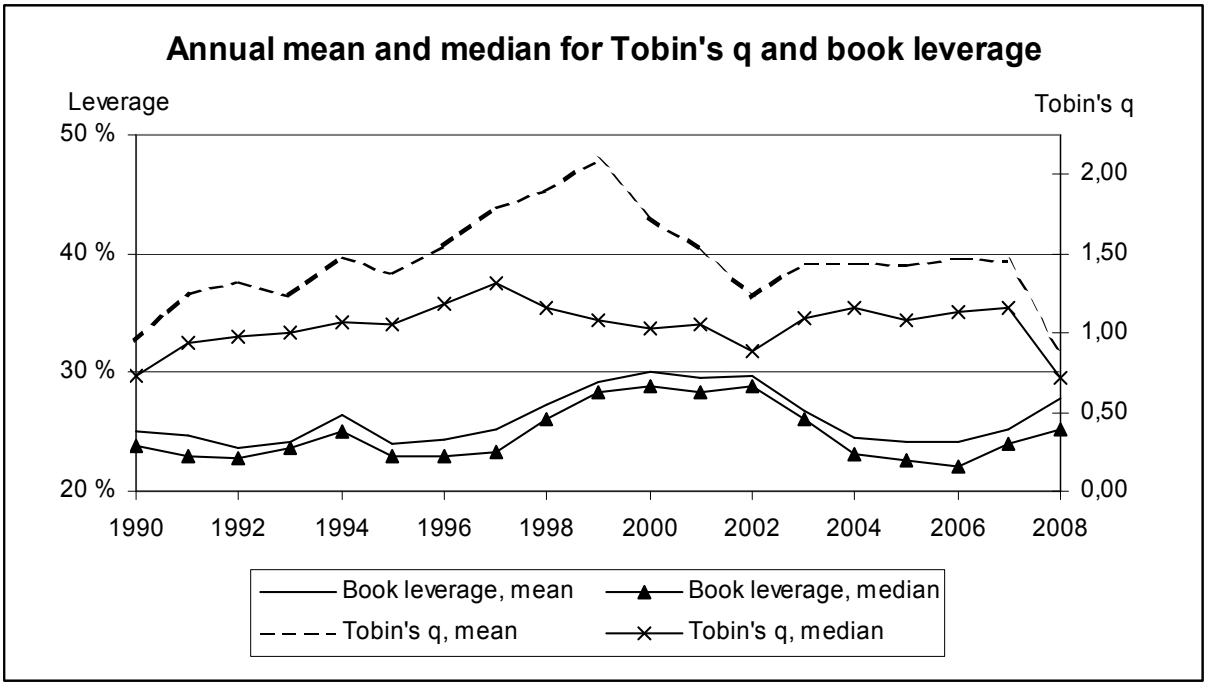


Figure 4.1: *Annual development of the mean and median for Tobin's q and book leverage in the sample set. The stock market bubble in the late 1990's is clearly seen as increased market capitalization of companies relative to balance sheet valuation, seen as unusually high Tobin's q - values. Leverage seems to increase lightly after the stock market crisis, both in the early 2000 century and in the 2007.*

Figure 4.1 shows the annual mean and median for Tobin's q and book leverage. As it can be seen from figure 4.1 the big dot-com bubble in late 1990's had an effect on the whole sample features due to the exceptional market conditions and stock market development. Book leverage shows slight adaptation to market conditions and follows loosely economic cycles based on the figure 4.1.

Correlation between variables is presented in table 4.2. Data shows high correlation between variables, which could be expected. While the growth measures and control variables experience significant positive correlation, book leverage correlates negatively with all variables.

Table 4.2: *Correlation among variables. The correlation between variables using raw data is shown on the first line. The second line presents the correlation between industry –adjusted variables. Industry adjustment is obtained by subtracting the industry median. Net investment is capital expenditures less depreciation in year +1 divided by fixed assets (FA) in year 0. Capital expenditures growth is the inflation adjusted percent change. Employment growth is measured as percent change. Cash flow is gross of interest expenses.*
** Significant at the 0,05 level. **Significant at the 0,01 level.*

	Net investment (1) / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**	**Book leverage**
Net investment (1) / FA	1,00	0,13**	0,16**	0,23**	0,08**	-0,14**
	1,00	0,13**	0,15**	0,23**	0,07**	-0,15**
1-year employment growth	0,13**	1,00	0,63**	0,26**	0,22**	-0,09**
	0,13**	1,00	0,63**	0,26**	0,22**	-0,08**
3-year employment growth	0,16**	0,63**	1,00	0,24**	0,45**	-0,09**
	0,15**	0,63**	1,00	0,24**	0,45**	-0,07**
1-year capital expenditure growth	0,23**	0,26**	0,24**	1,00	0,53**	-0,08**
	0,23**	0,26**	0,24**	1,00	0,53**	-0,08**
3-year capital expenditure growth	0,08**	0,22**	0,45**	0,53**	1,00	-0,09**
	0,07**	0,22**	0,45**	0,53**	1,00	-0,08**
Capital expenditures (0) / FA	0,08**	0,05**	0,06**	-0,05**	-0,06**	-0,14**
	0,09**	0,05**	0,05**	-0,05**	-0,07**	-0,10**
Tobin's q	0,17**	0,14**	0,15**	0,12**	0,06**	-0,24**
	0,19**	0,14**	0,15**	0,13**	0,07**	-0,21**
Cash flow (0) / total assets (-1)	0,28**	0,15**	0,16**	0,13**	0,05**	-0,18**
	0,28**	0,15**	0,15**	0,13**	0,05**	-0,16**
Sales growth	-0,03	0,13**	0,15**	0,15**	0,10**	-0,05**
	-0,04*	0,13**	0,14**	0,15**	0,09**	-0,01

4.2 Methodology

All analyses are done with Microsoft Excel 2000 and SAS Enterprise Guide 4. Chapter 4.2.1 describes the used variables and different growth measures. Analysis methods are covered in chapter 4.2.2.

4.2.1 Variables and growth measures

All data is adjusted for inflation using the Consumer Price Index (CPI). The inflation adjustment is done to the level of 1990s-dollars. Growth is measured by three different ways

following the settings in Lang *et al.* (1996). The first measure (4.1) is net investment in year +1 divided by the book value of fixed assets in year 0. Net investment is measured as capital expenditures in year +1 minus depreciation. The second measure (4.2) is the rate of change of investment expressed as growth rate of real capital expenditures. This measure is defined as the ratio of inflation adjusted capital expenditures in year +1 to the capital expenditures in year 0, minus 1, e.g. the percentage change of capital expenditures. The third and final measure (4.3) captures the growth rate of employment, and is measured as the ratio of the number of employees in year +1 to the number of employees in year 0, minus 1. For both of the growth rate measures (employment and capital expenditures) the time span to year +3 is also used when available. The measures are presented below

Growth measure 1: $Inv(+1) / FA(0) = [CapEx(+1) – Depreciation(+1)] / FA(0)$ (4.1)

Growth measure 2: $[CapEx(+1 \text{ or } +3) – CapEx(0)]/CapEx(0)$ (4.2)

Growth measure 3: $[Empl(+1 \text{ or } +3) – Empl(0)]/Empl\ (0)$ (4.3)

Where *FA* is fixed assets, *Inv* investments, *CapEx* capital expenditures and *Empl* employment at the year relative given in parenthesis, year 0 refers to base year.

Leverage is defined as the ratio of the book value of short-term and long-term debt to the book value of total assets. This definition follows Lang *et al.* (1996). Main reason to use book leverage instead of market leverage is that the book value does not reflect recent chances in the market valuation on equity or the market expectations of growth. Lang *et al.* (1996) test alternative measures of leverage and find similar relation to growth and leverage with all except market leverage, as with the book leverage. The tested measures include e.g. market leverage, interest/total assets, book equity/total assets and long-term debt/total assets. Based on these results the said book leverage was chosen for this study.

In addition, the other variables that are know to affect the used growth measures need to be controlled. The controlled variables include Tobin's q, cash flow before interest expenses divided by total assets, and percentage sales growth from year -1 to 0 to allow for a multiplier effect. Also capital expenditures, divided by fixed assets, in year 0 are controlled

Tobin's q is defined using approximation (Chung and Pruitt, 1994)

$$\textit{Tobin's q} = \textit{MV(installed capital) / Replacement cost of capital}$$

$$\approx \frac{MV(equity) + MV(debt)}{BV(equity) + BV(debt)} \approx \frac{MV(equity) + BV(debt)}{TA} \tag{4.4}$$

where *MV(x)* refers to market value of *x*, *BV(x)* refers to book value of *x*, and *TA* to total assets. Market value of equity is defined as share price multiplied by the number of shares outstanding. Market value of debt is approximated using the book value of debt including short-term liabilities minus short-term assets. It is worth to mention that this definition of Tobin's q differs from the one Lang *et al.* (1996) use in their study. The Tobin's q presented in (4.4) is a simple approximation of the Lindenberg and Ross algorithm (Lindenberg and Ross, 1981), which is notably more costly in terms of required data and computational effort. The use of simpler measure for anticipated growth opportunities (or Tobin's q) is suggested also in e.g. Myers (1977) and Rajan and Zingales, 1995).

Cash flow is measured gross of interest expenses to make it is less depended on firms capital structure. Using cash flow net of interest expenses would proxy for company's capital structure more than for the available internal funds for investment. It shall be noted that these both ways of definition are, in addition, slightly affected by firm's capital structure due to the tax payments relation to capital structure.

Business cycles affect the company growth and might result in negative relationship with leverage and growth if the leverage happens to be low at the same time. To control and avoid this business cycle effect, indicator variables (e.g. dummy variables) for each year are introduced to the regression analysis.

4.2.2 Regression and supporting methodology

Correlation among the variables used in the study is defined using sample correlation r_{XZ} as

$$r_{XZ} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(z_i - \bar{z})}{(n-1)s_x s_z} \tag{4.5}$$

where n is the number of measurements of variables X and Z denoted as x_i and z_i, i=1,2,…,n. Equally, $\bar{x}$ and $\bar{z}$ are the sample means of X and Z, s_x and s_z are the sample standard deviations of X and Z.

Explanatory variables (independent variables) were regressed against each growth measure (dependent variables) using general multiple linear regression for n data points with m independent variables

$$y_i = \beta_0 + \sum_{k=1}^{m} \beta_k x_{k,i} + \varepsilon_i \,, \quad i=1,2,\ldots, n \tag{4.6}$$

where y_i is ith observation of dependent variable, x_k, $k=1,2,\ldots,m$, are independent variables, β_k , $k=1,2,\ldots,m$, are the corresponding parameters, and ε_i is the error term for observation i. The population parameters can be thus estimated using the following regression model

$$y_i = \hat{\beta}_0 + \sum_{k=1}^{m} \hat{\beta}_k x_{k,i} + e_i \tag{4.7}$$

where e_i is the residual $e_i = y_i - \hat{y}_i$, and $\hat{y}_i$ refers to the estimated value of y_i. The residual is estimated using the ordinary least squares (OLS) method by finding the minimum of the sum of squared residuals (SSE)

$$SSE = \sum_{i=1}^{n} e_i^2 \tag{4.8}$$

Regression model assumes constant variance for the error terms. This assumption is not likely to hold with the chosen data set. Error terms may be correlated e.g. within industries. Heteroskedastic data can results in too good p-values. Thus, to avoid these problems, heteroskedasticity-consistent standard errors (the White adjustment) are used to define more reliable and conservative t-statistics for the regression coefficients.

In addition, for each base year the firms with high (q > 1) or with low (q < 1) Tobin's q were studied separately to discover potential differences in the relationships to the factors affecting growth. The sample selection was done with and without industry adjustment, as described below. With industry adjustment the high and low Tobin's q are defined as q > 0 and q < 0, correspondingly.

4.2.3 Industry adjustment

Analysis of industry-adjusted variables is used in parallel to analysis with non-adjusted variables. The aim is to control for industry effects. In the industry adjustment, all variables are adjusted by the industry median within the sample data. Industries are formed based on three- or two-digit SIC codes, so that each industry included at least four companies. From each firm in the industry, the median industry variable is subtracted from corresponding firm specific variable. Industry adjustments are done at the level of whole time span, in other words base years 1990-2008. Shorter adjustment periods would not have enabled the formation of industries with enough companies in each one. Thus it shall be noted that the dot-com bubble brings in larger than usual upward bias in medians for some industries.

4.2.4 Mann-Whitney-Wilcoxon test

In addition, the subgroups of high-q and low-q firms are compared at the level of mean and median to collect more information on the groups' behaviour and to help interpret the regression results. The growth and leverage of the groups are compared using Mann-Whitney-Wilcoxon (MWW) test (also know as Wilcoxon rank-sum or Mann-Whitney U test). MWW is a non-parametric test that does not require normal distribution for the variables. It was chosen instead of e.g. Student t-test because it compares medians and hence is not sensitive to extreme values. With large samples the statistic, so called U, is approximately normally distributed.

5 Analysis and results

In the first regressions with the whole time period 1990-2008 certain years rose systematically as statistically significant. These years were the last years of the stock market booms and the following year of recession. Other stock bubbles of similar scale have not been observed in previous history, especially such closely one after another, making this whole time period interesting. To see the possible deviations between these bubble years and the intermediate (i.e. "normal") years both the non-adjusted and industry-adjusted data was divided into two groups, regressions were run normally again within the said subgroups and results were reanalysed basing on the new information. The term "bubble" is used relatively loosely here to describe the last years of economic boom before clear downturn.

This chapter is divided into four parts. Regression results and their analysis with data from 1990-2008 are covered in chapter 5.1. Next chapter 5.2 covers analysis of stock bubble and recession years (1990, 1997-2001, 2006-2008), and chapter 5.3 represents regressions with only the intermediate years (1991-1996, 2002-2005). Each period is defined using the base years, thus it shall be noted that the three-year growth measures are determined only up to base year 2006. Last chapter 5.4 puts together the results.

5.1 1990-2008

Regression results are presented in tables 5.1-5.3, and 5.5. Results show congruence with previous empirical results, and are compared more detailed to the study by Lang *et al.* (1996) in chapters 5.4 and 6. Still some clear deviations and in some cases only low, instead of strong, statistical significance are detected. These variations and the exceptional features of the studied time period will be understood better after the results presented in chapters 5.2 and 5.3.

5.1.1 Regressions of growth on firm characteristics

Regression results show clear negative relation between leverage and all the used growth measures. Significance stays at 5%-level only for investments and three-year growth in employment growth, showing strong negative relation for other dependent variables. Cash flow does not seem to be important explanatory term for three-year growth in capital

expenditures, but the cash flow factor gives support to Lang *et al.* (1996) by showing strong positive relation to investments and employment growth. Base year capital expenditures show negative relation for capital expenditures growth, supporting the strong relation found in Lang *et al.* (1996). The multiplier effect of sales growth is significant in all regressions, despite investments.

The results imply that a firm with half the average book leverage (26,14%) would, *ceteris paribus*, have one-year employment growth of 4,08% and annual capital expenditures growth of 7,35% instead of the corresponding averages 2,93% and 5,64%. This means nearly 40% higher growth in employment and 30% higher capital expenditures, giving economical importance for leverage in terms of firm growth. Compared to results from 1970-1989 data (Lang *et al.*, 1996), the effect of debt level change on capital expenditures growth has decreased, whereas the employment growth shows slightly higher sensitivity to leverage change.

Table 5.1: *Unadjusted regression of growth for years 1990-2008. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990-2008. Unadjusted regression P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	4814	4804	4011	4815	4017
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,003 *(0,830)*	-0,009 *(0,619)*	0,056 *(0,158)*	0,169** *(0,000)*	0,495** *(0,000)*
Book leverage / TA	-0,067* *(0,018)*	-0,088** *(0,004)*	-0,148* *(0,028)*	-0,131** *(0,004)*	-0,304** *(0,001)*
Cash flow / TA	0,452** *(0,000)*	0,240** *(0,000)*	0,452** *(0,000)*	0,248* *(0,013)*	0,036 *(0,862)*
Capital expenditures / FA	0,040 *(0,183)*	0,009 *(0,548)*	0,020 *(0,630)*	-0,109* *(0,046)*	-0,192^{+} *(0,098)*
Sales growth	-0,074 *(0,469)*	0,109** *(0,000)*	0,240** *(0,000)*	0,264** *(0,000)*	0,357** *(0,000)*
Tobin's q	0,007** *(0,004)*	0,011** *(0,003)*	0,028** *(0,000)*	0,022** *(0,000)*	0,040** *(0,004)*
R-square	0,1239	0,054	0,0628	0,0894	0,085

The industry effects are not controlled in table 5.1. Table 5.2 presents regression with industry-adjustment in all variables. Industries were formed from the sample based on two- or three-digit SIC codes, ensuring at least four companies under each industry. After controlling for the industry effects, regression results stay clearly congruent with the unadjusted regressions in table 5.1. Noteworthy changes are seen in the disappearance of the negative relation between leverage and three-year employment growth. No relation between cash flow and three-year capital expenditures is found, supporting the regression in table 5.1. Also capital expenditures show still no clear relationship to any of the growth measures, excluding one-year capital expenditures growth.

Table 5.2: *Industry-adjusted regression for years 1990-2008. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990-2008. Industry–adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	4814	4804	4011	4815	4017
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,047** *(0,000)*	0,015 *(0,288)*	0,100** *(0,002)*	0,181** *(0,000)*	-0,524** *(0,000)*
Book leverage / TA	-0,075* *(0,016)*	-0,078** *(0,007)*	-0,095 *(0,142)*	-0,126** *(0,005)*	-0,251** *(0,003)*
Cash flow / TA	0,442** *(0,000)*	0,231** *(0,000)*	0,440** *(0,000)*	0,232* *(0,025)*	0,023 *(0,910)*
Capital expenditures /FA	0,042 *(0,194)*	0,009 *(0,580)*	0,014 *(0,715)*	-0,113* *(0,048)*	-0,194 *(0,100)*
Sales growth	-0,081 *(0,437)*	0,107** *(0,000)*	0,226** *(0,000)*	0,260** *(0,000)*	0,333** *(0,000)*
Tobin's q	0,011** *(0,000)*	0,014** *(0,001)*	0,033** *(0,000)*	0,029** *(0,000)*	0,056** *(0,000)*
R-square	0,1317	0,0514	0,0577	0,0900	0,0862

5.1.2 Relation of growth opportunities and leverage to firm growth

The effects of anticipated growth opportunities together with firm leverage can be studied, by allowing the coefficient for leverage to be different for high q (q > 1) and low q (q < 1) firms. Lang *et al.* (1996) found a negative relation between leverage and all growth measures only for low q firms in their study, only exception within high q firms being the finding of a significant negative relation to one-year capital expenditures growth with unadjusted data.

Table 5.3: *Unadjusted regression of growth for 1990-2008, data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990-2008. Unadjusted regression P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	4814	4804	4011	4815	4017
	Investment / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,011 *(0,474)*	-0,003 *(0,880)*	0,067+ *(0,089)*	0,173** *(0,000)*	0,478** *(0,000)*
Book leverage, Q < 1	-0,028 *(0,393)*	-0,119** *(0,000)*	-0,203** *(0,002)*	-0,148** *(0,009)*	-0,216* *(0,043)*
Book leverage, Q > 1	-0,105** *(0,000)*	-0,058 *(0,132)*	-0,097 *(0,232)*	-0,114* *(0,014)*	-0,386** *(0,000)*
Cash flow / TA	0,471** *(0,000)*	0,225** *(0,000)*	0,428** *(0,000)*	0,239* *(0,018)*	0,075 *(0,716)*
Capital expenditures /FA	0,040 *(0,179)*	0,009 *(0,550)*	0,020 *(0,633)*	-0,109* *(0,046)*	-0,192+ *(0,100)*
Sales growth	-0,077 *(0,454)*	0,111** *(0,000)*	0,243** *(0,000)*	0,265** *(0,000)*	0,351** *(0,000)*
Tobin's q	0,009** *(0,000)*	0,010* *(0,016)*	0,025** *(0,001)*	0,021** *(0,000)*	0,045** *(0,002)*
R-square	0,1275	0,0551	0,0637	0,0895	0,0858

Table 5.3 shows relation of growth and leverage with data from 1990-2008. All growth measures, except investment, shows strong negative relation to firm leverage for low q firms. Interestingly, and clearly differing from 1970-1989 data (Lang *et al.*, 1996), only high q firms seem to experience negative relation between leverage and investments. Also high q firms show significant relation between leverage and capital expenditures growth. Besides, the

three-year capital expenditures growth indicates higher sensitivity to debt than with low q firms. Other explanatory variables behave as in the earlier regression in Table 5.1. Both cash flow and sales growth explain partly the future growth, while the explanatory significance of capital expenditures per fixed assets stays low.

Table 5.4: *Mean and median leverage and growth measures of high-q and low-q firms during 1990-2008. The difference between groups is compared with Mann-Whitney-Wilcoxon test (MWW), which is a non-parametric test for medians.*

1990-2008				**MWW**	
		Q < 1	**Q > 1**	**Z value**	**Pr > |Z|**
Leverage	**Mean**	29,39%	23,24%	15,2372	<0,0001
	Median	27,86%	22,12%		
Investments	**Mean**	-0,92%	2,38%	-12,6968	<0,0001
	Median	-1,05%	1,67%		
1-year employment growth	**Mean**	-0,47%	5,96%	-16,9618	<0,0001
	Median	-1,42%	2,35%		
3-year employment growth	**Mean**	3,69%	15,95%	-13,1699	<0,0001
	Median	-1,95%	7,40%		
1-year capital expenditure growth	**Mean**	0,84%	9,93%	-10,8963	<0,0001
	Median	-3,74%	3,87%		
3-year capital expenditure growth	**Mean**	17,83%	20,34%	-3,9676	<0,0001
	Median	-1,52%	6,42%		

Table 5.4 presents the average and median growth and leverage for both high-q and low-q firms during the whole period 1990-2008. Results support that the growth and investments of low-q firms are significantly lower than for high-q firms. Similarly low-q firms have more debt than high-q firms. Low-q firms have negative growth median in all measures expect three-year employment growth. Only capital expenditures and three-year employment growth show positive average values. High-q firms on the other hand experience positive growth in all measure. Thus the firms on average behave as expected based on their anticipated growth opportunities.

Table 5.5 presents same results as table 5.3 but with industry-adjusted variables. Diverging from the above results (table 5.3), also low q firms have, although weak, negative relation between leverage and investments. In addition no significant relation between leverage and three-year capital expenditures growth is seen with low q firms. These findings support the earlier regression results in tables 5.1-5.3, suggesting that the years 1990-2008 might have been different from 1970-1989.

Table 5.5: *Industry-adjusted regression of growth for 1990-2008, data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990-2008. Industry–adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	4814	4804	4011	4815	4017
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,047** *(0,000)*	0,016 *(0,267)*	0,100** *(0,005)*	0,181** *(0,000)*	0,412** *(0,000)*
Book leverage, Q < 0	-0,056^{+} *(0,063)*	-0,121** *(0,000)*	-0,142* *(0,062)*	-0,138* *(0,038)*	-0,212 *(0,108)*
Book leverage, Q > 0	-0,096* *(0,026)*	-0,030 *(0,581)*	-0,049 *(0,518)*	-0,113* *(0,055)*	-0,289* *(0,005)*
Cash flow / TA	0,444** *(0,000)*	0,228** *(0,000)*	0,440** *(0,000)*	0,231* *(0,025)*	0,023 *(0,910)*
Capital expenditures /FA	0,042 *(0,196)*	0,009 *(0,557)*	0,015 *(0,491)*	-0,113* *(0,048)*	-0,195^{+} *(0,099)*
Sales growth	-0,081 *(0,433)*	0,109** *(0,000)*	0,227** *(0,000)*	0,260** *(0,000)*	0,332** *(0,000)*
Tobin's q	0,011** *(0,000)*	0,015** *(0,000)*	0,033** *(0,000)*	0,030** *(0,000)*	0,056** *(0,000)*
R-square	0,1320	0,0521	0,0578	0,0900	0,0862

In addition, as noted before, certain control years showed systematically significant (negative) coefficient in most of the regressions. These were the peak years in stock bubbles and the following year(s) of recession. Thus the data was divided into two groups 1) so called abnormal (or bubble) years (1990, 1997-2001, 2006-2008) and 2) normal years (1991-1996, 2002-2006) referring to the relatively more stabile periods of recovery. Regressions were repeated with both of the groups, and results are shown in the following chapters 5.2 and 5.3.

5.2 Abnormal years – 1990, 1997-2001, 2006-2008

The years 1990, 1997-2001 and 2006-2008 include stock market bubbles/booms with overheated stock markets and the subsequent fast drop and recession. Periods are linked to relatively high interest rates, which are dropped drastically after or during the first year of stock market decline. The exact choice of the used years was based on their significance in the

whole data regressions. In chapter 5.2.2.1 the abnormal years are further divided and the boom and recession periods are studied in separate regressions.

5.2.1 Regressions of growth on firm characteristics

The first difference to stand out in the regression results (table 5.6) is the lost of relation between leverage and firm growth, while other explanatory variables maintain similar significant relation to growth as seen with the whole data. Only weak significance for the relation between leverage and one-year employment and capital expenditures growth can be found. The sensitivity of growth to the explanatory variables shows no clear difference compared to the whole data results.

Industry-adjusted regression (table 5.7) gives supporting results to the unadjusted data (table 5.6) as no significant connection between leverage and growth is seen. In addition, the relation between cash flow and one-year capital expenditures growth shows no significance, hence differing from the whole data results.

Table 5.6: *Unadjusted regression of growth. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990, 1997-2001, 2006-2008. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2551	2542	1770	2551	1774
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,026 *(0,197)*	-0,045+ *(0,092)*	-0,092* *(0,024)*	-0,073+ *(0,074)*	0,018 *(0,816)*
Book leverage / TA	-0,037 *(0,378)*	-0,068+ *(0,054)*	0,013 *(0,903)*	-0,090+ *(0,080)*	0,005 *(0,965)*
Cash flow / TA	0,492** *(0,000)*	0,261** *(0,000)*	0,455** *(0,001)*	0,227+ *(0,070)*	-0,080 *(0,763)*
Capital expenditures /FA	0,026 *(0,165)*	-0,003 *(0,793)*	-0,018 *(0,134)*	-0,086* *(0,024)*	-0,126+ *(0,073)*
Sales growth	-0,147 *(0,370)*	0,121** *(0,000)*	0,184** *(0,015)*	0,294** *(0,000)*	0,156+ *(0,055)*
Tobin's q	0,007* *(0,023)*	0,013** *(0,001)*	0,028** *(0,000)*	0,027** *(0,000)*	0,068** *(0,000)*
R-square	0,1115	0,0583	0,0510	0,1179	0,0578

Based on these results so far, mainly cash flow together with anticipated growth opportunities (Tobin's q) seem to guide the investments during peak years and the following year of decline. Sales growth and Tobin's q, weakly together with earlier capital expenditures, become important factors with capital expenditures decisions. On the other hand, all the three mentioned factors (sales growth, cash flow and Tobin's q) explain employment growth.

Table 5.7: *Industry-adjusted regression. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990, 1997-2001, 2006-2008. Industry-adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2551	2542	1770	2551	1774
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,032** *(0,000)*	-0,014 *(0,104)*	-0,019 *(0,308)*	-0,041 *(0,197)*	0,037 *(0,481)*
Book leverage / TA	-0,043 *(0,366)*	-0,070 *(0,117)*	0,021 *(0,848)*	-0,092^{+} *(0,084)*	0,004 *(0,969)*
Cash flow / TA	0,480** *(0,000)*	0,241** *(0,000)*	0,413** *(0,002)*	0,182 *(0,165)*	-0,180 *(0,515)*
Capital expenditures /FA	0,028 *(0,176)*	-0,002 *(0,817)*	-0,018 *(0,178)*	-0,088* *(0,021)*	-0,127^{+} *(0,059)*
Sales growth	-0,153 *(0,358)*	0,120** *(0,001)*	0,173* *(0,019)*	0,294** *(0,000)*	0,150^{+} *(0,051)*
Tobin's q	0,010** *(0,002)*	0,014** *(0,005)*	0,028** *(0,001)*	0,028** *(0,000)*	0,067** *(0,000)*
R-square	0,1176	0,0547	0,0452	0,1138	0,0521

5.2.2 Relation of growth opportunities and leverage to firm growth

When growth opportunities are took into account (see table 5.8), leverage suddenly rises as strongly significant factor for one-year growth in employment and capital expenditures for low-q firms. High-q firms show no relation between leverage and growth, except the weak negative relation to investments. This finding supports the similar result seen with the whole time period of 1990-2008 (table 5.3). Other explanatory variables behave as expected, cash flow and sales growth presenting stronger explanatory power than capital expenditures.

Table 5.8: *Unadjusted regression of growth. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990, 1997-2001, 2006-2008. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2551	2542	1770	2551	1774
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,038^{+} *(0,089)*	-0,033* *(0,030)*	-0,065^{+} *(0,087)*	-0,049 *(0,232)*	0,024 *(0,757)*
Book leverage, Q < 1	0,011 *(0,811)*	-0,118** *(0,002)*	-0,107 *(0,306)*	-0,188** *(0,001)*	-0,024 *(0,851)*
Book leverage, Q > 1	-0,080^{+} *(0,052)*	-0,024 *(0,685)*	0,097 *(0,455)*	-0,003 *(0,959)*	0,025 *(0,830)*
Cash flow / TA	0,511** *(0,000)*	0,240** *(0,000)*	0,427** *(0,001)*	0,188 *(0,145)*	-0,087 *(0,744)*
Capital expenditures /FA	0,026 *(0,157)*	-0,003 *(0,703)*	-0,019 *(0,119)*	-0,086* *(0,022)*	-0,127^{+} *(0,073)*
Sales growth	-0,149 *(0,366)*	0,122** *(0,001)*	0,186* *(0,014)*	0,297** *(0,000)*	0,157^{+} *(0,055)*
Tobin's q	0,009** *(0,005)*	0,010* *(0,029)*	0,023** *(0,003)*	0,022** *(0,000)*	0,066** *(0,000)*
R-square	0,1152	0,0606	0,0541	0,1219	0,0579

Table 5.9 presents the same regressions with industry-adjusted data, again limiting the sample only to the abnormal years. Results support the unadjusted results with no noteworthy deviations. Again, only one-year employment growth and capital expenditures growth have significant negative relation to leverage with low-q firms. The growth of high-q firms is not affected by leverage, while only a weak negative relation to investments can be found.

Noticing the unusual characteristics of the included years, it is not too surprising that no clear relations are seen for three-year capital expenditures growth. The larger than usual changes in the business environment are likely to affect a company more and to be more difficult to forecast, than during the relatively stabile years.

Table 5.9: *Industry-adjusted regression of growth. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1990, 1997-2001, 2006-2008. Industry-adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2551	2542	1770	2551	1774
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,032** *(0,000)*	-0,010 *(0,229)*	-0,013 *(0,480)*	-0,037 *(0,242)*	0,035 *(0,504)*
Book leverage, Q < 0	-0,031 *(0,507)*	-0,140** *(0,000)*	-0,110 *(0,311)*	-0,174* *(0,012)*	0,058 *(0,725)*
Book leverage, Q > 0	-0,057 *(0,371)*	0,010 *(0,910)*	0,148 *(0,428)*	0,002 *(0,980)*	-0,047 *(0,731)*
Cash flow / TA	0,481** *(0,000)*	0,235** *(0,000)*	0,413** *(0,002)*	0,175 *(0,187)*	-0,180 *(0,514)*
Capital expenditures /FA	0,028 *(0,178)*	-0,001 *(0,891)*	-0,016 *(0,220)*	-0,086* *(0,022)*	-0,128^{+} *(0,058)*
Sales growth	-0,153 *(0,357)*	0,122** *(0,001)*	0,175* *(0,017)*	0,297** *(0,000)*	0,149^{+} *(0,052)*
Tobin's q	0,010** *(0,003)*	0,014** *(0,004)*	0,029** *(0,001)*	0,029** *(0,000)*	0,067** *(0,000)*
R-square	0,132	0,0521	0,0578	0,09	0,0862

Table 5.10 represents the average and median growth and leverage for the bubble years and subsequent downturn. If compared to table 5.4 (whole period averages and medians), this period has clearly lower growth and investments for low-q firms. The low-q firms maintain the leverage at the level of whole period average (median: 27,86%). Although the high-q firms experience slight decrease in growth, they still maintain the positive growth rates over the bubble and downturn. For high-q firms, only three-years capital expenditures growth is noteworthy lower than within the whole period (mean: 3,70% vs. 20,34% and median: -9,47% vs. 6,42%). The subgroups (low-q and high-q) are significantly different from each other also during the abnormal years. The decreased growth within the low-q firms suggest that these firms are more sensitive to and suffer more from the negative effects of bubble years and the following recession.

Table 5.10: *Mean and median leverage and growth measures of high-q and low-q firms during the bubble years and following downturn. The difference between groups is compared with Mann-Whitney-Wilcoxon test (MWW), which is a non-parametric test for medians.*

1990, 1997-2001, 2006-2008				MWW	
		Q < 1	Q > 1	Z value	Pr > |Z|
Leverage	**Mean** **Median**	29,98% 27,88%	24,38% 22,94%	9,8766	<0,0001
Investments	**Mean** **Median**	-2,14% -1,69%	1,02% 1,33%	-12,6968	<0,0001
1-year employment growth	**Mean** **Median**	-1,59% -2,59%	6,32% 1,82%	-16,9618	<0,0001
3-year employment growth	**Mean** **Median**	0,45% -6,00%	14,79% 5,51%	-13,1699	<0,0001
1-year capital expenditure growth	**Mean** **Median**	-7,95% -11,16%	7,36% 1,31%	-10,8963	<0,0001
3-year capital expenditure growth	**Mean** **Median**	-9,64% -20,99%	3,70% -9,47%	-3,9676	<0,0001

5.2.2.1 Difference between the bubble and recession periods

As the abnormal years include two substantially different types of economic periods, the above data was further divided into clear bubble years (1997-1999, 2006) and recession years including the bubble burst (1990, 2000-2001, 2007-2008). Regressions were repeated for unadjusted and industry-adjusted data with different coefficient for low-q and high-q firms. Tables 5.11 and 5.12 present the results for the bubble years and tables 5.13 and 5.14 show the regression for recession periods. It shall be noted that the three-year growth measures were not available for base years 2007-2008, resulting in a relatively low amount of data (roughly 700 firm years each).

Within the bubble years, data shows that low-q firms continue experiencing statistically significant negative relation between leverage and growth. This holds even for three-year employment growth and capital expenditures growth, diverging for the regressions over abnormal years (tables 5.7-5.10). For high-q firms only investment seem suffer at some level from higher level of debt. Results hold in industry-adjusted regression, excluding the capital expenditures growth. As the data has been split once again, the sample size is relatively low. This affects also to the statistical significances. Although, in case of capital expenditures growth during bubble years, there seem to be a clear industry effect included as the coefficient decreases after industry-adjustment. Regarding other explanatory variables, sales growth and

cash flow continue showing strong significance, while Tobin's q loses its power in explaining investment and employment growth.

Table 5.11: *Unadjusted regression of growth – boom years. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1997-1999, 2006 – bubble years. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	1095	1093	1069	1095	1072
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,049^{+} *(0,058)*	-0,052 *(0,318)*	0,037 *(0,654)*	0,097^{+} *(0,072)*	0,210* *(0,018)*
Book leverage, Q < 1	-0,080* *(0,017)*	-0,182* *(0,013)*	-0,264^{+} *(0,065)*	-0,277** *(0,002)*	-0,440** *(0,006)*
Book leverage, Q > 1	-0,120* *(0,018)*	-0,007 *(0,952)*	0,074 *(0,707)*	-0,031 *(0,761)*	-0,211 *(0,174)*
Cash flow / TA	0,331** *(0,000)*	0,404* *(0,036)*	0,438 *(0,115)*	0,215 *(0,267)*	-0,239 *(0,384)*
Capital expenditures /FA	0,311** *(0,004)*	0,202 *(0,215)*	0,210 *(0,337)*	-0,218 *(0,176)*	-0,650** *(0,000)*
Sales growth	0,011 (0,678)	0,107^{+} *(0,098)*	0,273* *(0,012)*	0,421** *(0,000)*	0,490** *(0,000)*
Tobin's q	0,001 *(0,767)*	0,006 *(0,504)*	0,018 *(0,110)*	0,022* *(0,012)*	0,078** *(0,001)*
R-square	0,1983	0,0639	0,0674	0,1023	0,1048

Base years including recession and the year preceding (bubble burst) present the other type of abnormal years. The result support that high-q firms do not face the limiting effects of debt during recession. Also the negative relation for low-q firms partly disappears, but is strongly significant for one-year employment and capital expenditures growth. Industry-adjustment amplifies this relation. While interpreting the industry-adjusted results it shall be noted that the adjustment is done at the level of whole time period of 1990-2008. Cash flow increases in importance (significance) explaining firm growth compared to bubble years. Again, the lowered sample size shall be noted, especially the three-year growth measures were regressed only with roughly 700 firm years.

Table 5.12: *Industry-adjusted regression of growth – boom years. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1997-1999, 2006 – bubble years. Industry-adjusted regression.
P-value in parenthesis. + 10% level, * 5% level, ** 1% level

n	1095	1093	1069	1095	1072
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,021* *(0,027)*	0,023 *(0,213)*	0,124** *(0,001)*	0,096** *(0,000)*	0,067 *(0,150)*
Book leverage, Q < 0	-0,065^{+} *(0,085)*	-0,205** *(0,001)*	-0,276^{+} *(0,100)*	-0,160 *(0,322)*	-0,185 *(0,502)*
Book leverage, Q > 0	-0,153* *(0,029)*	0,043 *(0,773)*	0,178 *(0,502)*	-0,018 *(0,877)*	-0,272^{+} *(0,079)*
Cash flow / TA	0,295** *(0,001)*	0,411* *(0,026)*	0,388 *(0,170)*	0,240 *(0,266)*	-0,307 *(0,287)*
Capital expenditures /FA	0,359** *(0,002)*	0,240 *(0,215)*	0,331 *(0,178)*	-0,281 *(0,160)*	-0,736** *(0,000)*
Sales growth	0,004 *(0,867)*	0,091 *(0,195)*	0,224* *(0,036)*	0,416** *(0,000)*	0,490** *(0,000)*
Tobin's q	0,002 *(0,488)*	0,013 *(0,138)*	0,025* *(0,034)*	0,033** *(0,002)*	0,087** *(0,000)*
R-square	0,132	0,0521	0,0578	0,09	0,0862

Table 5.13: *Unadjusted regression of growth – recession. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity. Three-year growth measures lack the data from base years 2007-2008.*

1991, 2000-2001, 2007-2008 – recession. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	1456	1448	701	1456	702
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,049* *(0,061)*	-0,024 *(0,150)*	-0,075 *(0,105)*	-0,053 *(0,244)*	-0,047 *(0,610)*
Book leverage, Q < 0	0,063 *(0,292)*	-0,084* *(0,031)*	0,048 *(0,730)*	-0,156* *(0,035)*	0,307 *(0,120)*
Book leverage, Q > 0	-0,040 *(0,436)*	-0,018 *(0,694)*	0,138 *(0,245)*	-0,014 *(0,828)*	0,162 *(0,340)*
Cash flow / TA	0,526** *(0,000)*	0,183** *(0,001)*	0,347** *(0,000)*	0,184 *(0,245)*	0,009 *(0,978)*
Capital expenditures /FA	0,019^{+} *(0,098)*	-0,012 *(0,136)*	-0,025** *(0,005)*	-0,079* *(0,018)*	-0,093^{+} *(0,060)*
Sales growth	-0,266 *(0,262)*	0,102* *(0,044)*	0,067 *(0,483)*	0,242** *(0,000)*	-0,010 *(0,931)*
Tobin's q	0,013* *(0,036)*	0,005 *(0,377)*	0,019* *(0,072)*	0,022* *(0,016)*	0,051* *(0,015)*
R-square	0,1431	0,048	0,0327	0,099	0,036

Table 5.14: *Industry-adjusted regression of growth – recession. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity. Three-year growth measures lack the data from base years 2007-2008.*

1991, 2000-2001, 2007-2008 – recession. Industry-adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	1456	1448	701	1456	702
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,034** *(0,000)*	-0,012 *(0,166)*	-0,017 *(0,387)*	-0,039 *(0,223)*	0,025 *(0,624)*
Book leverage, Q < 0	-0,019 *(0,764)*	-0,114** *(0,005)*	0,006 *(0,966)*	-0,184** *(0,008)*	0,182 *(0,323)*
Book leverage, Q > 0	0,046 *(0,595)*	0,007 *(0,916)*	0,132 *(0,381)*	-0,025 *(0,815)*	0,099 *(0,710)*
Cash flow / TA	0,482** *(0,000)*	0,171** *(0,003)*	0,328** *(0,000)*	0,163 *(0,315)*	-0,086 *(0,806)*
Capital expenditures /FA	0,020 *(0,111)*	-0,010 *(0,102)*	-0,028** *(0,001)*	-0,078* *(0,013)*	-0,094* *(0,037)*
Sales growth	-0,272 *(0,258)*	0,105* *(0,032)*	0,067 *(0,482)*	0,247** *(0,000)*	-0,029 *(0,784)*
Tobin's q	0,013* *(0,029)*	0,004 *(0,493)*	0,018 *(0,121)*	0,024* *(0,010)*	0,034^{+} *(0,100)*
R-square	0,34	0,042	0,0247	0,0916	0,0289

5.3 Normal years – 1991-1996, 2002-2005

It is reasoned to expect that the variations or unclear results in the 1990-2008 regressions were mainly due to the effect of abnormal years included in the sample. The results in chapter 5.2 support this argument, as the relation between leverage and growth disappeared especially for high-q firms. On the other hand, the still seen explanatory power of leverage with low-q firms suggests that this particular dependence is strong enough to remain significant despite the economical environment for these firms.

Thus regressions were run with the data from rest of the years, namely 1991-1996, 2002-2005, to see the differences compared to these relatively normal time periods. Normal years refer here to years with no particular global or nationwide abnormalities (e.g. bubbles/boom or recession) in stock market, but rather stabile development with mainly upward directing

stock markets. These periods, 1991-1996, 2002-2005, had rising interest rates, which started from low level during economical downturn and increased more or less steadily till the high level of the period in question (see figure 3.1 for historical interest rates). Stock markets and general economic environment experienced recovery after recession, but the next bubble to come was still not developing at full blast.

5.3.1 Regressions of growth on firm characteristics

As expected, the results with the more stabile years differ from the bubble years' results. Table 5.15 and 5.16 present the regressions with unadjusted and industry-adjusted data selected directly form the whole data used in 1990-2008 – regressions.

Table 5.15: *Unadjusted regression of growth. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1991-1996, 2002-2005. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2263	2262	2241	2264	2243
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,024^{+} *(0,067)*	-0,021 *(0,304)*	0,006 *(0,892)*	0,241** *(0,000)*	0,694** *(0,000)*
Book leverage / TA	-0,071** *(0,003)*	-0,090** *(0,002)*	-0,217** *(0,001)*	-0,245** *(0,002)*	-0,750** *(0,000)*
Cash flow / TA	0,155* *(0,011)*	0,110 *(0,305)*	0,060 *(0,693)*	0,560** *(0,002)*	0,806* *(0,019)*
Capital expenditures /FA	0,297** *(0,000)*	0,193* *(0,028)*	0,582** *(0,000)*	-0,461** *(0,000)*	-0,985** *(0,000)*
Sales growth	0,002 *(0,906)*	0,069^{+} *(0,071)*	0,223** *(0,000)*	0,264** *(0,000)*	0,692** *(0,000)*
Tobin's q	0,009* *(0,021)*	0,007 *(0,306)*	0,030** *(0,003)*	0,011 *(0,339)*	-0,017 *(0,460)*
R-square	0,3084	0,0584	0,1119	0,0434	0,0518

During the years 1991-1996 and 2002-2005 leverage seems to have a strong significance in explaining growth in all used measures. This is highly supported with industry-adjusted data. Another clear difference is seen with cash flow. Cash flow has positive relation to capital expenditures growth, which was not seen neither with whole data nor the abnormal years. On

the other hand, the earlier seen relation of cash flow to employment growth has disappeared. Moreover, capital expenditures per fixed assets stands up as strongly significant factor for all growth measures (only significant or weak for one-year employment growth). These relations, were not seen with other data sets, or were clearly weaker (with capital expenditures growth).

Table 5.16: *Industry-adjusted regression. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1991-1996, 2002-2005. Industry-adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2263	2262	2241	2264	2243
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,038** *(0,000)*	0,013 *(0,389)*	0,084** *(0,008)*	0,189** *(0,000)*	0,412** *(0,000)*
Book leverage / TA	-0,085** *(0,000)*	-0,070* *(0,010)*	-0,150* *(0,018)*	-0,222** *(0,004)*	-0,623** *(0,000)*
Cash flow / TA	0,130* *(0,031)*	0,122 *(0,260)*	0,099 *(0,554)*	0,597** *(0,001)*	0,854* *(0,013)*
Capital expenditures /FA	0,335** *(0,000)*	0,179^{+} *(0,056)*	0,517** *(0,003)*	-0,554** *(0,000)*	-1,185** *(0,000)*
Sales growth	-0,011 *(0,463)*	0,067^{+} *(0,080)*	0,213** *(0,004)*	0,264** *(0,000)*	0,676** *(0,000)*
Tobin's q	0,014** *(0,001)*	0,013^{+} *(0,094)*	0,046** *(0,002)*	0,038** *(0,003)*	0,046^{+} *(0,060*
R-square	0,3392	0,054	0,099	0,0521	0,0552

5.3.2 Relation of growth opportunities and leverage to firm growth

When the anticipated growth opportunities are took into account with the firm leverage (see table 5.17), low q firms experience negative relation between debt and growth with all measures except one-year capital expenditures growth. Interestingly, high-q firms show negative relation to all growth measures. Moreover, the relation between leverage and growth seems to be more sensitive to debt changes with high-q firms than with low-q firms, if considering investments and three-year capital expenditures growth.

Table 5.17: *Unadjusted regression of growth. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1991-1996, 2002-2005. Unadjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2263	2262	2241	2264	2243
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	-0,027* *(0,035)*	-0,017 *(0,394)*	0,007 *(0,864)*	0,220** *(0,000)*	0,652** *(0,000)*
Book leverage, Q < 1	-0,057** *(0,006)*	-0,104** *(0,005)*	-0,225** *(0,003)*	-0,151 *(0,140)*	-0,554** *(0,001)*
Book leverage, Q > 1	-0,088** *(0,006)*	-0,072* *(0,018)*	-0,207* *(0,012)*	-0,358** *(0,000)*	-0,992** *(0,000)*
Cash flow / TA	0,165** *(0,006)*	0,100 *(0,349)*	0,054 *(0,746)*	0,629** *(0,001)*	0,950** *(0,006)*
Capital expenditures /FA	0,295** *(0,000)*	0,196* *(0,026)*	0,583** *(0,000)*	-0,478** *(0,000)*	-1,022** *(0,000)*
Sales growth	0,000 *(0,989)*	0,071+ *(0,064)*	0,224** *(0,003)*	0,254** *(0,000)*	0,671** *(0,000)*
Tobin's q	0,010* *(0,013)*	0,006 *(0,451)*	0,029* *(0,040)*	0,021+ *(0,093)*	0,003 *(0,894)*
R-square	0,3096	0,0587	0,1119	0,0467	0,0556

Thus, repeating the same comparison as with the whole period of 1990-2008 using the whole period averages as done in chapter 5.1, we get following numbers. During the stabile years a low-q (high-q) company with half the whole period average leverage (26,14%) would, *ceteris paribus*, have investments of 1,56% (1,97%) and three-year capital expenditures growth of 26,45% (32,18%) instead of the corresponding averages of 0,83% and 19,21%. This suggests nearly 90% (140%) higher investment rate for low-q (high-q) firm with 50% lower than average leverage, and nearly 40% (70%) increase in terms of three-year capital expenditures growth.

But, if in addition the data in table 5.19 (Tobin's q–specific period averages and medians) is taken into consideration the same reasoning looks following: During the intermediate years, a low-q (high-q) company with half the average leverage of 28,71% (21,97%) would, *ceteris paribus*, have investments of 1,28% (4,89%) and three-year capital expenditures growth of 45,86% (45,29%) instead of the corresponding averages of 0,46% (3,93%) and 37,91%

(34,39%). This suggests almost 180% (25%) higher investment rate for low-q (high-q) firm with 50% lower than average leverage, but only 20% (30%) higher growth in terms of three-year capital expenditures. These numbers give more importance to the debt level of low-q firms in affecting the level of investments, but also diminish the real influence on capital expenditures growth. Similarly half the average leverage would result in over 180% higher one-year employment growth (2,29% instead of 0,80%) for low-q firms and close to 15% higher growth for high-q firms (6,33% instead of 5,54%).

Table 5.18 represents the industry-adjusted regression results. These support the unadjusted results, although showing a little weaker significance, as should be expected due to industry effects. Other explanatory variables behave as expected based on the earlier results.

Table 5.18: *Industry-adjusted regression of growth. Data is split based on anticipated growth opportunities. Investment is capital expenditures minus depreciation at year +1 divided by fixed assets (FA) at the end of year 0. Capital expenditures (employment) growth is the percentage change of capital expenditures (employment) for 1- or 3-year time period compared to year 0. Book leverage is the ratio of book value of total debt to total assets (TA). Cash flow and capital expenditures in explanatory variables are computed for the base year. Sales growth is the percentage growth form year –1 to 0. All data is adjusted for inflation. Results are corrected for heteroskedasticity.*

1991-1996, 2002-2005. Industry-adjusted regression. P-value in parenthesis. + 10% level, * 5% level, ** 1% level					
n	2263	2262	2241	2264	2243
	Investments / FA	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditure growth**	**3-year capital expenditure growth**
Intercept	0,038** *(0,000)*	0,013 *(0,385)*	0,084** *(0,008)*	0,188** *(0,000)*	0,412** *(0,000)*
Book leverage, Q < 0	-0,062** *(0,002)*	-0,073^{+} *(0,059)*	-0,129 *(0,150)*	-0,129 *(0,321)*	-0,589** *(0,004)*
Book leverage, Q > 0	-0,111* *(0,014)*	-0,067 *(0,109)*	-0,170^{+} *(0,074)*	-0,326** *(0,000)*	-0,657** *(0,000)*
Cash flow / TA	0,131* *(0,029)*	0,122 *(0,261)*	0,100 *(0,549)*	0,601** *(0,001)*	0,855* *(0,012)*
Capital expenditures /FA	0,334** *(0,000)*	0,179^{+} *(0,057)*	0,517** *(0,003)*	-0,556** *(0,000)*	-1,186** *(0,000)*
Sales growth	-0,011 *(0,430)*	0,067^{+} *(0,079)*	0,213** *(0,004)*	0,261** *(0,000)*	0,675** *(0,000)*
Tobin's q	0,014** *(0,002)*	0,013^{+} *(0,085)*	0,046** *(0,002)*	0,035** *(0,004)*	0,046^{+} *(0,061)*
R-square	0,34	0,054	0,0991	0,0529	0,0552

Table 5.19 shows the general growth characteristics of the subgroups. Both groups experience clearly higher growth in all measures than during the abnormal years. Moreover, high-q and low-q firms do not differ in capital expenditures growth at three-year level. Other growth measures are significantly lower for low-q firms. Low-q firms also continue having significantly higher debt level. The three-year growth measures are weighted by the bias from the early bubble years (the base years span intermediate years). Similarly as in the table 5.10 (abnormal years), where the three-year growth measures are weighted by the economic downturn and the few following years. Considering this, the result support that the low-q firms may utilize the early bubble years relatively more strongly, and on the other hand suffer the downturn more than high-q firms. Thus, being more sensitive to economic cycles.

Table 5.19: *Mean and median leverage and growth measures of high-q and low-q firms during the intermediate years. The difference between groups is compared with Mann-Whitney-Wilcoxon test (MWW), which is a non-parametric test for medians.*

1991-1996, 2002-2005				**MWW**	
		Q < 1	**Q > 1**	**Z value**	**Pr > |Z|**
Leverage	**Mean**	28,71%	21,97%	11,7577	<0,0001
	Median	27,83%	21,03%		
Investments	**Mean**	0,46%	3,92%	-8,0791	<0,0001
	Median	-0,39%	1,91%		
1-year employment growth	**Mean**	0,80%	5,54%	-10,4585	<0,0001
	Median	-0,45%	2,68%		
3-year employment growth	**Mean**	6,06%	16,92%	-9,3934	<0,0001
	Median	0,00%	9,26%		
1-year capital expenditure growth	**Mean**	10,79%	12,82%	-3,2003	0,0014
	Median	4,42%	6,78%		
3-year capital expenditure growth	**Mean**	37,91%	34,39%	-0,9691	0,3325
	Median	15,66%	17,59%		

5.4 Summing up of the results

The results are collected here by one growth measure at time and each time period is examined. Please refer to figure 2.1 regarding the results of Lang *et al.* (1996). As seen from the tables 5.4, 5.10, and 5.19, the average leverage is relatively stabile for low-q firms during the sample period. The median leverage stays within 27,83-27,88% during the both abnormal (bubble) years and normal (intermediate). The high-q firms experience larger fluctuations as the median leverage varies between the 22,94% of abnormal years and the 21,03% of the intermediate years. The relation between leverage and growth measures on the other hand varies clearly between different time periods, as seen in below review of the results.

5.4.1 Investments per fixed assets

Investment shows clear difference between bubble years and intermediate years (see table 5.20). There is no significant relation to book leverage during recession, whereas the normal years show clear connection for both high-q and low-q firms. During stock market bubble the relationship seems to weaken for low-q firms. Out of the other explanatory variables cash flow's effect is positive and significant during both periods, and capital expenditures count positively only during the normal years and recession. Thus the sample firms behave as the study by Lang *et al.* (1996) suggest excluding the period of recession, whole sample supporting also their results. One deviation to their results is that during 1990-2008 the high-q firms seem to experience higher sensitivity to leverage chances compared to low-q firms.

Table 5.20: *Relation between book leverage and investments during 1990-2008. Relation is stated as "Neg."/"Positive" (5%-level significance), or "No" (no significance in regression), weak (10%-level) relation is stated separately. The regression coefficient is given in relevant cases, and should be compared between separate regressions only with high caution. Abnormal years cover base years 1990, 1997-2001, 2006-2008. Normal years include the intermediate periods 1991-1996 and 2002-2005. Both subgroups are split directly from the whole sample of 1990-2008, and industry effects are controlled at this level. FA: fixed assets.*

Investment / FA	**1990-2008**		**Abnormal years**						**Normal years**	
			Whole period		*Boom*		*Recession*			
Overall										
Book leverage	Neg.	-0,067	No	-	*Not analysed*		*Not analysed*		Neg.	-0,071
Industry-adjusted leverage	Neg.	-0,075	No	-					Neg.	-0,085
Low-q										
Book leverage	No	-	No	-	Neg.	-0,080	No	-	Neg.	-0,057
Industry-adjusted leverage	Weak neg.	-0,056	No	-	Weak neg.	-0,065	No	-	Neg.	-0,062
High-q										
Book leverage	Neg.	-0,105	Weak neg.	-0,080	Neg.	-0,120	No	-	Neg.	-0,088
Industry-adjusted leverage	Neg.	-0,096	No	-	Neg.	-0,153	No	-	Neg.	-0,111

The median investment stays negative within both periods for low-q firms, while high-q firms maintain positive rate of investment through the studied period. The difference between these groups is significant all the time. Both subgroups experience slightly lower investment during the so-called abnormal years, a result that is likely to derive largely from the downturn years.

5.4.2 Employment growth

Employment growth (table 5.21) shows clear negative relation to leverage at one-year level within low-q firms. At three-year level this relation disappears only during recession, and could be parlty due to small sample size. The high-q firms experience this relation only during normal years. Thus, excluding the intermediate years, the results are congruent with Lang *et al.* (1996), who find negative relation for only low-q firms.

Table 5.21: *Relation between book leverage and* ***a)*** *one-year or* ***b)*** *three-year employment growth during 1990-2008. Relation is stated as "Negative"/"Positive" (5%-level significance), or "No" (no significance in regression), weak (10%-level) relation is stated separately. The regression coefficient is given in relevant cases, and should be compared between separate regressions only with high caution. The abnormal years cover base years 1990, 1997-2001, 2006-2008. Normal years include the intermediate periods 1991-1996 and 2002-2005. Both subgroups are split directly from the whole sample of 1990-2008, and industry effects are controlled at this level.*

A) 1-year employment growth	**1990-2008**		**Abnormal years**						**Normal years**	
			Whole period		*Boom*		*Recession*			
Overall *Book leverage*	Neg.	-0,088	Weak neg.	-0,068	*Not analysed*		*Not analysed*		Neg.	-0,090
Industry-adjusted leverage	Neg.	-0,078	No	-					Neg.	-0,070
Low-q *Book leverage*	Neg.	-0,119	Neg.	-0,118	Neg.	-0,182	Neg.	-0,084	Neg.	-0,104
Industry-adjusted leverage	Neg.	-0,121	Neg.	-0,140	Neg.	-0,205	Neg.	-0,114	Weak neg.	-0,073
High-q *Book leverage*	No	-	No	-	No	-	No	-	Neg.	-0,072
Industry-adjusted leverage	No	-	No	-	No	-	No	-	No	-

B) 3-year employment growth	**1990-2008**		**Abnormal years**						**Normal years**	
			Whole period		*Boom*		*Recession*			
Overall *Book leverage*	Neg.	-0,148	No	-	*Not analysed*		*Not analysed*		Neg.	-0,271
Industry-adjusted leverage	No	-	No	-					Neg.	-0,150
Low-q *Book leverage*	Neg.	-0,203	No	-	Weak neg.	-0,264	No	-	Neg.	-0,225
Industry-adjusted leverage	Neg.	-0,142	No	-	Weak neg.	-0,276	No	-	No	-
High-q *Book leverage*	No	-	No	-	No	-	No	-	Neg.	-0,207
Industry-adjusted leverage	No	-	No	-	No	-	No	-	Weak neg.	-0,170

Cash flow and sales growth show significant positive relation to employment growth during abnormal years and the whole time period, whereas capital expenditures and sales growth rise important during the intermediate years.

Overall, low-q firms do have negative median employment growth during both the bubble- and intermediate periods, both at one-year and three-year levels (figure 5.1). On the other hand, the high-q firms experience positive growth over the whole period, and the growth is highest during the stabile intermediate years.

These results suggest that at one-year level the relation between leverage and employment growth is relatively stabile and unrelated to economical chances. During economic downturn the changes in economy are likely to reflect in employment relatively fast and, especially at three-year level, the growth is likely to be determined by other factors than firm leverage.

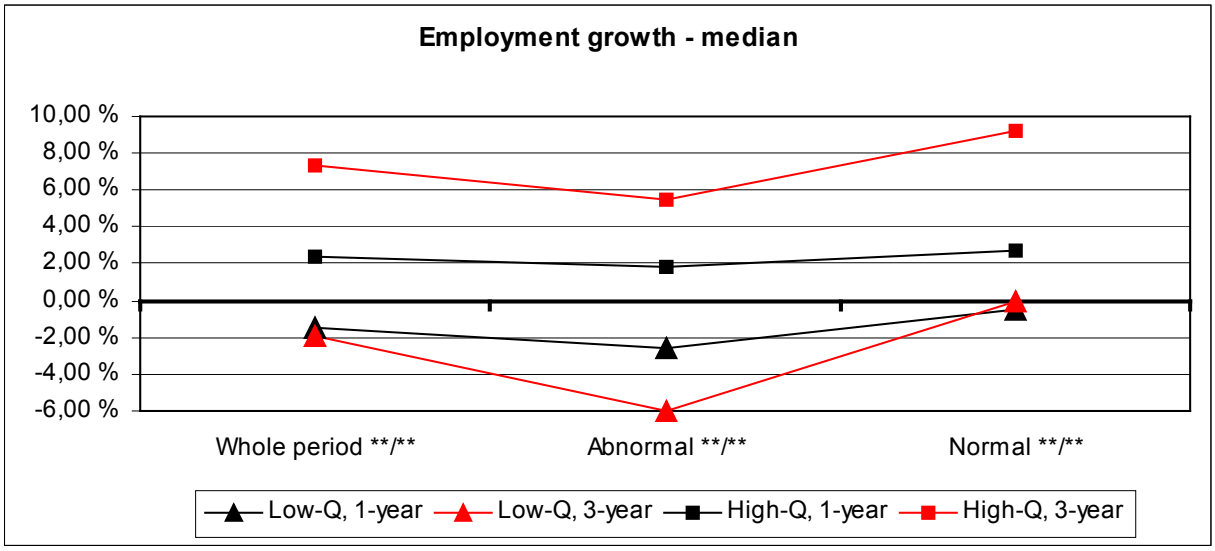


Figure 5.1: *Median growth for low-q and high-q firms. Both types of firms have positive mean growths during normal years, and also positive three-year average growth during abnormal years. Significance of the difference between the two groups is indicated next to the measurement period as "1-year level" / "3-year level". *5% - level ** 1% - level, based on MWW.*

5.4.3 Capital expenditures growth

Patterns regarding capital expenditures growth and leverage are clearest at three-year level (Table 5.22b). Relation is negative for both high-q and low-q firms within the whole period of 1990-2008 and the intermediate (normal) years. Lang *et al.* (1996) find significant relation only for low-q firms. During recession the three-year relation disappears fully in this sample.

Low-q firms show negative relation between leverage and three-year capital expenditures growth also during bubble years. Other explanatory variables do not show noteworthy divergence from Lang *et al.* (1996).

Table 5.22: *Relation between book leverage and* ***a)*** *one-year or* ***b)*** *three-year capital expenditures growth during 1990-2008. Relation is stated as "Negative"/"Positive" (5%-level significance), or "No" (no significance in regression), weak (10%-level) relation is stated separately. The regression coefficient is given in relevant cases, and should be compared between separate regressions only with high caution. The abnormal years cover base years 1990, 1997-2001, 2006-2008. Normal years include the intermediate periods 1991-1996 and 2002-2005. Both subgroups are split directly from the whole sample of 1990-2008, and industry effects are controlled at this level.*

A) 1-year capital expenditures growth	**1990-2008**		**Abnormal years**						**Normal years**	
			Whole period		*Boom*		*Recession*			
Overall *Book leverage*	Neg.	-0,131	Weak neg.	-0,090	*Not analysed*		*Not analysed*		Neg.	-0,245
Industry-adjusted leverage	Neg.	-0,126	Weak neg.	-0,092					Neg.	-0,222
Low-q *Book leverage*	Neg.	-0,148	Neg.	-0,188	Neg.	-0,277	Neg.	-0,156	No	-
Industry-adjusted leverage	Neg.	-0,138	Neg.	-0,174	No	-	Neg.	-0,184	No	-
High-q *Book leverage*	Neg.	-0,114	No	-	No	-	No	-	Neg.	-0,358
Industry-adjusted leverage	Weak neg.	-0,113	No	-	No	-	No	-	Neg.	-0,326

B) 3-year capital expenditures growth	**1990-2008**		**Abnormal years**						**Normal years**	
			Whole period		*Boom*		*Recession*			
Overall *Book leverage*	Neg.	-0,304	No	-	*Not analysed*		*Not analysed*		Neg.	-0,750
Industry-adjusted leverage	Neg.	-0,251	No	-					Neg.	-0,623
Low-q *Book leverage*	Neg.	-0,216	No	-	Neg.	-0,440	No	-	Neg.	-0,554
Industry-adjusted leverage	No	-	No	-	No	-	No	-	Neg.	-0,589
High-q *Book leverage*	Neg.	-0,386	No	-	No	-	No	-	Neg.	-0,992
Industry-adjusted leverage	Neg.	-0,289	No	-	Weak neg.	-0,272	No	-	Neg.	-0,657

Surprisingly, the results regarding one-year capital expenditures (5.22a) are not exactly what could be expected in the first place. Whole data shows negative relation to leverage for both

high-q and low-q firms, same as Lang *et al.* (1996) in their study. But in the bubble year and recession regressions a significant negative relation to leverage is seen only with low-q firms. On the other hand, normal years show opposite, as only high-q firms indicate existing connection. Other controlled variables behave as in the one-year capital expenditures growth. Also the high-q firms seem to experience larger sensitivity to leverage than low-q firms, both at one-year and three-year level.

Highest fluctuation in the growth medians between the economic cycles is seen in the capital expenditures. Both high-q and low-q firms have positive capital expenditures growth during the normal years, and there is no significance difference for the groups at three-year level (see figure 5.2). Again, low-q firms show higher sensitivity to economic cycles. As the low-q firms do not seem to experience any controlling effects by debt during normal years, they increase they capital expenditures up to positive level. These are also the years of low interest rates and hence relatively favorable for building up growth.

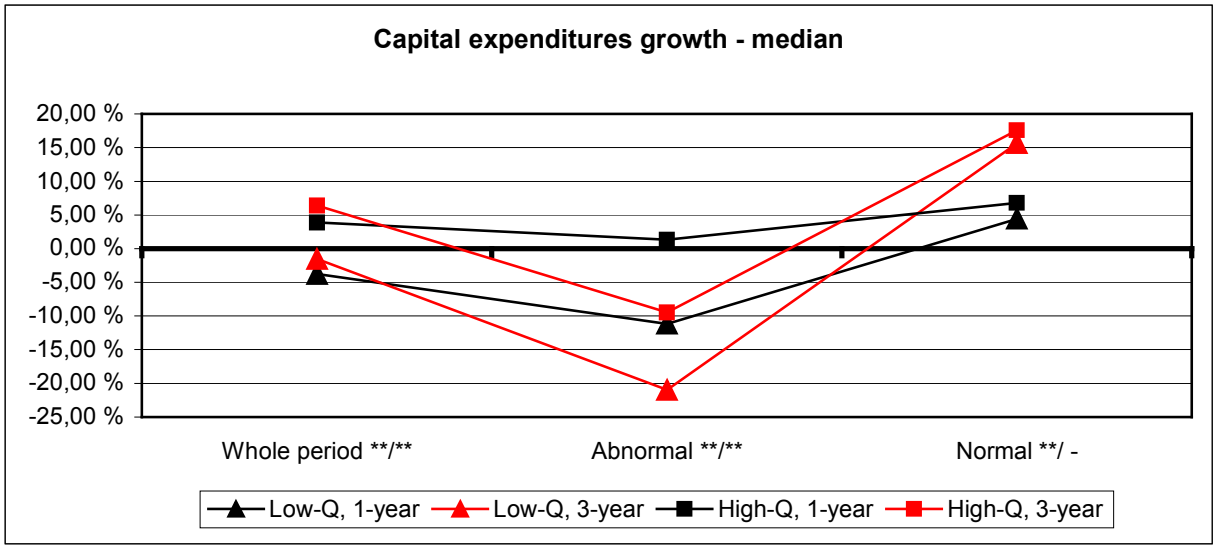


Figure 5.2: *Median growth for low-q and high-q firms. Both types of firms have also positive mean growth during normal years. Significance of the difference between these two groups is indicated next to the measurement period as "1-year level" / "3-year level". *5% - level ** 1% - level, based on MWW.*

6 Discussion

As the results in the previous chapter indicate, there seems to be a clear negative relationship between book leverage and growth with all growth measures at the whole time period (1990-2008) level. Also industry-adjusted data indicates negative dependence for leverage and growth. Only employment growth for high-q firms show no significant relation to leverage. At this level, the results give still support to the suggestion by McConnell and Servaes (1995) that relation between leverage and real growth is partly determined by the expected growth opportunities, or Tobin's q.

When the data was divided into two time period-groups based on the negative significant coefficient for base year dummies, a notable difference in the behaviour during "abnormal" bubble years and relatively stabile "normal" intermediate, or early expansion, years is seen. After studying the abnormal years more detailed, it reveals that low-q firms are limited by debt over bubbles and recession, but the high-q firms lack this relation during these unusual periods (excluding investment during bubble years). During normal years, both types of firms indicate negative relation between leverage and growth.

Regarding investment and capital expenditures growth, if the negative relation is seen within both subgroups of firms, the regression coefficient is larger for high-q. This implies that these growth measures are more sensitive to debt level within the high-q firms than low-q firms, when a negative relation to book leverage is seen. In addition, the median debt and growth measures are distinguishable, with statistical significance, between the two groups. While low-q firms keep their book leverage at constant and significantly higher level, the high-q firms vary their leverage between bubble (increase) and intermediate (decrease) years. Also low-q firms experience mainly negative median growth over the two types of economic time periods, while high-q firms are able to maintain positive growth.

In the following chapters the results are discussed openly period by period and reflected to earlier studies. Different interpretations for and reasons behind the results are considered

6.1 Intermediate years – Early expansion (1991-1996 and 2002-2005)

The intermediate years between bubble and the first years of downturn, namely 1991-1996 and 2002-2005 give strong support that there is a negative relation between leverage and growth. These periods have low interest rates after they have been decreased by fiscal policy to ensure economic recovery after the U.S. recessions of 1990 and 2001. The low interest rates make debt financing more attractive and also more accessible, if considering the costs, for many firms. On the other hand, the general availability of external financing is likely to be more limited than during economic overheating. Another noteworthy feature for these periods is a stabile, positive stock market growth and no obvious thread of economic downturn. On the other hand the past recession is still close, and economic recovery is only beginning. But regarding the overall circumstances, these so-called intermediate years are the most favourable periods for investments and growth, if a company can afford it and has clear growth opportunities in long term. As these also are relatively more stabile and predictable years, as well as follow roughly more closely the theoretical world with some continuity, it would be natural to expect companies to follow traditional models and theories more closely during these years.

Both high-q and low-q firms increase their investment and have higher growth rates than on average during the abnormal years. High-q firms also decrease their book leverage, while low-q firms keep their debt level relatively unchanged. Low-q firms have significantly lower growth rate medians compared to high-q firms, except capital expenditures growth, which end up positive. Book leverage has negative and significant effect on all growth measures with both high-q and low-q firms, excluding one-year capital expenditures growth for low-q firms.

During the intermediate years **high-q firms** seem to behave as expected by *pecking order theory* as they decrease their leverage during the "good" years. As the market recovers firms use their excess cash flow to decrease debt level. On the other hand, the seen negative relation between leverage and growth with high-q firms could also be supported by pecking order theory if assuming that these firms do not have enough internal funds to finance growth. This could be the case especially right after recession when companies may still experience limited ability to create enough excess cash flow. But this again slightly conflicts with the earlier stated fact that these firms decrease their leverage at the same time. Though, it could be that the high-q firms deliberately lower their leverage with accumulated earnings, and at the same

time invest and finance growth mainly with the internal financing. And, possibly raise new equity at the end of the period when stock valuations are more favouring for this.

The statistically significant lower leverage of high-q firms compared to low-q firms gives support the earlier works by Smith and Watts (1992) and Barclay *et al.* (2006). Also the lower debt level of high-q firms over the whole 1990's and the early 21st century is in consistent with the findings of Barclay *et al.* (2006), which suggest a declining optimal debt level for firms with new growth opportunities. It could be expected that firms with valuable investment and growth opportunities would have higher information asymmetries and hence larger cost for external funding. This is supported by the results with investment and capital expenditures growth.

Low-q firms show negative relation between leverage and growth, excluding the one-year capital expenditures growth. They also have negative, though larger than during the bubble years, median employment growth and investments. Median capital expenditures growths increase up to positive values, as does all averages for growth measures. Thus also low-q firms behave as expected during the prevailing economic conditions. The found negative relation between leverage and employment growth together with negative overall (1990-2008) employment growth together with the periodic medians support the findings by Sharpe (1994). Sharpe's results suggest that higher degree of leverage results in faster decrease of employment during recession, but lowers the hiring during the "good" years. Thus indicating that the leverage forces managers to behave more efficiently and favour the interests of equityholders, but consequently also slow down the firm growth.

Besides the low interest rates, the availability of equity is likely to be more limited outside economic bubbles, hence limiting the availability of equity based financing even if a firm would otherwise prefer it to debt. In addition the possibly of undervalued equity issue is larger right after recession, making debt again more attractive source of external financing for both high-q and low-q firms. Consequently, it could be deduced that firms are more likely to follow pecking order theory during the intermediate periods than during bubbles. But, it shall be remembered that this study alone is not extensive enough, and not aiming to be, for making this statement. More detailed study on the periodical changes in firm behaviour should be carried out to clarify these issues.

The results for both subgroups are most congruent with the theories drawing from *conflicting interests and agency costs*. The high-q firms seem to suffer the negative effect of debt, as their growth is limited by debt repayments and by the resulting underinvestment. This could explain, at least partly, the negative relation of leverage and growth. At the same time, the early economic expansion is likely to increase the availability of internal funding for profitable firms, making also the leverage reduction easier. The high-q firms are likely to have lower optimal debt level, and they may move toward it during the expansions. The accumulated earnings could also serve as cash buffer against worse economic periods. Or just lowering the debt level when possible, gives more flexibility in issuing debt later. These could explain the decreasing book leverage together with high growth and investments for high-q firms. Similarly, the low-q firms, i.e. mainly mature and slow- or negative-growth firms, are controlled and prevented from overinvestment by debt. Consistent with e.g. Jensen (1986) and Stulz (1990), these firms have higher leverage than firms with good growth opportunities.

The results suggest clearly that *leverage affects growth and investments of both high-q and low-q firms during the intermediate years*. Only deviation is that the one-year capital expenditures growth of low-q firms does not show dependence on book leverage. Still at three-year level the relation is seen. Probably the negative leverage-capital expenditures growth–relation within low-q firms is emphasized during the bubble/boom years, thus seen only at three-year level when regressed with data from the normal base years. This argument is supported by the regression results, as this relation is seen with low-q firms during bubble/boom years (see next chapter). But, it would require more detailed study to give a comprehensive answer to this difference.

Low-q firms show notable capital expenditures growth during the normal years (one-year median: 4,42% vs. –11,6% during bubble and recession). One explanation could be that the low-q firms are able and willing to raise equity funding despite the higher probability of undervaluation after recession. Or they might raise new debt and utilize the decreased interest rates. The increasing debt expenses would then help to explain the relatively large drop in growth during the periods of downturn and high interest rates. On the other hand, assuming that these low-q firms are on average well profitable, the early expansion is likely to increase their available internal finance relatively fast as the interest rates are low. This decreases the expenses on existing debt. In addition, these firms have, probably, decreased the investments and capital expenditures during the past years more than the high-q firms. Thus, now these

firms have favourable time to relatively increase their capital expenditures, which is seen as diminishing of the negative relation between one-year capital expenditures growth and leverage. In addition, the slightly lowering leverage of low-q firms during the intermediate years of does not support the theory of increasing issuance of debt during this period.

To sum up, although at the whole period level 1990-2008 the results are congruent with findings by Lang *et al.* (1996), during the years of early expansion the negative relation between leverage and growth for low-q firms is supported, but conflicting Lang *et al.* (1996), the same relation was found also for high-q firms. The results hold across and within industries as the industry-adjusted regressions support the unadjusted results. Only employment growth indicates partial industry component in the leverage-growth relationship.

6.2 Abnormal years – Booms and recession (1990, 1997-2001, 2006-2008)

The periods of stock market bubble and following recession follow each other in economic history. The term "bubble" is used relatively loosely here to describe the last years of economic boom before clear downturn. There is nothing abnormal as such in a stock market bubble/boom, although each bubble develops from different reasons and has own characteristics. But if studied in shorter term and especially if compared to the intermediate, early expansion, years, the bubble periods can easily be called abnormal since these years include higher level of uncertainty, drastic fluctuations in economic conditions and in market environment, making the intermediate years look "normal". The bull market and bubble expansion are market with rising share prices, but also with rising interest rates. After a bubble bursts and the economy moves to recession, interest rates drop slightly behind. In this study, these so called abnormal years included both bubble expansion and the following recession, and shall be examined with sufficient caution.

At the level of whole abnormal period, the sample firms seem to behave differently from normal years. Investments and three-year growth measures have no relation to firms leverage during these times. Only one-year employment and capital expenditures growths show statistically significant negative relation to leverage with low-q firms. Any of the growth measures of high-q firms has no statistically significant relationship to book leverage. At three-year growth level the lack of any relation to leverage might be simply explained by the highly volatile economic and market conditions during the studied periods. Within the sample

of the abnormal years as base years, three years spans the overheated bubble, the bubble burst and recession, as well as the first years after recession for the later base years. Thus the firm behaviour and growth is most likely dependent on other factors than debt level within a three-year time span, other factors also including external and random elements with increasing importance. In other words, regarding the economic conditions, the possible relations seen in short-term disappear at three-year level due to the drastic changes in market environment.

As seen with the normal years, the sample firms increase investments and growth during the early expansion years. But in addition, based on the three-year growth numbers seen with these normal (base) years, firms are likely to continue the higher growth until late boom. On the other hand the investments and other growth measures are clearly lower during the abnormal years for both high-q and low-q firms. This suggests that the effects of recession are strong enough to drop the average and median growth to the seen levels. High-q firms maintain positive median and mean growth, except median three-year capital expenditures growth, thus on average surviving well over the downturn. Low-q firms on the other hand show statistically significantly lower rates, which in addition are negative. Based on this, the *low-q firms seem to suffer, in terms of growth, more from the bubble and recession*.

The more detailed regression results suggest that *high-q firms have good access to external financing unrelated to the amount of debt they carry*. They show negative relation only between leverage and investment during economic bubbles. Otherwise no relation is seen in the sample of high-q firms. Based on the increasing average and median book leverage, these firms probably issue more new debt than equity while their internal funds are not sufficient alone, supporting pecking order theory. Firms might in addition use their earlier accumulated earnings as internal financing to cover increasing debt interest payments. This would again increase the relative amount of debt. This would give support to that the high-q firms tend to foresee upcoming financial needs by building internal cash buffer. A combination of these approaches is supported by figure 4.1, which shows that the highest leverage is seen during and right after recession. The lowest leverage roughly in the middle between the end of recession and the burst of new bubble – in other words, during the rising share prices. In other words, high-q firms possibly finance their growth by rising external financing during the bubble growth, utilizing the relatively correctly valued or even over-valued share prices, and use their internal buffer to mitigate the pressure during recession.

The results for **high-q firms** during the abnormal years support the findings of Lang *et al.* (1996) whose study suggest that these firms do not experience clear relation between leverage and firm growth. This implies that firms with anticipated growth opportunities are able to get financing for new investments and do not face the underinvestment problem, which is often seen as a cost of debt for high-q firms. Noting the more easily accessible external financing during bubbles, it is logical to expect to see the disappearance of leverage-growth relation for high-q firms over these abnormal years. Thus although during the normal years the leverage seems to decrease especially investments and capital expenditures growth more for high-q firms than for low-q firm, these high growth firms do not experience serious difficulties in borrowing or rising equity during boom years. This suggests that, at least during bubble and recession years, financing is easily accessible as long as the growth opportunities are recognized by investors.

Low-q firms *continue experiencing the limiting effects of debt*, as a significant negative relation is seen between leverage and all growth measures during economic bubble years, as well as the periods of recession. The lack of this relation at three-year level during recession might be partly explained with the small sample size as the base years 2007-2008 lack three-year level data. Otherwise, the result that leverage affects negatively only low-q firms implies that only firms with low growth opportunities, but that would like to grow anyway, and firms with good growth opportunities, but which are unrecognised by markets, face the limiting effect of debt. Why investment do not show any relation to leverage during recession, is difficult to answer alone with these results. The regression indicates that cash flow has strong positive effect especially in investment, and especially during these so-called abnormal years (both bubble and recession) it appears pronouncedly powerful. Thus assuming that excess cash flow creates excess accumulated earning to be used next year, one implication would be that the low-q firms simply prefer investment to other growth and concentrate on average their activity to investments, or in case negative investments, at least prefer to keep them relatively unaffected.

The results hold across and within industries as the industry-adjusted regressions support the unadjusted results.

6.3 Summing up of the whole period

Although the results with whole data and whole time period show significant negative relation of book leverage to investment and growth, across and within industries (only three-year employment growth expressing clearly identifiable industry effect), these results do not hold after the anticipated growth opportunities (or Tobin's q) are let to affect the regression coefficient for leverage. It turns out that during 1990-2008 firms behave closely as Lang *et al.* (1996) suggest in their study with data from earlier years (1970-1989). In other words, low-q firms experience negative relation between growth and leverage, while high-q firms show this relation (partly weakly) only for investment and capital expenditures growth. But these results hold only on average, namely over the studied period, but not to the chosen subperiods.

Low-q firms experience negative relation between book leverage and growth (employment and capital expenditures) during the periods of stock market bubble and following recession. For high-q firms leverage shows no relation to growth during these abnormal years, neither at one-year nor three-year level.

During the early expansion years, or "normal years", firms leverage shows negative and significant relation to growth and investment with both high-q and low-q firms. Only one-year capital expenditures growth for low-q firms does not indicate any relation to leverage. This could be due to the seen high increase in capital expenditures growth during the normal years. Low-q firms may simply direct the excess cash more strongly to capital expenditures, which they strongly cut off during abnormal years (especially recession), and now direct the limiting effect of debt to other targets. This together could result in the disappearance of the relation for a short time period; at three-year level the negative relation to leverage is seen again.

The seen relations are not only industry effects, since the industry-adjusted regressions support the unadjusted results. But, although not clearly seen at whole data level, it shall be noted that the lower significance of industry-adjusted employment growth during normal years indicates that there is a certain industry component in employment growth.

One explanation for the results is that high-q firms are able, and let, to utilise economic booms more efficiently than low-q firms and their growth or investment are not constricted by their debt. High-q firms may also be able to build up financial buffer to overcome recessions

more smoothly than low-q firms, and this way avoid limiting effects of debt also during the economic downturns. Low-q firms on the other hand experience an increased limiting effect of debt. In other words, they are more or less over the different periods prevented from overinvestment by directing the excess cash flow to debt repayments instead of low-value or negative-value projects. On the other hand, early intermediate years (and recession) limit the availability of financing. Meantime, the negative effects of debt predominate also within high-q firms as debt repayments tie up funds and results in underinvestment.

At the same time, management makes decisions on the firm's leverage based on private information on future growth. Thus a manager expecting high growth opportunities might simply choose lower leverage to enable taking full advantages of their investment opportunities. This is supported by the lower leverage of high-q firms in the study. Thus, the negative relation between debt and growth could arise from this managerial choice, instead of the level of leverage itself.

6.4 Limitations of this study and approaches for new studies

The presented results hold for the used sample, and should only be applied for other firms or samples with high caution. As stated earlier, the big, established firms should be less likely to experience controlling effects of debt, if these kind of relation even exists. Thus it would be interesting to expand the data to span medium and why not also small companies. Small companies would bring selection bias problems but could give interesting results and help to understand the small firms and their use of capital and funds. Also different measures of leverage could be introduced to the study, especially if the sample reconstruction is changed.

Particularly the division to subperiods could be done differently. The data could be studied for example at two-period level (expansion and recession/downturn) or at the level of one economic cycle (recession to recession). Annual regressions would help to explain the seen variations, but would require a large base sample to enable statistical significance. With the current sample it wouldn't have been possible. In general, increasing sample size could be possible by widening the time span or loosening the criteria for included firms (e.g. size). Both approaches have also drawbacks. Smaller firms may induce sample bias as the amount of lacking information as well as bankruptcy probability are likely to increase. Thus the probability to end up with a base sample with relatively larger amount of good companies has

to be controlled. Expanding time span would provide more data, but if the subperiods are not studied separately at some state, some bubble-specific behavior may be lost – for example the IT-bubble itself is interesting and has surely affected firms differently than economic bubbles in the earlier days. Also the development of stock market during the recent decades has likely affected the nature of economic cycles. Besides, larger sample size would help to make industry-adjustments at more detailed SIC-code level, and at subgroup level. In addition, calculating the annual and periodical average and medians for each variable would help to explain seen variations.

Not only to try to see the leverage-growth relation, but also understand it more deeply it would be interesting to study the capital structure itself and combine the results with the seen relationship to growth. This would in practice mean studying for example the change in debt, debt-to-equity and leverage, and their dependence on base year leverage and anticipated growth opportunities. In addition, the past realized growth could be added into the study. Also the amount of issued new debt and equity could be studied similarly. Moreover, the relation of these variables measuring change to real growth and investment could be studied. This could help to explain the financing source preferences, as well as the use of funds, within low-q and high-q firms and the effect of current amount of debt.

All together, there are various approaches still to take if trying to draw more detailed picture of the relation between firm capital structure and growth. So far it seem clear that this relation is not as simple and one-dimensional as it is sometimes given to understand.

7 Conclusions

Capital structure is not irrelevant in the real, imperfect world. This far, there is a certain common consensus in the field of finance theory. But the question about its effects on specific factors in a firm's life is still unanswered. One of these still not perfectly understood relations is the relationship between firm leverage and growth. Basing on capital structure theories and empirical evidences, this relation should be negative, when found. This thesis contributes to this discussion by repeating the study settings in Lang *et al.* (1996) using data from the past two decades (1990-2008) and taking the data analysis one step further by separating two subperiod types from the full data.

Study is conducted with companies based and operating in the U.S. The data consist of large sized industrial firms and spans the base years 1990 to 2008. Large sized industrial firms are defined as firms operating under SIC codes 2000-3999 and with at least 1 billion sales in the 1990-dollars on a base year when included into the sample. The final sample consists of 4,816 firm-years. Growth is measured as net investment, one-year and three-year employment growth and capital expenditures growth. Three-year growth measures are defined only for base years 1990-2006, as the data was available only up to year 2009 at the time of conducting the study.

The time period included two very interesting stock market bubbles/booms followed with recession in the U.S. In addition, the analysis of the full data (1990-2008) suggested a year specific effects for the "abnormal" years of bubble and recession, the full data was divided into 1) abnormal years (1990, 1997-2001, 2006-2008) covering the bubble and following recession periods, and 2) normal years covering the more stabile intermediate years of recovery after recession and early expansion. All regressions were repeated for these two sample sets, without further data modifications.

Full data results support roughly the earlier results by Lang *et al.* (1996), who used data from 1970-1989. Book leverage shows statistically significant negative relation to all growth measures. After letting the regression coefficient vary between low-q and high-q firms these results lose their significance. Low-q firms show strong negative relation between book

leverage and growth, excluding net investments. High-q firms show same relation only for investments and capital expenditures growth.

When the normal, intermediate, years are regressed as own group, there is seen again a strong negative relation between leverage and all growth measures. After adding the division based on Tobin's q, the negative relation is seen in all cases expect for one-year capital expenditures growth of low-q firms. Industry effects explain partly the relation to employment growth, as it weakens clearly or disappears in industry-adjusted regression.

On the other hand, the period of bubble-to-recession show no relation between book leverage and growth or investment for high-q firms. Only exception is the negative relation to investment during bubbles. At the same time low-q firms seem to experience negative relation between leverage and growth over both the bubbles and recession. Results hold across and within industries as the industry-adjusted regressions support the unadjusted results.

Overall, based on these results *high-q firms suffer from the limiting effects of debt only during the intermediate years,* when availability of external funding is relatively limited and the economy is still recovering for the recession, although in a clear uptrend. After the expansions takes off, *these firms are able to better utilise their investment opportunities and are not limited by the debt load*. High-q firms are suffering less from the recession than *low-q firms*, which do *experience the controlling effects of debt over the both types of economic periods*. This indicates that, debt might be used to control and prevent low-q firms from overinvesting. It also indicates that high-q firms are able to finance their growth during most of the time, and if recognise this, can plan their growth better by taking these more challenging periods into account. On the other hand, the data shows also that the *high-q firms do have systematically lower leverage than low-q firms*. Thus the possibility that the leverage is chosen by management based on their inside information about firms growth opportunities, and the seen negative relation is only reflecting this behaviour, cannot be precluded.

Results indicate that leverage affects negatively to firm future growth, but in addition that this relation is depended on external factors such as economic cycles. Future research on this topic is still needed. While several theoretical approaches provide different explanations to the level of firm's leverage, as well as to the effects of leverage on e.g. growth, the aim should be to understand better the empirical results and this way widen the understanding of the capital

structures importance for different types of firms in different phase in their life span and economic cycles.

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