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Corporate performance in recessions:

The effects of capital structure and growth

Casper Michal Tingvoll Bolle and

Daniel Hundvin Kårbø

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Supervisor: Eirik Sjøholm Knudsen

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Abstract

The purpose of this study is to analyze how recessions affect the impact of prior growth and capital structure on corporate performance. Using multiple regression analysis on financial statement data from the period 2000-2012 we were able to investigate this on a large sample of Norwegian firms. Splitting our performance construct into profitability and growth, our results show that i) recessions negate the positive effects of prior growth on growth that rapidly growing firms experience in non-recessionary years; ii) recessions induce a negative non-linear effect of prior growth on profitability, which particularly affects fast-growing firms; iii) recessions exacerbate the negative effect of high leverage found in non-recessionary years; iv) recessions induce an increasingly negative effect of leverage on profitability, and v) there is little evidence of an interaction effect between capital structure and growth on corporate performance in our sample. In sum, our findings indicate that both prior growth and high leverage can have substantial negative impact on firm performance in recessions.

The thesis includes a brief investigation of potential causal mechanisms behind the negative effects we observe. We find support for a removal of creditors and investors' intertemporal productivity indifference during recessions, and that industry affiliation and credit constraints provide important channels for recessionary impact. Lastly we provide directions for future research that can expand on our exploratory study.

Acknowledgements

The work on the thesis has been an exciting journey into the relatively unexplored effects of capital structure and growth in recessions. We hope that our study has contributed to the existing literature in the field, and that it will be of value to future researchers.

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1 Introduction

Explaining corporate performance outcomes and how these differ between enterprises is one of the key endeavors in firm level research. Firm performance is often segmented into growth and profitability (Chakravarthy & Lorange, 2009), both of which are central measures of firm success. Profitability is required to generate return on capital, while growth is often desired to increase firm value or long-term profits (ibid).

Two key factors that are important for understanding differences in performance outcomes are capital structure and prior growth. Both these factors have received extensive academic attention regarding their effects on corporate performance (Petty & Guthrie, 2000; Brealey, Myers & Allen, 2008). In the capital structure literature, several departures from Modigliani and Miller's (1965) seminal capital structure irrelevance theorem have been established, and empirical research illustrate how various market imperfections can cause capital structure to have a substantial impact on corporate performance (Rajan & Zingales, 1995; Fama & French, 2002; Shyam-Sunder & Myers, 1999; Graham & Harvey, 2001). Similarly, the effects of prior growth on firm performance have also been extensively researched in fields like strategy, neo-classical theory, stochastic modelling and organizational theory (Geroski, 1999; Coad & Holzl, 2009; Carizzosa, 2005).

Although growth and capital structure are often studied in isolation, the two are arguably interrelated concepts that could benefit from being studied simultaneously. For example, the growth potential of firms can impact their capital structure (Knudsen & Lien, 2014), while debt level might dictate growth investment decisions of managers (Myers, 1977; Myers & Majluf, 1981). A theoretical prediction from the simultaneous study of growth and capital structure is that these firm characteristics should not cause discrimination in financial markets in normal times (Knudsen & Lien, 2014). There should be minimal discrimination between firms that have low leverage and high profitability today, and those that have high leverage and low profitability today, but high growth potential.

The big question is, however, how the various theoretical mechanisms mentioned above are affected by changes in macroeconomic conditions. Although the current research on both capital structure and growth on product market outcomes is relatively well developed, less attention has been given to how these effects vary over the business cycle. Recessions have

naturally not gone unheeded in the academic world – the field of economics is brimming with business cycle theory and macro level research on the causes and impacts of downturns. However, less attention has been devoted to micro level issues such as how firms' prior growth and capital structure affect product market outcomes in recessions. In the limited existing literature, there seems to be a link between growth, capital structure and corporate performance in recessions. Growth, normally a desired state for firms, has been shown to induce high vulnerability during downturns (Geroski & Gregg, 1996; Knudsen, 2014). Similarly, high leverage has been shown to negatively affect product market outcomes in recessions (Parsons & Titman, 2008; Campello et al., 2010). Furthermore, as capital structure and growth are interrelated concepts, it seems appropriate to study their simultaneous impact on corporate performance during recessions, and explore potential interaction effects between the two. To the extent of our knowledge, this has not been addressed before.

The purpose of this thesis is to address these gaps in the literature by investigating how capital structure and prior growth influence corporate performance outcomes depending on the state of the overall economic environment. Our aim is to provide a broad exploration of how these relationships change during recessions. Our research question is:

How does capital structure and prior growth influence corporate performance outcomes during recessions?

To study this research question, we use annual financial statement data on Norwegian firms in from 2000 to 2012. Comparing real GDP developments to a polynomial long term GDP trend line, we identify two recessions during our time period: The dot com crisis of 2001, with its following recessional years 2002-2003, and the financial crisis of 2008, with the subsequent 2008-2009 real recession. While separating industry and idiosyncratic firm effects, and controlling for relevant firm characteristics, we perform multiple regression analysis to isolate the effects of capital structure and growth on performance outcomes. To increase robustness, we use two separate measures for both profitability and growth. In order to investigate how the effects of growth and capital structure are affected by recessions, we shift our OLS specifications across the 13 annual databases, while accounting for non-linear and interaction effects among the main variables.

Our main findings are as follows. First, we find that in non-recessionary years, the presence of a convex quadratic effect indicates that fast growers are able to sustain their growth, while firms with moderate growth are subject to a mean reversion effect. Recessions appear to negate this growth momentum effect for fast growers, exposing them to the negative prior growth effect of other firms. Regarding the effects of growth on profitability, we find evidence that recessions induce a negative effect of prior growth on profitability performance. Specifically, we find a non-linear, concave relationship between prior growth and profits, indicating that particularly fast growers experienced negative profitability outcomes during recessions.

Second, in our analyses of capital structure on growth we find that recessions exacerbate the negative effect of high leverage in normal years. Again we find evidence of non-linear relationships, where high-leveraged firms are most severely affected by recessions. Similar results are found when investigating the effects of capital structure on profitability. We find that recessions induce a negative exponential relationship between leverage and both profitability measures.

Third, we do not find evidence of an interaction effect between growth and capital structure during recessions. Though there are traces of a negative interaction effect during the dot-com crisis, this does not replicate during 2008-2009 recession. Additionally, the interaction term consistently displayed a lack of economic significance. We investigated the presence of an interaction effect further by segmenting our sample into 10% percentiles based on prior growth and debt levels. However, this method also failed to yield sufficient evidence to conclude with the presence of a negative interaction effect between capital structure and growth during recessions.

Fourth, we explored some causal pathways for the negative effects of prior growth and capital structure in downturns. We investigated whether investors and creditors discriminate against firms with low current performance, but potentially high performance in the future. We find strong indications that this is the case. Further, we test industry affiliation as a pathway for recessionary impact. Our findings indicate that affiliation with severely impacted industries provided an important causal pathway for negative performance impacts during the 2008-2009 recession. We also investigate the causal impact of credit constraints during recessions,

and find that firms with high credit rating experienced considerable better performance outcomes during recessions than low-rated firms.

Before we start off, we provide some delimitations for the scope of our thesis. First of all, we only look at the *effect* of downturns. We do not discern between types of recessions (Morley, 2009; Chen et. al, 2011) or their cause (Hamilton, 1989). This is discussed in further detail in the theory section on recessions. Second, multiple theoretical approaches can be probably be assumed when investigating firm performance. We assume a combined strategy and finance approach. An in-depth argument for this is provided in the theory section. Moreover, the literature on both capital structure and growth is too vast to be reviewed in detail in our thesis, so we focus on the most central contributions. The reasoning behind inclusion of specific theories is also provided in the theory section. Third, we aim to provide a broad, exploratory study that lays a foundation for future research. As a result, our focus has not been on generating econometrically bulletproof results. This is discussed in-depth in the methods section. Another implication is that we have not provided extensive analyses on the causal mechanisms behind the impact of recessions on firm performance. Though we compare our results to theoretical predictions and prior empirical research, we only briefly test specific causal mechanisms. Fourth, we wanted to investigate the performance of representative Norwegian firms, which means we have limited our sample to profit-maximizing firms of medium and large size.

The rest of our thesis proceeds as follows. In chapter 2 we will present the theory and literature we use to answer our research question, while also developing the hypotheses we test in the analysis chapter. Chapter 3 presents an in-depth discussion of our methodological approach, including a discussion of research design, sampling strategy, multiple regression analysis and the thesis' validity and reliability. In chapter 4, identify the most severely affected years during the dot-com crisis and the 2008-2009 recession, and their impact on key performance variables using descriptive statistics. We then present results from the regression analysis. In chapter 5 we discuss our findings in light of relevant theory and literature. Chapter 6 concludes the paper by summarizing our findings, and providing suggestions for future research.

2 Theory

The purpose of our thesis is to investigate how capital structure and growth influence corporate performance outcomes depending on the state of the overall economic environment. There are multiple ways to approach this, so we briefly expand on our theoretical approach. A discussion that involves capital structure must necessarily rely on finance literature at some point. Another natural approach is the strategy field, which is occupied with explaining differences in performance outcomes. We argue that a multidisciplinary approach which combines these two fields could be appropriate. When researching growth and capital structure we would likely benefit from accounting for both product and factor market conditions. The finance field is naturally oriented towards factor markets, with an inherent focus on capital market imperfections. A strategy approach, however, could contribute with insights from both product and factor markets, but could probably not offer much insight into capital markets, which are often presumed perfect in strategy literature (Besanko, 2008). Furthermore, the strategy field is predominantly occupied with explaining differences in corporate performance. The finance field focuses on how firms' assets are financed, which necessarily includes assets providing superior performance. Overall, therefore, these research areas seem to complement each other well. Though not all theories we have included fall into either of these fields, these are the two major research areas from which we have drawn our theories.

In this chapter we start by discussing how capital structure and growth can explain corporate performance outcomes in normal times. We then introduce theory on recessions and their role in business cycles. The last part of this chapter discusses how economic downturns affect the relationships between growth, capital structure and performance. The final subchapter also contains the development of our hypotheses.

2.1 The importance of capital structure and growth (in normal times)

Why does capital structure and growth matter for firms? We start with a discussion of how growth influences performance, before presenting theory on the effects of capital structure. Third and last we discuss how growth in conjunction with capital structure might affect corporate performance outcomes.

2.1.1 Growth and corporate performance

Why and how firms grow has naturally received substantial academic attention (Hart, 2000; Geroski & Mazzucato, 2002; Geroski, 1999; Carrizosa, 2007). Given the complexity of the topic, various approaches to growth has emerged (Correa, 1994). Geroski (1999) identifies four main streams of literature on growth: stochastic growth models; the classical economic or ‘optimum firm size’ approach; models of organizational capabilities; and life cycle or stage theories. We limit our discussion to theories that explicitly or implicitly predict how corporate growth might affect performance. This limits the field somewhat, as we find that life cycle models are less applicable in our setting. That leaves us with three theoretical approaches to growth. In order to ensure a broad and robust foundation for the rest of the thesis, we choose to present theories from all three approaches.

The rest of the subchapter is structured as follows. The first theory we discuss comes from the stochastic approach. Gibrat’s law is arguably the most influential stochastic theory (Coad & Holzl, 2009), and views growth as a random process. We then move on to the organizational capabilities approach. Here we present a growth theory based on one of the key contributions to the strategy field – the resource-based view. The resource-based model predicts that Gibrat’s law breaks down in the presence of Penrosian firm resources. The classical economic approach to firm growth is covered through presenting implications from economies of scale, the Kaldor-Verdoorn law and optimum firm size theory. The implication here is that firm growth has positive performance effects until a critical size is reached. Lastly we present two theories that does not easily fit into Geroski’s framework, namely organizational inertia and fitness landscape theory. These theories provide a counterweight to the other theories, indicating a possible negative relationship between growth and firm performance.

2.1.1.1 Gibrat’s law

In his 1931 paper, Robert Gibrat found that firm size in his sample was almost perfectly lognormally distributed. To explain this distribution, he developed a model that describes firm growth as a process of small, stochastic shocks (Coad & Holzl, 2009).

We follow Steindl's (1965) method of presenting Gibrat's argument. Assume x_t denotes the size of any firm x in period t , and ε_t is a random variable measuring individual growth shocks from period $t-1$ to period t . The growth in any period can then be generalized as

$$x_t - x_{t-1} = \varepsilon_t x_{t-1} \quad (2.1)$$

Building on this, to find the firm size at any period t , we have

$$x_t = x_0(1 + \varepsilon_1)(1 + \varepsilon_2) \dots (1 + \varepsilon_t) \quad (2.2)$$

Steindl (1965) then argues that ε_t can be approximated by taking $\log(1 + \varepsilon_t)$. Sutton (1997, p. 40) states that this is justifiable as long as t is a "short" time period. Taking logs, we obtain

$$\log x_t = \log x_0 + \varepsilon_1 + \varepsilon_2 + \dots + \varepsilon_t \quad (2.3)$$

The model can then be developed further to demonstrate an expected lognormal distribution of firm size. As we can see, equation 2.3 predicts that firm growth at any period is a purely stochastic variable, completely independent of growth in other periods. The shocks in any period t is not affected by either firm size or growth in other periods. Therefore, according to Gibrat's law, previous growth should *not* influence future growth. This theory then provides an irrelevance theorem of growth, even if it can give no predictions regarding the effect of growth on future profitability. Gibrat's law provides the null hypothesis for the discussion of growth: that it is a random, unpredictable process. We now turn to situations where other theories predict that Gibrat's law breaks down.

2.1.1.2 Organizational resources and capabilities

We now turn to the organizational capabilities approach to growth. This approach builds on the resource-based view of firms. Resource-based theory (RBT) differs sharply from Gibrat's law when predicting the effect of growth on performance outcomes. In this theory firms can be seen as bundles of resources, which are defined as stocks of inputs that affect firms' relative ability to implement product market strategies (Jacobsen & Lien, 2001). These resources form the basis for sustained competitive advantage (Penrose, 1959; Wernerfelt, 1984; Barney, 1991; Peteraf, 1993). Nelson (1991) argues that firms have routines, processes and knowledge that aggregate into organizational capabilities. These capabilities can be seen as part of a firm's resource base (Geroski, 1999).

Peteraf (1993) identifies four prerequisites for resource-based competitive advantage. The first is that there is some heterogeneity of resources among firms in an industry. This allows for generation of economic rent for those with superior resources. The second criterion is that there must be imperfect *ex post* competition when utilizing these superior resources, to allow for sustainable competitive advantage. If this prerequisite is not met, other firms will mimic the resource portfolio of superior performers and any economic rents will be competed away. Limited *ex post* competition is achieved through inimitability or imperfect substitutability of rent-generating resources. One way this could arise is through causal ambiguity of how a resource is acquired or created, for example if competitors or potential industry entrant are unable to identify which resources generate economic rent. The third criterion is that resources are imperfectly mobile. This could arise from resource intangibility, which is the case for assets such as brand names, or high transaction costs when purchasing the resource. Imperfect mobility prevents resources to be bid away, therefore ensuring sustained competitive advantages. The last criterion states that there must be imperfect *ex ante* competition, in other words there must be imperfect resource factor markets. Otherwise, any profitability generated through superior resources will be negated by the cost of acquiring them.

As we have seen, RBT is based on the assumption of imperfect factor mobility, heterogeneity in resources and imperfect factor markets. As factor mobility and markets grow increasingly imperfect, firms are increasingly dependent on generating resources internally. Financial resources are arguably of lesser worth, since capital markets are often (at least in the strategy literature) assumed to be approximately perfect. Some resources will tend to be completely

untradeable, such as brand names, and can only be acquired through accumulation. It is therefore important to make a distinction between stocks of resources and flows which increase or decrease these stocks (Dierickxs & Cool, 1989). An often used metaphor is the image of a bath tub, where the stock of resources at any given time is equal to the amount of water in the tub. Water added or drained from the tub signifies resource flows. Geroski (1999), building on RBT and Dierickxs and Cool's stocks and flows view, present a formal model for firm growth. Assume that the size of firm i at period t is denoted by $S_i(t)$, and, following Gibrat's law, growth is measured as the change in the natural logarithm of size, formally $\Delta \log S_i(t)$. $X_i(t)$ signifies a measure of firm i 's competencies or resource stocks at time t . The key assumption in Geroski's model of firm growth is dependent on the resource stock of firms. In other words, resource stocks do not only generate economic rents as presented by Peteraf (1993), they also provide the basis for growth. Given the discussion and variables introduced above, growth can then be measured as

$$\Delta \log S_i(t) = g(t) + X_i(t) \quad (2.4)$$

where $g(t)$ is the growth rate of firms with no advantage in organizational competencies ($X=0$). Another way to view this is that firms with $X=0$ are industry average performers. Firms who are at a disadvantage in competencies ($X<0$) will grow even slower, or face negative growth (Geroski, 1999). If competencies develop in a systematic way, where incremental increases in resources or competencies depends on previous levels, competency or resource level can be modeled as

$$X_i(t) = \rho_1 X_i(t-1) + \rho_2 X_i(t-2) + \varepsilon_i(t) \quad (2.5)$$

where ρ_1 and ρ_2 indicate the growth rate of resource or competency stocks (i.e. its resource flows). $\varepsilon_i(t)$ measures unexpected changes in these stocks. If $\rho_1 + \rho_2 > 1$, competence stock growth is positive and increasing, which then leads to sustained firm growth. When $\rho_1 + \rho_2 < 1$ is maintained over time, competence stock levels will revert to a long-run mean level

(Geroski, 1999). Unlimited growth is of course not realistic, but asset stock flows can credibly be thought to fluctuate around 1 for highly successful firms with high resource maintenance and development capabilities. However, even if $\rho_1 + \rho_2 < 1$ over long periods of time, we would still expect to see a positive relation before resource stocks revert to the mean.

Furthermore, Penrose (1959) argues that if firm resources are discrete, i.e. “lumpy” or unscalable, firms will seek to grow to ensure full resource exploitation. If firms have stocks of underutilized resources they will then seek to “push” on to further expansion, predicting a positive relation between resource stocks and growth. As we have seen, and in contrast to Gibrat’s law, the RBT model introduced above attributes prior growth to firm resource stocks and flows. Based on the classical profitability predictions of Peteraf (1993), combined with Geroski’s (1999) modification into a growth model, we should therefore see a consistent, positive relation between firm growth, $\Delta \log(S)$, and both future growth and profitability.

2.1.1.3 Economies of scale, the Kaldor-Verdoorn Law and the ‘optimal size firm’

We now turn to the third category of growth theories: the classical economic approach. Besanko (2008) and Gupta (1981) argue that scale economies can drive profitability. This theory also offers a clear departure from Gibrat’s law. As enterprises grow, cost advantages can be realized as fixed costs are spread over more units of output. This generates lower costs per units, increasing profitability. In conjunction with Bertrand competition, lowering unit cost might also allow firms to increase market shares if prices are reduced (Pindyck & Rubinfeld, 2009), potentially also increasing growth. This would likely happen in industries or markets where goods are relatively homogenous and competitive behavior is price-oriented. Examples of such industries in Norway could be convenience stores or salmon farming. Additionally, Gupta (1981) argues that operational efficiency increases with scale, reducing variable costs and further decreasing unit cost.

Related to economies of scale and Gupta’s argument, the Kaldor-Verdoorn Law implies a positive, causal relationship from output growth rate to productivity growth rate (Kaldor, 1966). Formally, the law assumes that p and q represent the logarithmic growth rates of labor productivity and manufacturing output, respectively. The Kaldor-Verdoorn Law is estimated as

$$p = a + bq \tag{2.6}$$

where b is a positive parameter measuring the elasticity of labor productivity to output. The estimate of b , known as the Kaldor-Verdoorn coefficient, was originally found by Verdoorn to be approximately 0.5 for British manufacturing firms. In other words, the law states that simply increasing the size of a firm's operations should induce higher productivity. According to Verdoorn (1980), this productivity growth arises from increasing returns to scale when output is raised. A source of these increasing returns could be indivisibilities of key assets such as machinery or managerial talent. As the scale of operation increases, so does asset utilization, and overall costs decrease. Another underlying driver could be the realization of increased specialization in labor, machinery and management.

The discussion so far assumes unlimited returns to scale. As is clear from the neoclassical 'optimal size' literature, however, increasing firm size also entails some diseconomies of scale. These are often portrayed as bureaucracy and agency costs related to controlling a larger organization (Coad & Holzl, 2009). Firms therefore seek some optimal size where the marginal overall benefits of increasing size equals costs. This makes it harder to predict the effects of growth, as at some point it becomes costly to grow. However, if we assume firms rationally evaluate benefits and costs of output levels each year, we should still expect firms of sub-optimal sizes to increase their size to reap scale benefits. Firms that have reached their optimal size will choose not to grow. The net effect of growth on performance should therefore still be positive.

Overall, in light of theories on economies of scale and the Kaldor-Verdoorn law, we should therefore expect a positive effect of growth on future profitability, unless all of the cost savings are spent on price reductions. The effect on growth levels depends on whether the firm wishes to increase market shares by cutting prices or retain the higher margins scale economies provide. If we assume some share of firms engage in market capturing strategies, we should expect a positive relationship also for growth on growth.

2.1.1.4 Organizational inertia and fitness landscapes

The theoretical departures from Gibrat's law we have considered so far largely indicate that growth has positive effects on corporate performance. The theory on organizational inertia, coupled with fitness landscape theory, however, provides a different view. Hannan and

Freeman (1984) argue that there exist strong internal and external forces which provide “inertial pressures” on organizations. Examples of internal forces could be internal politics, sunk costs and organizational structure, while external forces could arise through legislature or the need for legitimacy (Hannan and Freeman, 1977). Hannan and Freeman argue that these forces are the reason organizations rarely perform fundamental changes.

One of the key theorems in Hannan and Freeman (1984) is that organizational inertia increases with size. They present a threshold model where management in firms above a certain size is forced to relinquish and delegate power in order to continue to grow. Firms above this threshold rapidly lose agility as top management exerts increasingly smaller influence on daily operations. Very large firms have limited methods with which to change the behavior and actions of its employees. They will also likely be relatively more restrained by a deeply embedded culture, sunk costs, or other path-dependent influences.

Furthermore, Hannan and Freeman also state implications for firm performance given high inertia. In the case that firms must reorganize, they state that “the process of attempting [change] lowers reliability of performance” (Hannan and Freeman, 1984, p. 159). They also argue that firms who undergo reorganization are more vulnerable to bankruptcy. We know that organizations might frequently need to adapt to changes in the environment (Siggelkow, 2001; Cappelli et al., 1997). This does not necessarily involve major exogenous shocks, but also incremental adaptations. One theory that illustrates this is fitness landscape theory (Siggelkow, 2001). The theory states that firms can have varying degrees of internal fit between organizational activities, and external fit with the general environment the firm faces. High fit means that firms are on or close to performance ‘peaks’ in the landscape, while less well-adapted firms are closer to the ‘valley floors’ of the landscape. Firms whose fit levels allow them to reach peaks should outperform less well-adjusted firms. A key implication in the theory is that the overall geography of fitness landscapes might change, creating new peaks and destroying old ones. This can happen gradually, or relatively quickly. Changes in fitness landscapes forces firms to adapt their activities to retain performance.

In light of theory on organizational inertia, larger firms should find this adaptation to new landscapes harder than smaller, more agile firms. This prediction is supported by Audia, Locke and Smith (2000). Intuitively, we could also expect a non-linear relationship between size and inertia. Very small firms might not experience noticeable inertia effects even if they

double in size. Multinational firms, on the other hand, might face such large degrees of inertia that adapting to abrupt or major exogenous shocks becomes an insurmountable challenge. An example of this might be Kodak, the previous world leader in photography equipment. During the 1990s and 2000s, the company completely failed to adapt to the digital revolution in camera equipment, which slowly eroded away the old peak where activities oriented towards analogous camera technology provided high fit and profit levels. This inability to adapt could arguably have been caused by Kodak's commitment to analog technology (McCarthy & Jinks, 2012).

Overall, we should expect the positive effects of growth discussed above to be affected somewhat by inertia effects of size: As firms grow, organizational inertia causes firms to become less agile, thus becoming more vulnerable to changes in the environment, and less able to seize new opportunities. Hannan and Freeman's theory therefore predicts a negative relationship between growth and performance outcomes, particularly in environments where frequent or major adaptations are required.

2.1.2 Capital structure and corporate performance

Having discussed some central theoretical predictions from the effect of growth on performance, we now turn to how capital structure might impact firm outcomes. Capital structure is arguably one of the most extensively researched areas in the field of finance (Brealey, Myers & Allen, 2008), and again we are forced to narrow the discussion. As above, some theories are excluded because they have limited applicability in our setting. Most noticeably, perhaps, this includes agency cost theories. Apart from this, we aimed to include the most central theories in the capital structure literature. We therefore set out with the Modigliani-Miller theorem, a natural starting point for any discussion on capital structure. Similar to Gibrat's law, the Modigliani-Miller theorem also provides a useful 'irrelevance platform' from which to discuss our other capital structure theories. We then move on to debt overhang theory, another key contribution to the finance literature. This theory states that a departure from the Modigliani-Miller theorem occurs when leverage becomes sufficiently high to deter further investments. The third theory we present is pecking-order theory, which also predicts negative effects of using debt financing. Another central theory we present is trade-off theory, which accounts for tax shield effects and bankruptcy costs of debt, predicting that firms will 'trade off' between these two until an optimal debt ratio is found. The theories

so far are heavily oriented towards factor market mechanisms, and so lastly we include theory on capital structure's effect on product market outcomes.

2.1.2.1 The Modigliani-Miller theorem

This seminal theorem has shaped much of the modern thinking on capital structure. Modigliani and Miller presented four distinct propositions published in a series of papers (Modigliani & Miller 1958; 1961). Their first proposition states that, given certain conditions, the debt-equity ratio of a firm does not influence its market value. Their second proposition states that a firm's average weighted cost of capital (WACC) is not affected by its leverage ratio. The last two propositions in the theorem are less relevant for our thesis, so we will not present them in further detail.

There are four main conditions Modigliani and Miller assume in their derivation of the theorem. The first is that there are no taxes. The second is that there are no capital market frictions, including bankruptcy costs or transaction costs. The third is that there are symmetric interest rates, meaning investors and firms can lend at equal rates. The fourth and final assumption is that the financial policies adopted by firms reveal no information (Modigliani & Miller, 1958).

The authors derive their theorem as follows. Imagine two companies, one completely unlevered (Firm U), and one financed partly with debt and partly with equity (Firm L). The first proposition of the Miller-Modigliani theorem states that the value of these two firms is exactly the same. Miller (1991) explains the intuition behind the theorem by comparing the firm to a large tub of whole milk. The farmer who owns the whole milk can sell it as it is, or he can separate it into cream and skimmed milk. The Modigliani-Miller theorem states that if there are no costs of separation, selling the cream and the skimmed milk would net the same price as selling the whole milk. This is essentially an arbitrage argument. If proposition 1 does not hold, investors could buy and sell securities in order to generate risk-free economic rent until prices move to an equilibrium (Modigliani & Miller, 1958). In a formal argument, assume that $Value_U < Value_L$, but that expected return on income streams (X) is identical. Furthermore, assume an investor holding s_L worth of company L's shares, which equates a fraction α of total shares S_L . The investor's return, (Y_L), given interest rate r on debt D , can then be written as

$$Y_L = \alpha(X - rD_L) \quad (2.7)$$

The investor now sells his αS_L shares and instead purchases shares in company U, to the amount of $s_U = \alpha(S_L + D_L)$. In order to take personal debt αD_L , the investor uses s_U as collateral. This would give him the fraction $\frac{s_U}{s_U} = \frac{\alpha(S_L + D_L)}{s_U}$ of the income from company U. Given $r\alpha D_L$ in personal debt costs, the net income from this portfolio is

$$Y_U = \frac{\alpha(S_L + D_L)}{s_U} - r\alpha D_L = \alpha \left(\frac{V_L}{V_U} \right) X - r\alpha D_L \quad (3.4)$$

When comparing equations (3.3) with (3.4), we see that if $V_U < V_L$, $Y_U < Y_L$ must hold under the conditions stipulated by Modigliani and Miller. Basically, the investor reverses company U's decision of pure equity financing through personally leveraging his investments. Similarly, it can be shown that if $V_U > V_L$, investors have the opportunity to undo the leverage of firm L by adjusting their individual portfolios to account for arbitrage opportunities. In general, it is this "undoing" of leverage that hinders V_U to systematically differ from V_L (Modigliani & Miller, 1958).

The second proposition of Modigliani and Miller basically states that overall capital costs are unchanged by leverage ratio. Continuing our analogy, increasing the amount of debt (cream) lowers the value of the remaining equity (skimmed milk) as the total fat content is lowered. In other words, any financial gain achieved from increasing debt is balanced by the higher cost associated with riskier equity. Thus, given a certain level of total capital, the distribution of capital and debt is inconsequential because the weighted average of the different capital costs is equal for all possible combinations of the two. Formally, this last argument can be presented with the help of the weighted average cost of capital formula (WACC):

$$WACC = \frac{D}{D+E} r_D + \frac{E}{D+E} r_E \quad (2.8)$$

where r_E is the cost of equity and r_D is the cost of risk-free debt. Given proposition 1 and the conditions of the theorem, the WACC is independent of $\frac{D}{E}$. While increased leverage ratios must be compensated with a higher return on equity, this does not imply that greater value is created by highly leveraged firms, since this would violate proposition 1 (Brealey, Myers & Allen, 2008).

While some might regard Miller & Modigliani's theorem as irrelevant due to its strict and unrealistic assumptions, it is very useful for highlighting why and how capital structure does matter. For example, Villamil (2004) views the theorem as fundamentally a structured debate on why capital structure irrelevance fails in a real world setting.

In sum, the Miller-Modigliani theorem states that capital structure should not influence product market outcomes, either in terms of growth or profitability. In other words, capital structure does not influence corporate performance at all. In a real world setting, the assumptions of Modigliani and Miller are likely to fail. The rest of the theory presented in this subchapter will explore situations where the Modigliani-Miller assumptions are likely to break down.

2.1.2.2 Debt overhang theory

As mentioned above another key contribution to the financial structure literature is debt overhang theory, developed by Myers (1977). Debt overhang occurs when an organization has a sufficiently high leverage that further borrowing becomes financially unfeasible, even for investments with positive NPV. In his 1977 paper, Myers views the value of firms as determined by the present value of options for future investments. He then argues that firms with and without risky debt behave differently when faced with these investment options. If a firm is highly leveraged, the cost of issuing further risky debt causes the value of debt to exceed expected profits from the investment (Myers, 1977). Equity holders or managers that act in the best interest of stockholders will therefore hesitate to invest because most or all of the profits accrue to debt holders. As Huang and Song (2002) point out, such investments effectively shift wealth from stockholders to debtors. Even if debtors are willing to allow increased leverage, indicating that the firm is technically not financially constrained, rational

managers will still avoid such investments. This causes the firm to potentially forgo growth investment opportunities.

Thus, a departure from the Modigliani-Miller theorem occurs when creditors demand extra compensation for perceived bankruptcy costs when firm debt increases. This theory therefore predicts a negative relationship between the leverage ratio and growth levels of firms, because leveraged firms will tend to underinvest. Furthermore, if creditors “punish” highly leveraged firms with extra compensation for bankruptcy costs, we might also expect a negative relation between debt and profitability. Taken together, debt overhang predicts a negative relationship between debt and both measures of corporate performance.

2.1.2.3 Pecking-order theory

Pecking order theory, first presented by Donaldson (1961) and popularized by Myers and Majluf (1984), is based on information asymmetry between corporate managers and external investors. More specifically, the theory states that managers are better able to evaluate opportunities and asset values of a firm than investors. Myers and Majluf argue that if the disparity in information becomes too great, this will distort financing and investment decisions, potentially affecting corporate growth and profitability.

Myers and Majluf develop a stylized explanation. In the theory, firms face three options for financing investments: internally generated funds, issuing debt and issuing fresh equity. A firm has one asset A and one investment opportunity I . The firm has a sum $S < I$ of immediately available capital. The difference $I - S$ must then be financed with either risky debt D or new equity E . In a model where managers have superior information on firm and investment value, Myers and Majluf show that firms will always prefer to issue debt over new equity. This occurs regardless of whether the firm is over- or undervalued relative to market expectations. Their reasoning is that issuing new equity E signals overpriced assets and opportunities, which investors punish by placing a lower value on E . The market, upon receiving news that the firm is issuing new equity, will assume that management has information indicating overvaluation of the firm. Though the market will not know the true value of the firm, they will assume it is below current levels, and therefore reduce their valuation. If the firm acts in the interest of old stakeholders, they might prefer to forgo the investment opportunity instead of incurring stock value losses (Myers & Majluf, 1984). This

occurs when overall value of old assets A plus the reduced value of E is less than the value gains from the investment.

Issuing new debt partly mitigates the underinvestment issue. Doing so signals profitable investment opportunities. It also signals a potential undervaluation, or at least a correct valuation, because the firm refrains from issuing new equity (Brealey, Myers & Allen, 2008). Myers and Majluf show, however, that only internally generated funds completely solve the underinvestment problem.

Issuing new debt incurs flotation costs and potentially requires disclosing proprietary information that could lead to either market punishment or a loss of competitive advantage. This could again distort investment decisions, in worst case scenarios forcing management to refrain from issuing further debt in order to invest in a growth project. Furthermore, as seen in debt overhang theory, issuing further debt might also be unfeasible for firms with very high leverage. In sum, according to pecking-order theory, firms investing in growth opportunities will prefer to do so using internal funds. Though debt is a preferred financing choice over new equity, it still suffers from underinvestment issues associated with external capital financing. Therefore, the theory predicts a negative relation between debt levels and growth.

Pecking-order theory can also provide predictions for the relationship between debt and profitability. Given the arguments above, firms should prefer internal financing. However, unpredictable cash flows and investment opportunities mean that capital expenditures are not always covered. When internal financing of cash expenditures is insufficient, firms must seek external finance. According to the theory discussed above, firms will prefer issuing new debt, then potentially issue hybrid securities, and lastly turn to new equity when all other options are exhausted. The pecking-order theory therefore implies that firms with low levels of debt typically are highly profitable, and thus able to cover capital expenditure through retained profits (Brealey, Myers & Allen, 2008). Firms that are less profitable are more dependent on external funds to cover their expenditures. In light of pecking-order theory we should therefore expect a negative relationship also between debt and profitability.

2.1.2.3 Trade-off theory

Trade-off theory of capital structure, originally proposed by Kraus and Litzenberger (1973), proposes that a departure from the Modigliani-Miller theorem occurs with the presence of

both bankruptcy costs and tax shield effects of debt. We can see this when modifying equation 2.8 with the presence of tax deductible interest rates,

$$WACC = \frac{D}{D+E} r_D (1 - T_c) + \frac{E}{D+E} r_E \quad (2.9)$$

where T_c is the corporate tax rate. The weighted average cost of capital can now be reduced by increasing debt. This is what Kraus and Litzenberger calls the tax shield effect. With frictionless capital markets, the end result should be fully leveraged firms. However, Kraus and Litzenberger argue that with capital market imperfections debt also entails costs for the firm. These costs are usually referred to as bankruptcy costs, and are taken as the increased compensation that must be paid to creditors as the risk of bankruptcy increases. However, these costs can also plausibly include costs related to deteriorating stakeholder relations (Kraus and Litzenberger (1973), which we will discuss in greater detail in the next subchapter.

The prediction from trade-off theory is that leverage can increase profitability through reduced tax costs, as long as the tax shield benefit of debt exceeds its bankruptcy costs. The theory predicts a diminishing marginal benefit from the tax shield effect as bankruptcy costs increase. When the benefits equal costs, in other words when the firm has completed a trade-off between these marginal effects, it has reached its optimal capital structure (Brealey, Myers & Allen, 2008).

An implication from the trade-off theory is that increases in bankruptcy costs, for example if creditors' risk perception increases, should induce a negative effect of high leverage on profitability. This reduces the target debt ratio, but firms cannot quickly or costlessly shift their capital structure (Brealey, Myers & Allen, 2008). This can cause a negative effect of debt on profitability.

2.1.2.4 Capital structure and product market outcomes

The Miller-Modigliani theorem states that capital structure choices should not influence company value and product markets outcomes. However, there exist several theoretical implications for how debt levels influence competitive behavior and relations between firms

and stakeholders. Parsons and Titman (2008) aggregate several findings and implications from the finance and strategy literature on how capital structure might affect product market outcomes. A key prediction from their paper is that highly leveraged firms are less willing and able to compete aggressively with relatively unleveraged competitors. Highly leveraged firms may for example lack the financial reserves and solidity to sustain a prolonged price war (Parsons & Titman, 2008). They are also more vulnerable to predation by competitors, as they may be perceived as “softer” targets due to their inability to weather predatory moves. In other words, if a firm’s capital structure is characterized by high debt levels, the firm might struggle to capture or defend market shares in the event of predation, thereby predicting a negative relationship between leverage and growth.

Furthermore, Parson and Titman (2008) and Titman and Wessel (1988) argue that capital structure affects supplier and customer relations. The following argument relies on asset specificity theory as presented by Williamson (1981). In a relationship with high asset-specificity and high switching costs, suppliers and customers might demand compensation from highly leveraged firms. For the stakeholders, the risk of losing relation-specific investments increases with the client’s leverage, which raises his bankruptcy vulnerability (Parsons & Titman, 2008). This implies that highly leveraged firms are at a disadvantage when attempting to grow or increase profitability through partnerships or alliances with other firms. At the same time, a risk-premium cost might be incurred when selling to customers who face high switching costs. Suppliers might also refuse to extend credit to clients with high perceived bankruptcy risk, or charge a premium if they do. Therefore, in light of these theories, we should see a negative relationship between debt and corporate performance.

2.1.3 Capital structure, growth and corporate performance

So far we have discussed the effects of growth and capital structure separately. The theories we presented on growth largely predicted a positive relationship between growth and performance, with the exception of Gibrat’s law and inertia theory. Capital structure theory largely predicted a negative link between debt levels and firm outcomes, excepting trade-off theory and the Modigliani-Miller theorem. In this subchapter we present theories where growth and capital structure *in conjunction* determine performance outcomes. We first discuss capital opportunity cost theory, before reviewing a holistic model for firm growth and capital flows.

2.1.3.1 Capital opportunity cost theory

The capital opportunity cost theory states that there should be a positive relationship between leverage and the current growth opportunities a firm faces (Barton & Gordon, 1988; Toy et al., 1974). The theory states that high-growth firms have above-average investment opportunities, i.e. projects generating positive net present value (NPV) for the firm. These firms therefore have a high opportunity cost of hoarding capital rather than investing the money. For particularly fast-growing firms, it is reasonable to expect that cash requirements for further investments at some point exceed the capacity for generating funds internally (Barton & Gordon, 1988). The best solution, according to pecking-order theory, then becomes borrowing external capital to continue growth. Gupta (1969) further argues that high growth firms might frequently turn to external capital, as this allows flexibility in investment decisions. Managers with a sufficient desire for high growth might also accept restrictive debt covenants to achieve leverage (Barton & Gordon, 1988). This might mitigate some of the potential underinvestment problems associated with debt-overhang and pecking-order theory.

If high-growth firms actually do face above-average investment opportunities, we should expect a positive relationship between leveraged growth and performance outcomes. Assuming managers make accurate project NPV predictions, firms with above-average investment opportunities should also be more profitable. Naturally, they should also have larger growth potential relative to other firms. In sum, capital opportunity cost theory states that there should be a positive relationship between high leverage and high growth opportunities, and performance outcomes.

2.1.3.2 Capital allocation, growth prospects and the selection environment

So far we have presented a number of different theories and ideas. In an attempt to pull the different strands together, we present a holistic model for capital structure and growth, developed by Knudsen & Lien (2014). The model combines product market insights from our growth theories with factor market insights from theory on capital structure.

In the model, productivity is the determining factor of competitive outcomes in both factor and product markets. More productive firms “win” in product markets, where selection pressures cause these firms to increase market shares. A similar pattern will emerge in factor markets, where capital is allocated to more productive firms at the expense of less efficient companies. A key difference in factor market allocation, however, is the existence of a time

horizon aspect. Firms with low levels of profitability or productivity today might still be attractive if growth prospects are sufficiently high. In normal times, investors are therefore indifferent regarding the exact period in which productivity occurs. An example used by Knudsen and Lien is the recent valuation of Snapchat to 19 billion dollars – a company almost completely devoid of current revenue generation. This characteristic of capital markets is important for ensuring efficient resource allocation. Without it, financing R&D-intensive projects and innovation might for example be problematic. In addition to attracting equity and credit in factor markets, a third and last source of finance is through retained earnings. The discussion so far can be summed up in the model below.

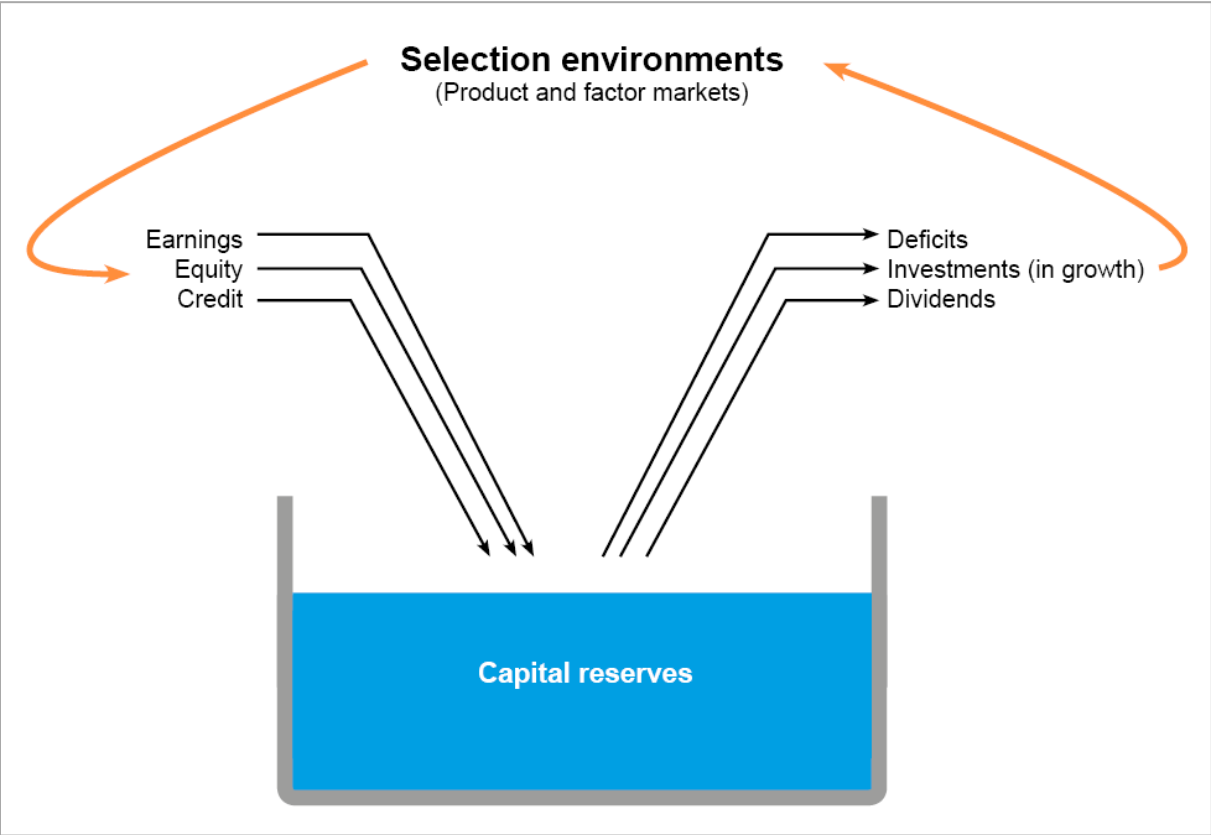


Figure 1: Selection environments and capital flows

The left hand side of the figure shows the three potential capital sources of firms – retained profits, equity and credit. The inflow from these increase capital reserves of companies, which is depleted by capital outflows – deficits, investments in growth and dividend payouts. The inflows can also be seen as a form of feedback from the environment. If investors and creditors view the company as a viable investment object, they will allocate capital to the

firm. If customers value and purchase the firm's products and services, feedback is provided through high earnings.

A central implication from the model is that the nature of these capital flows will depend on the type of company. Companies that are highly profitable today receive substantial capital inflows through retained earnings. However, they might have fewer investment opportunities, therefore preferring to let the cash flow out through dividends. Firms with high growth potential, on the other hand, might have negative current profits, while the majority of capital outflows are funneled into growth investments. This is supported by Chakravarthy & Lorange (2009), who find that only a small percentage of firms are able to simultaneously achieve high growth and high profitability. The growth projects of high-potential firms are then mainly financed through equity or credit, since they have limited ability to use retained earnings. The point is that two companies can have the same net capital inflow, but through very different channels. Furthermore, two companies can have the exact same valuation, with drastically different earnings and dividend flows.

What does all of this mean? First, there is a key implication for the interplay between growth and capital structure. So far the discussion points towards equity and credit as the most viable source of finance for high growth firms. However, in light of pecking-order theory, funding growth by issuing new equity should be the last resort for firms. This leaves high-growers with debt as their main source of capital. This model therefore also predicts a positive relationship between growth opportunities and debt levels, similar to the capital opportunity cost theory. Furthermore, provided the temporal indifference of investors hold, a firm's access to external capital should not depend on current performance and growth prospects. In other words, factor market allocation should not discriminate against firms whose high-productivity phase lies in the future, rather than today.

So far we have discussed a variety of theoretical mechanisms that explain how growth and capital structure affect corporate performance. The structure and theoretical relationships can be illustrated in the model below. We started with discussing effect 1, the impact of growth on corporate performance. We then moved on to theoretical implications for capital structure on performance outcomes, before arguing that there could be an interaction effect between our two main variables. We now turn to how recessions can impact the mechanisms discussed above.

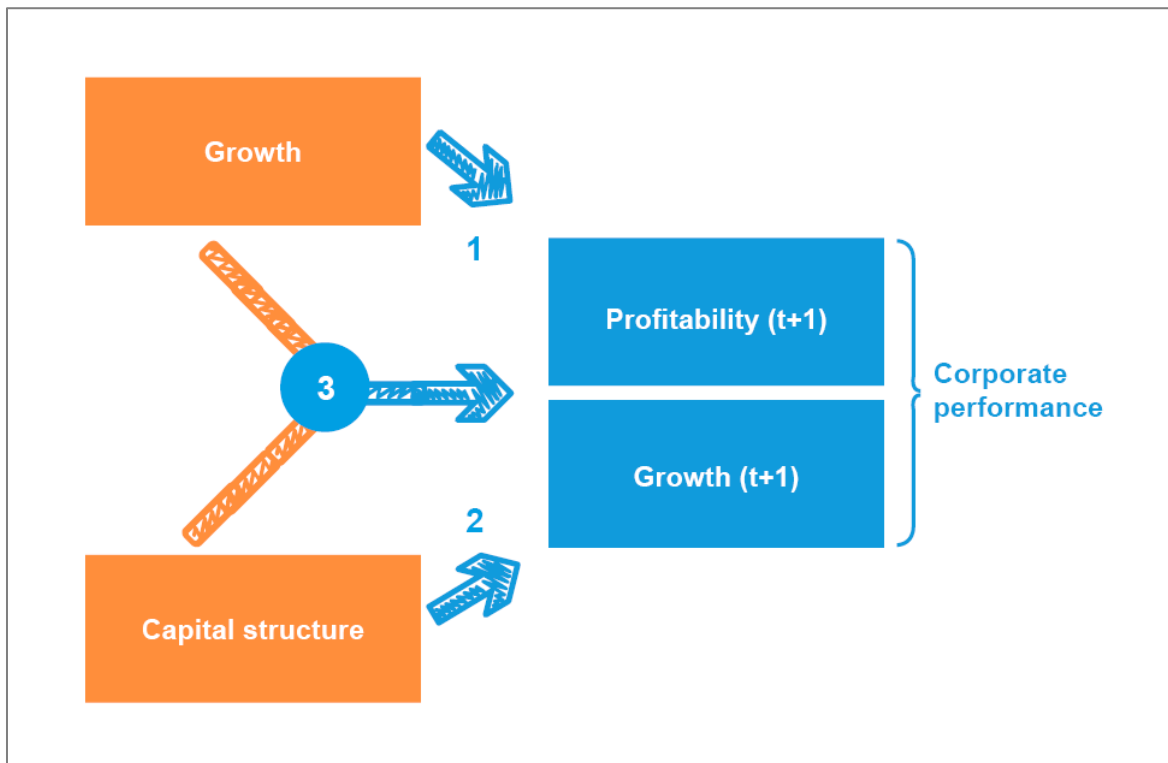


Figure 2: Relationship between growth, capital structure and corporate performance

2.2 The game changer: When recessions hit.

Implicitly, most of the theories presented above presume stable or ‘normal’ firm environments. We now turn to how the mechanisms of prior growth and capital structure might be affected by recessions. In this subchapter we start off with a discussion of what recessions are and how they fit in the context of business cycle theories. We then explain how the theoretical relationships introduced above are affected by recessions. Since there are few relevant theories on how downturns impact firms (Agarwal et al., 2009; Garcia-Sanchez, Mesquita & Vassolo, 2013; Bromilley, Navarro & Sottile, 2008; Mascarenhas & Aaker, 1989), this subchapter relies more heavily on empirical findings. Parallel to this discussion we also develop our hypotheses.

2.2.1 What are recessions?

There are various definitions of what constitutes a recession. We use the definition provided by the U.S. National Bureau of Economic Research (NBER) to identify whether macroeconomic conditions are recessionary. NBER state that “(...) a recession is a significant decline in economic activity spread across the economy, lasting more than a few months,

normally visible in real GDP, real income, employment and industrial production” (NBER, 2010). In other words, recessions are lasting economical contractions that impact entire economies.

2.2.1.1 Business cycle theory

To better understand recessions, we put them in the context of business cycles. The idea of business cycles was first introduced in 1819 by historian Jean Charles Léonard de Sismondi, and has since garnered substantial academic interest (Burns & Mitchell, 1946; Hamilton, 1989; Hodrick & Prescott, 1997; Lucas, 1977). Business cycles are defined as the fluctuation in economic activity around an economy’s long-term trend (Hamilton, 1989). Gartner (2009) posits that boom years occur when an economy exceeds its potential or optimal GDP, while downturns occur when GDP falls below potential GDP.

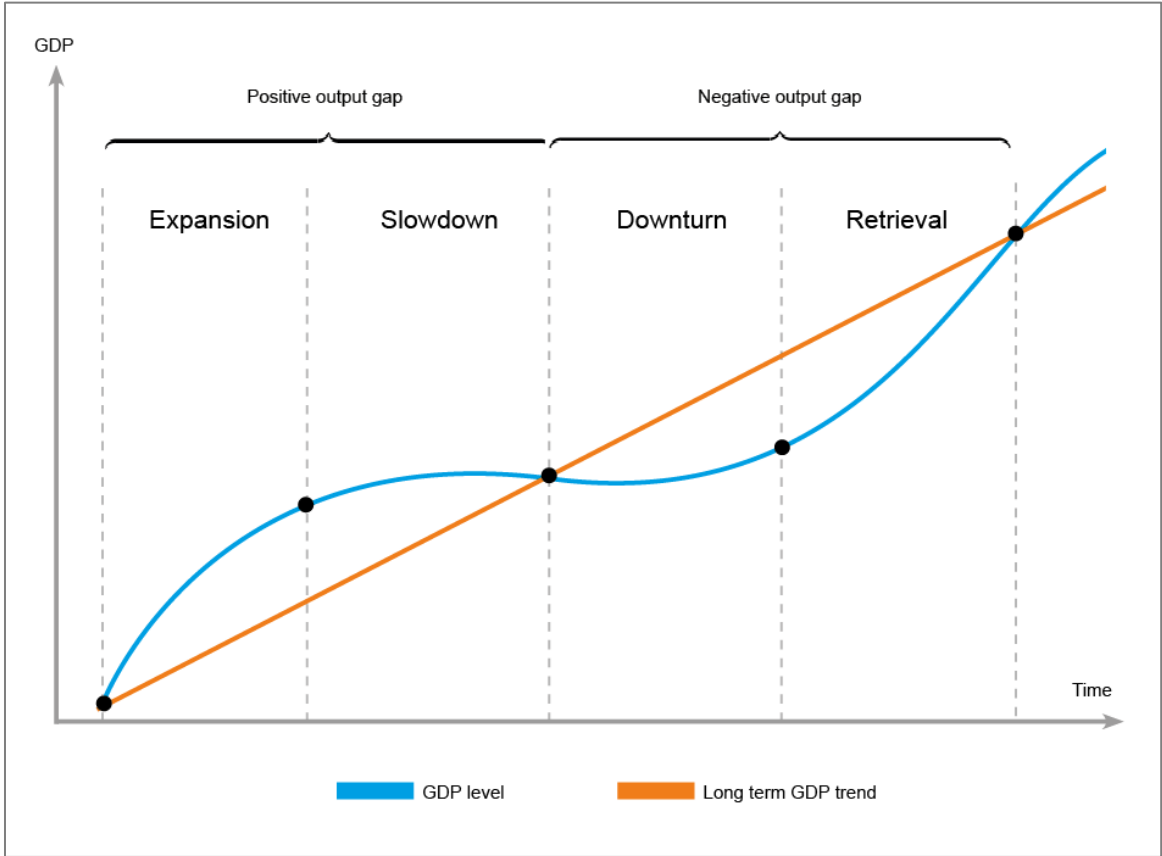


Figure 3: Phases of the business cycle. Source: Gartner, 2009; Benedictow & Johansen, 2005.

Figure 3.1 demonstrates how business cycles cause variations around the long-term trend as posited by Garner (2009) and Hamilton (1989). There are various classification schemes for different phases of the business cycle. Gartner simply distinguishes between cyclical

downturns, which last from peak to bottom of the cycle, and expansions, which last from bottom to peak. Benedictow and Johansen (2005) adopt a more detailed approach, differentiating between four phases of a business cycle: expansion, slowdown, downturn and retrieval. In this model, the downturn and retrieval phases constitute the recessionary stage of the business cycle. Our focus lies on the impact of recessions, and so we naturally concentrate on the downturn stage. Throughout the rest of our thesis, the terms recessions and downturns will be used interchangeably.

2.2.1.2 Impact of recessions

Cyclical downturns usually involve higher unemployment rates, lower GDP growth, less positive forecasts, reduced investments and a slump in stock markets (Gartner, 2009). According to the IMF, global recessions typically occur every 7-10 years, and can last anywhere from 8-18 months (Reinhart & Rogoff, 2013). The IMF have identified six periods since 1970 that qualify as global recessions, the two most recent being the dot-com bubble and the 2008-2009 downturn. These recessions caused a negative real GDP-growth of 0.4 and 2.3 in the OECD area, respectively (OECD, 2015).

For firms, the impact of recessions is likely to be twofold (Tong & Wei, 2008). The first is a reduction of consumer demand, where real and anticipated reduction in consumer spending power reduces consumers' purchasing power. This decreases the aggregate consumer demand over which firms compete. During the financial crisis more than two thirds of Norwegian firms experienced a decline in demand (Lien & Knudsen, 2012). The second impact is that access to equity and credit is reduced. In short, there are less available funds in capital markets for firms to compete over. Both of these indicate that the selection environment faced by firms becomes harsher during recessions. We return to the impact on Norway and Norwegian firms in greater detail in the analysis section.

A characteristic of recessions is that they are highly unpredictable (Reinhart & Rogoff, 2013). Therefore, their impact can be viewed as exogenous, environmental shocks for firms. This makes recessions interesting in a research perspective, because they can be viewed as large natural experiments imposed on corporations. However, empirically investigating the impact of recessions is not quite as straightforward as this might imply. We briefly present a model from Knudsen (2014) to illustrate conceptual issues with using recessions as exogenous treatments on firm performance.

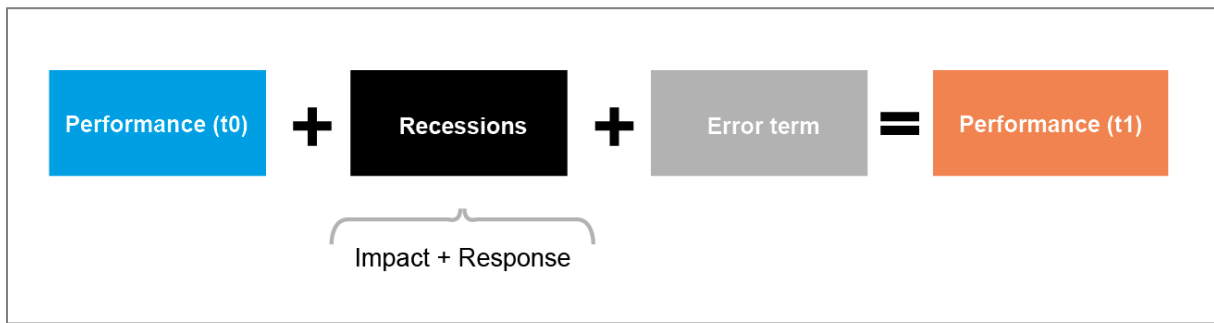


Figure 4: Impact of recessions. Source: Knudsen (2014)

As we can see from the model above, three categories of factors influence firm performance outcomes in recessions. First, there is the impact of the recession itself. Second comes the response of firms to the occurrence of a downturn. Third is the error term, which accounts for all other factors that influence firm performance in the period that are not related to the downturn. We return in detail to the error term in the methods section, where we discuss control variables that allow for us to capture some of this variation. We can therefore argue that we can control for at least parts of the error term. Separating recessionary impact from the response of firms, however, is not something we can easily do. For example, the impact of a recession can cause a reduction in sales growth for a given firm, but the response of the firm can be to engage in a spontaneous (and successful) viral marketing campaign, ending with a net positive effect on growth. To us, this would only register as a small positive increase in sales growth, since the marketing campaign is not the result of observable firm characteristics. We return to the problem of separating impact and response in the discussion chapter.

2.2.1.3 Types and causes of recessions

Various types of recessions have been identified based on the “shapes” they impose on long-term growth patterns, and whether they can be considered structural or cyclical (Morley, 2009; Chen et. al, 2011). We do not spend time on distinguishing between types of recessions, since this falls outside the positioning of our thesis.

There are also differing opinions on the cause of recessions, and whether they originate in demand or supply side factors (Hamilton, 1989). However, the underlying drivers for downturns are not highly relevant for this thesis, only their effects. Therefore, we devote no more time to the underlying economic explanation of recessions.

2.2.2 Capital structure and growth in recessions

So far we have presented some theoretical underpinnings for recessions and how they fit in business cycles, and their likely impact on firms. We now turn to how recessions affect the impact of capital structure and growth on corporate performance. We follow the same structure as above, meaning we start with the discussion of growth, before moving on to capital structure and lastly consider the combined effects of growth and capital structure. As mentioned above, the lack of theoretical contributions on the effect of growth and capital structure during recessions, we adopt a more empirical approach in this chapter.

2.2.2.1 Growth and corporate performance in recessions

As we saw above, Gibrat's law predicted no relationship between current and future growth, while Geroski's RBT model predicts a positive, stable relationship between current growth and future profits and growth rates. Theory on economies of scale and the Kaldor-Verdoorn Law also predicted a positive relationship between growth and profitability. Organizational inertia theory, coupled with fitness landscape theory, indicated potentially negative effects of growth on performance. Generally, empirical findings for normal years indicate that predicting firm growth is difficult, and that firm growth largely follows a random pattern (Geroski, 1999; Geroski, Machin & Walters, 1997; Coad & Holzl, 2003; 2007). This lends credibility to Gibrat's law, and indicates that sustaining growth over time is very difficult. However, regarding the *effects* of growth, some empirical support is provided for the positive relationships predicted by RBT, economies of scale and the Kaldor-Verdoorn Law (Davidsson & Fitzsimmons, 2009; Chandler and Jansen, 1992; Coad, 1997). Some authors, on the other hand, find that growth can have a negative impact, particularly on profitability (Chakravarthy & Lorange, 2009)

Now we turn to how these relationships are affected by downturns. Intuitively, we might expect fast growers to be less severely affected during recessions. High growth is, after all, a desired state for many firms, and might be an indicator of the general 'proficiency' of firms in meeting consumer demand. Additionally, from a competitive forces perspective, high-growth industries might be subject to less intense rivalry during recessions, since demand is relatively abundant (Knudsen, 2014; Porter, 1980). To the contrary, however, several authors find that recessions induce a negative effect of prior growth on corporate performance (Geroski &

Gregg, 1996; 1997; Knudsen, 2014; Lien, 2010). Geroski and Gregg (1996) find that British firms with high growth rates prior to a recession were more vulnerable during the downturn than other firms. Using survey-based data from a sample of 614 manufacturing firms, they find a positive, significant relationship between prior growth and the probability of being extremely severely or severely affected. Their vulnerability construct encompasses both profitability and growth (Geroski & Gregg, 1997).

Knudsen (2014) arrives at a similar conclusion. Combining survey and financial statement data for over 1000 Norwegian firms he finds that Norwegian high-growth firms were more likely to experience severe demand reductions in the 2008-2009 recession. Lien's (2010) findings are similar to those of Geroski and Gregg and Knudsen. He argues that industries with high pre-recession growth have a large share of marginal customers, whose perceived utility from purchases just exceeds their costs (*ibid*). These customers only enter the market because of the peaking economic boom. When the downturn hits, these customers are the first to leave the industry (Lien, 2010). Examples of such boom industries might include luxury spas or limousine services.

Taken together, these findings indicate that high-growth firms are more vulnerable during recessions than their more modestly growing competitors. In other words, the empirical findings indicate that recessions actually reverse the positive relationship between growth and corporate performance predicted by the RBT model, economies of scale, and the Kaldor-Verdoorn Law.

How do recessions reverse the theoretical mechanisms above? We briefly attempt to outline how downturns can effectively reverse relatively robust theoretical mechanisms. We start with RBT. Knudsen and Lien (2014) offer a potential explanation: recessions can change the fitness landscapes of the competitive environment, as presented by Siggelkow (2001). These changes can be imposed through shifts in customer and investor preferences (Knudsen & Lien, 2014). Investors and creditors will tend to “flee to quality” during recessions (Bernanke, Gertler & Gilchrist, 1991). Similarly, customer demands have been shown to change during downturns, for example in disfavor of luxury and durable goods (Knudsen, 2014). This might alter the worth or exploitability of resource bases during downturns. The flight to quality is just one example of capital market inefficiency during recessions, a phenomenon that

strategists typically do not account for. Overall, these explanations might provide some basis for understanding how recessions might reverse RBT predictions on firm performance.

Regarding economies of scale and the Kaldor-Verdoorn Law, we can turn to organizational inertia to explain why these mechanisms might be reversed during recessions. If large firms typically reap economies of scale and benefit from the Kaldor-Verdoorn prediction, we can also assume that these organizations will experience more inertia than smaller firms (Hannan & Freeman, 1984). Therefore, when recessions hit and potential fitness landscape changes occur, these firms are less able to adjust to the new environment. In the long term, the effects of inertia depends on whether landscape changes are temporary or permanent, but in the short term larger firms are likely to suffer more than smaller, more agile firms. Organizational inertia might therefore explain why the growth mechanisms are reversed in recessions.

Based on the discussion above, we develop the following hypothesis.

H.1.a: *Prior firm growth has a negative effect on growth performance in recessions.*

and

H.2.a: *Prior firm growth has a negative effect on profitability performance in recessions.*

Similar to growth, it is unlikely that these relationships are linear for all degrees of leverage. We intuitively expect the effects of prior growth to display non-linear relationships with corporate performance. Firms with high pre-recession growth levels, for example, might suffer relatively more in recessions than more modest growers. In light of the resource-negation and marginal customer effects during recessions, these high growers might suffer disproportionate negative impacts of recessions that would not be captured by linear models. We therefore add two more hypotheses we will use to test for non-linearities in the effects of prior growth on performance.

H.1.b: *During recessions the negative effect of prior growth on growth performance increases exponentially with prior growth levels.*

H.2.b: *During recessions the negative effect of prior growth on profitability increases exponentially with prior growth levels.*

2.2.2.2 Capital structure and corporate performance in recessions

As we saw above, the theoretical predictions for the effect of capital structure on performance were somewhat disparate. Pecking-order and debt overhang theory predicts a negative relationship, as did the product market theories. On the other hand, capital opportunity cost theory predicted a positive relationship between debt levels and performance outcomes.

For normal years, overall empirical findings suggest that there is a negative relationship between debt levels and future growth (Rajan & Zingales, 1995; Gupta, 1969; Titman & Wessels, 1988; Chen & Zhao, 2001). Some, however, find a positive relationship (Barton & Gordon, 1988). Largely, it seems predictions from pecking-order and debt overhang theory hold firm in empirical investigations. Empirical investigations of capital structure's effect on profitability have yielded rather disparate findings. Some authors find that leverage has a positive relationship with profitability (Abor, 2005; Gill, Bigger, Mathur, 2011). Others find that high leverage is associated with reduced profits (Hurdle, 1974; Shubita & Alsawalha, 2012). One explanation for the disparity in findings could be the different methods and data used in the analysis.

However, we are more concerned with the impact of capital structure during recessions. In the empirical studies we have reviewed, highly leveraged firms appear to be more severely affected by recessions. Geroski and Gregg (1996) find that firms with high levels of debt relative to total assets were more vulnerable in recessions. As we discussed above, their vulnerability construct encompassed both output growth and profit rates, indicating that highly leveraged firms suffer in both performance dimensions during downturns. Similar to Geroski and Gregg, Lien and Knudsen (2012), measuring recessionary impacts on demand reductions and credit constraints using survey data, find that industry-adjusted debt level was the most influential factor in determining vulnerability among Norwegian firms.

Campello et al (2010) find that financially constrained firms, i.e. firms unable to further increase their debt ratio, to a larger extent reduced investments, number of employees and marketing expenditures relative to unconstrained firms during the 2008-2009 recession.

Though they do not explore the capital structure characteristics of credit constrained firms, it seems natural to assume that the reason they are denied further credit is an already high debt ratio. Campello et al. further show that three aspects of credit constraints drove the negative relationship between debt and performance: limited credit availability, higher costs of external funds and difficulties in retaining or establishing new lines of credits with banks. They do not investigate the impacts on profitability and growth, but the increased interest rates indicate that profitability should suffer as a consequence of being highly leveraged during recessions. Furthermore, the reduction in investments, employees and marketing expenditure should intuitively induce a reduced growth relative to more moderately leveraged competitors.

Braun and Larrain (2004), when performing analyses on industry level, found that industries that are more dependent on external finance are more severely affected during recessions. Using a sample of multiple manufacturing industries in more than a hundred countries, they find that output growth rates are disproportionately reduced for industries where high debt levels were the 'norm'. Additionally, they discover that this leverage effect is exacerbated by capital market inefficiencies. In other words, the less effective capital markets were, the worse the impact on high-leverage industries.

Similar predictions as the ones discussed above are presented by Opler and Titman (1996). They find that firms with a high debt to assets ratio lose market shares to less leveraged firms when faced with financial distress. They argue that this negative growth is partly attributable to customer and competitor actions, not only downsizing decisions by managers. Zingales (1998) show that exogenous shocks affected highly leveraged firms more heavily. He argues this is caused by predatory pricing of competitors viewing leveraged firms as easy targets for a price war. These findings coincide with the conclusions made by Chevalier (1995a; 1995b), who investigated competitive behavior among supermarket stores and found that prices tended to drop following leveraged buyouts. She argues that this is caused by predation on the buying firm, which experiences a sharp increase in debt levels following the buyout. In a related stream of research, Titman & Wessels (1988) investigate the effects of leverage on customer and supplier relations. They find that firms which can potentially incur high liquidation costs among stakeholders tend to choose lower debt ratios.

How can we explain the empirical findings above? Seen in light of debt overhang theory, the findings of Geroski and Gregg (1996), Lien and Knudsen (2012) and Campello et al. (2010)

might indicate that recessions further increase the cost of financing investment projects with debt. For example, firms with high debt levels, who have already incurred high risk in the eyes of debtors, should face even steeper interest rates during downturns. As we saw above, this is directly supported by Campello et al. (2010). In the debt overhang model, this exacerbates the underinvestment problem, since debtors now retain even more of a project's potential profit. Highly leveraged firms are therefore forced to forgo even more investment prospects with positive NPV, reducing growth. In light of this theory, recessions should therefore a greater reduction in profitability and growth relative to more modestly leveraged firms.

These findings can also be seen in light of trade-off theory. Recessions are likely to reduce the optimal debt ratio of firms, as creditors risk perceptions increase, effectively raising bankruptcy costs. This should lead firms to attempt a reduction in debt ratio, but this is costly and takes time. Meanwhile, their profitability performance is likely to suffer.

The findings of Braun and Larrain (2004) indicate that the underinvestment problems predicted in pecking-order theory is exacerbated by recessions. That decreased financial market efficiency further reduces growth might indicate that the preference of internal capital is strengthened during downturns.

The findings in Opler and Titman (1996), Zingales (1993) and Chevalier (1995a; 1995b) indicate recessions aggravate the mechanisms of capital structure on product market outcomes we presented in chapter 2.1.2.3. The findings from Titman and Wessels (1988) point in a similar direction. Their results indicate that firms anticipate that credit constraints exacerbate the mechanisms of switching costs and asset specificity.

In sum, it seems downturns exacerbate many of the theoretical mechanisms of how capital structure might affect growth. These findings point to a clear negative relationship between debt levels and growth and profitability during recessions. When comparing our discussion to the Modigliani-Miller theorem, it could be argued that recessions put further distance between the 'real' world and the one Modigliani and Miller imagined.

When formalizing our discussion into hypotheses, we have

H.3.a: *Debt has a negative effect on corporate growth performance during recessions.*

H.4.a: *Debt has a negative effect on corporate profitability performance during recessions.*

Similar to the relationships in growth, we expect non-linearities in the effects of capital structure. This is perhaps most evident when looking at debt overhang theory, which implies that there exists some threshold before underinvestment problems start to arise. Above this threshold, we should intuitively expect the negative effects of debt to be increasingly negative. Firms with particularly high debt levels should therefore be relatively more severely affected.

H.3.b: *During recessions the negative effect of debt on growth performance increases exponentially with debt levels.*

H.4.b: *During recessions the negative effect of debt on profitability performance increases exponentially with debt levels.*

2.2.2.3 Growth, capital structure and corporate performance in recessions

As we can see from the discussion so far, recessions seem to induce a negative effect of both high growth and high leverage on firm performance. In the capital structure lens, recessions force a departure from the Modigliani-Miller world by punishing firms with high leverage, exacerbating the mechanisms of debt overhang and product market theories. The discussion on growth revealed that the growth mechanisms were largely reversed during recessions. In sum, therefore, we should expect high levels of both pre-recession growth and leverage to be particularly harmful to performance.

This can be further discussed in light of Knudsen and Lien's (2014) model on capital flows and selection environments, as presented in 2.1.3. In normal years, there is not much factor market discrimination between firms regarding their growth prospects and capital structure. Put differently, the mix of the three capital inflow channels should not affect a company's operations. Similarly, product market selection pressures, which favor high current productivity, are mitigated by access to efficient financial markets, which provide a "buffer" for high-potential firms.

As we mentioned in 2.2.1.2, two things tend to happen in recessions – demand reductions and equity and credit availability reductions. In light of Knudsen & Lien’s model, demand reductions are likely to decrease capital inflows from retained profits. Another way to think of equity and credit availability reduction is that investors increase their threshold for required future growth, and banks increase their demands for collateral or solidity (Knudsen & Lien, 2014). This last effect can cause recessions to induce a distorted or myopic selection effect on firms. The intertemporal productivity indifference discussed above, where productive firms can be valued equally regardless of when high productivity occur, is gone or at least weakened. In other words, markets will discriminate heavily towards firms with high growth opportunities. Additionally, firms that have low current profitability might find retained revenues insufficient to cover deficits or dividend payments.

This effect can be exacerbated if we include capital opportunity cost theory in the discussion. In light of this theory, firms with high growth potential should have higher opportunity cost of capital reserves. In other words, they should have fewer reserves to draw on during a crisis. Additionally, if these firms have chosen a high degree of leverage to finance growth investments, they are likely to be particularly severely affected.

Based on the discussion above, we propose the following effect of the interaction between debt levels and growth during recessions.

H.5: *There is a negative interaction effect between prior growth and debt levels on growth performance in recessions.*

H.6: *There is a negative interaction effect between prior growth and debt levels on profitability performance in recessions.*

To sum up, we have seen that from both a theoretical and empirical viewpoint, recessions can have a potentially large impact on the effects of growth and capital structure. Building on the visual representation from above, we have included the following figure to demonstrate the mediating effect of recessions.

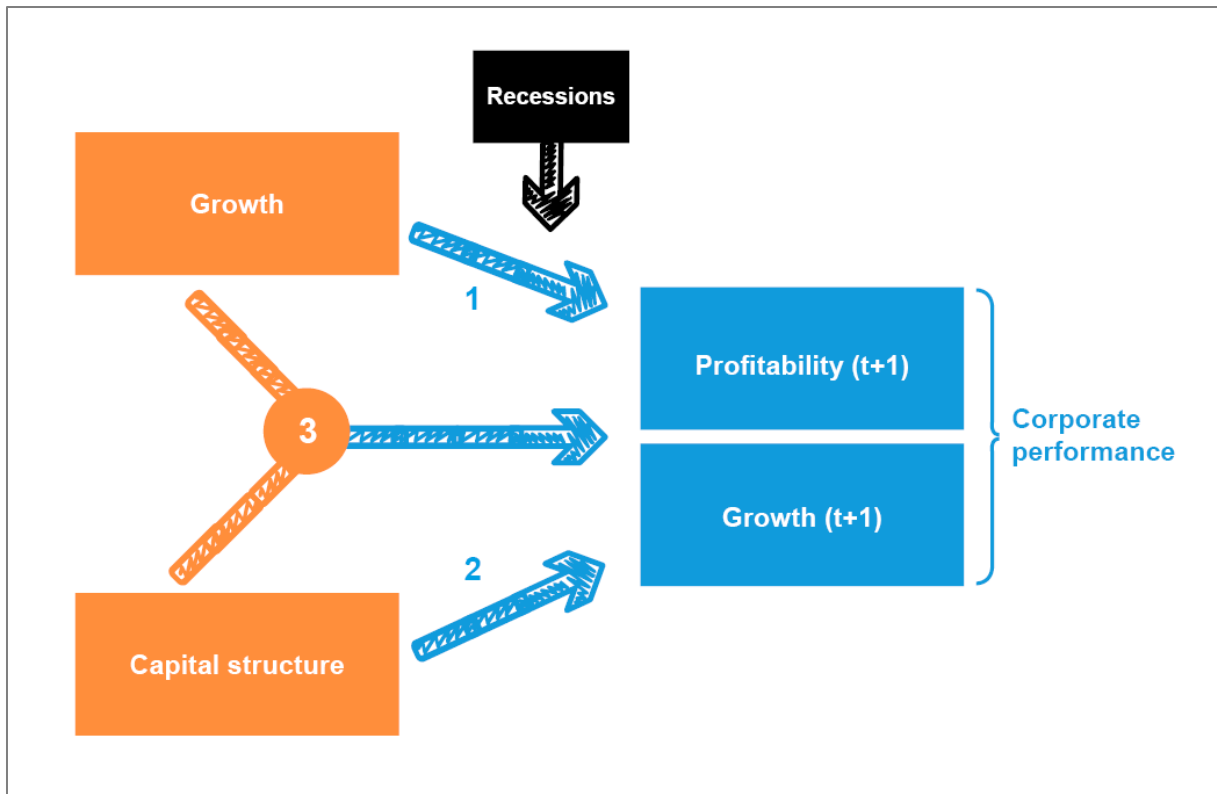


Figure 5: Growth, capital structure, corporate performance and the mediating effect of recessions.

3 Research design and method

In this chapter we will present our methodological choices. We start by describing the general research design of our thesis, before discussing data acquisition and our sampling strategy. We then present the variables we include in our models before discussing multiple regression analysis. Lastly, we discuss the reliability and validity of the thesis.

3.1 Research design

As stated in our research question, the purpose of this paper is to investigate how capital structure and growth patterns influence firm performance in recessions. Johannesen et. al (2005) underline that the purpose dictates the research design, in other words should the research question shape design choices. Therefore, we have structured our research design after the purpose of our study. At the same time, coherence between different aspects of the research design should be emphasized (Saunders, Lewis & Thornhill, 2009). The rest of this subchapter discusses the suitability of research design choices and the overall coherence of our research.

Saunders et al. (2009) develop a framework for research purpose and design. We use this framework to verify that our design choices are appropriate given the purpose of our thesis. In the model research purpose can be placed in three different categories: explorative, descriptive and explanatory. Explorative studies seek to reveal new information and evaluate a phenomenon from a different perspective. Descriptive research aims to establish an accurate description of people, events or situations. Explanatory studies aim to explain causal relationships between variables. Saunders et al. state that the different approaches are not mutually exclusive or even easily separable from each other.

Our research arguably contains aspects of exploratory, descriptive and explanatory purposes. We seek to further explore relationships that have not been investigated thoroughly in a business cycle context, and therefore our thesis can be said to be exploratory. At the same time, it is our aim to describe our empirical findings as accurately and robustly as possible, which in Saunders, Lewis and Thornhill's framework indicates a descriptive purpose. Furthermore, our research also implicitly attempts causal explanation of how certain firm characteristics affect recessionary impacts, through tying a causal link between debt and growth levels and firm outcomes. However, the focus in this thesis is not *why*, but rather *what*. By this we mean that our main purpose is to establish whether the broad relationships between debt, growth and performance exist, not why these relationships might occur. At the same time, it is our aim to be as transparent and accurate while performing analyses. Therefore, we conclude that our thesis has a mostly descripto-exploratory purpose. We now turn to the implications this classification has for our research design.

A key consideration is what Saunders et al. call research approach. They state that research can be either inductive or deductive. In inductive approaches, the researcher explores data and subsequently creates, modifies or refers to theory to explain findings. Deductive research typically develops hypotheses from existing literature and then test hypotheses on data. We argue that the last approach fits a descripto-exploratory purpose well. Our purpose dictated that we base our analysis on existing research, since we were dependent on previous literature to develop our baseline relationships between growth, capital structure and performance in normal times. Furthermore, we were reliant on existing empirical studies to develop our hypotheses on how recessions affect these relationships.

Additionally, our research question dictates that we use quantitative data. It seems highly unfeasible to collect sufficient qualitative data for a representative sample of Norwegian firms. Saunders, Lewis and Thornhill (2009), however, argue that use of qualitative data might be better suited to exploratory studies. But this seems to disregard the potential wealth of information that can result from exploring quantitative data, as well as the feasibility of data access. Furthermore, quantitative data is intuitively better suited to perform objective, accurate portrayals of reality, in line with the descriptive purpose of our thesis. Additionally, our access to databases of financial statement data is a resource we should utilize. It therefore seems appropriate to use quantitative data.

The research design is summarized in the figure below.

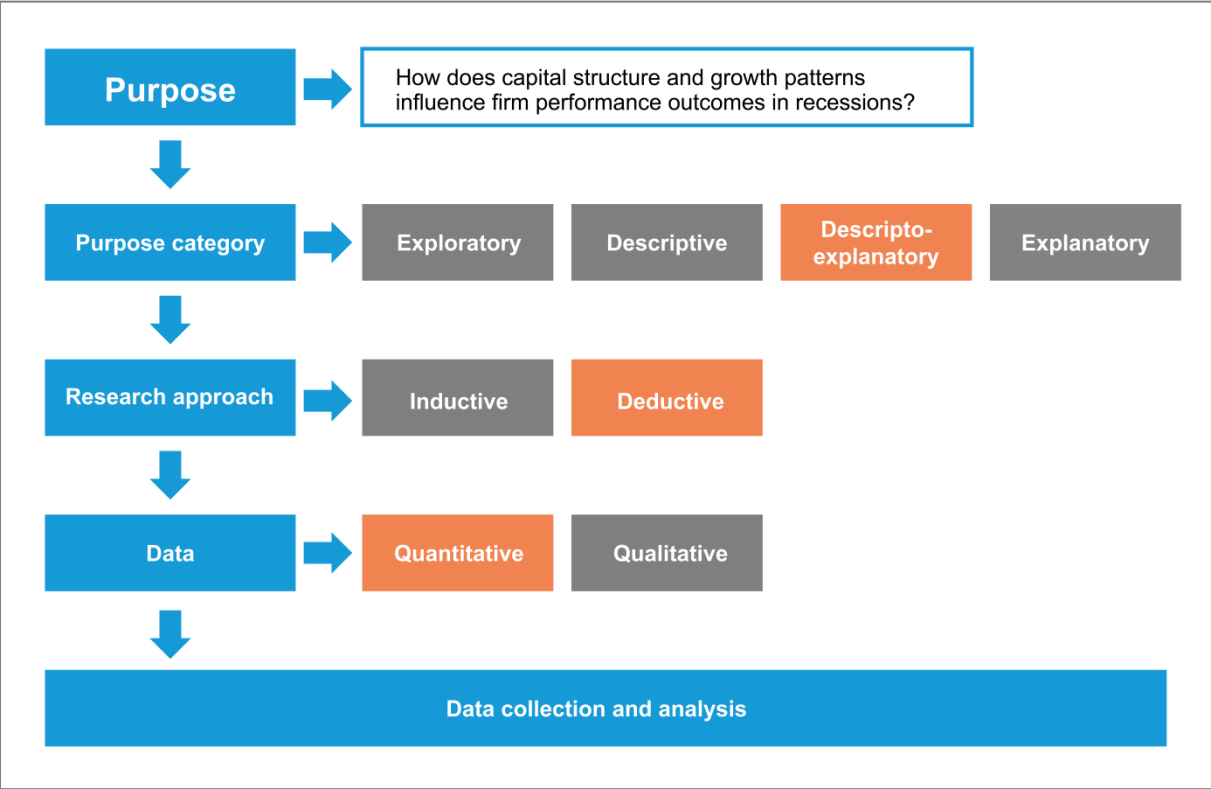


Figure 6: Research design

3.2 Data and sample

3.2.1 Data

The data we have used in this thesis stems from the Norwegian Entity Registry database (Brønnøysundsregisteret), delivered to SNF by Dun & Bradstreet Norge and Menon Business

Economics. The data is mainly comprised of yearly individual financial statements from every firm operating in Norway. These statements are intended to provide information to various interested parties, such as tax authorities and investors, and therefore contain in-depth financial information about the enterprises. The database is therefore comprised of key financial information on all Norwegian enterprises, published in separate databases released annually from 1992-2012. In addition to variables reporting profit margins, debt and liabilities, cash holdings and so on, the data sets contain information about firms' ownership structure, legal form, and industry affiliation.

The databases from the Entity Registry fall under the definition of secondary data given by Saunders, Lewis & Thornhill (2009, p. 681): “(...) secondary data is data collected by others for another purpose than yours”. A brief assessment of how well-suited the data are to our purposes is therefore expedient. Our aim is to explore relationships between key characteristics of firms and how these are affected by business cycles. Many of these characteristics can be computed or approximated from variables in the databases, so our application of the data seems justifiable. Furthermore, the Entity Registry supplies an unparalleled sample of firms, and data is provided for almost two decades. Lastly, there are few viable alternative methods. The only other realistic option for generating a comparable amount of relevant data would be through a quantitative survey, as in Knudsen (2014), but such an endeavor falls beyond the scope of this thesis. Mjøs and Øksnes (2012) have also performed a quality assurance of the entire database, mitigating data quality concerns.

3.2.2 Empirical setting and sampling strategy

We aim to describe the relationships between capital structure, growth and corporate performance among Norwegian firms during the two recessions in the 2000s. It is therefore crucial to generate an empirical setting that allows for an accurate portrayal of reality and generalization of results. We sought to generate a base sample of Norwegian firms that were representative for a hypothetical “normal” Norwegian firm. Our reasoning is that certain organizations, such as very small firms, holding companies, or charities might exhibit characteristics and behavior that differ substantially from a “normal” firm. These non-normal firms might generate noise and inaccuracies in our analysis results.

Here we faced a general trade-off. On one hand we could include more firms and thus achieve higher “realism” and external validity. On the other hand we could exclude certain firms in

order to remove noise from non-normal firms and increase internal validity. This would arguably also increase external validity when generalizing to our sub-group of “normal” firms, as opposed to the entire population of Norwegian firms. Since this thesis is focused on profit-maximizing corporations and on generating results representative for these, the latter sampling approach was preferred. The drawback remains, however, that this involves a non-probabilistic sampling method and manipulation of the data sets that will clearly influence the base sample. We have therefore strived for transparency whenever performing manipulations on the data sets, while also attempting to remove as few observations as possible from the data. Additionally, an argument for using our selection criteria is to generate a comparable sample to Bjørkli and Sandberg (2012), Fjelltveit and Humlung (2012), Brynildsrud (2013) and Lien & Knudsen (2013), which should allow for more easily comparable results.

3.2.3 Selection criteria and sample size

Selection criterion 1: Time period 1999-2012

Ideally, we would want to use data from every year in the database. However, while data as far back as 1992 is available, the implementation of Regnskapsloven renders pre-1999 unusable, due to large disparities in accounting practices. The period 1999 to 2012 was chosen since it should allow us to capture two recessions in our analyses. Data for 2013 has not yet been released at the time of writing.

Selection criterion 2: Sales revenue > 10.000.000 NOK

This selection criterion was chosen for several reasons. First, to ensure a minimum size of the firms included, and so exclude small firms that could potentially exhibit very high growth rates. The second reason was to eliminate non-commercial, non-profit maximizing firms. The selection criterion has been adjusted for inflation using Statistics Norway’s (Statistisk Sentralbyrå) inflation index. The basis year for all inflation adjustments is 2007, and a table with the inflation rate index can be seen in appendix A.1.

Selection criterion 3: Labor costs and social expenses > 3.000.000 NOK

The criterion that firms have above 3 million NOK in labor costs and social expenses was included to ensure that juridical entities such as holding companies were dropped from the base sample. Again the reasoning was that these might behave and respond in different ways than a typical commercial firm. As we see below, we used labor costs and social expenses as a

criterion instead of number of employees, since the latter displays faulty reporting. This criterion was adjusted for inflation using the same method as above.

Selection criterion 4: Legal form = AS, ASA ANS or DA

This criterion was intended to remove publicly owned entities or other non-profit maximizing firms that were not excluded by the criteria above, mainly government-owned firms. The included legal forms are limited companies (AS for short in Norwegian), public limited companies (ASA), general partnerships (ANS) and liable companies (DA). While the list of legal forms that are excluded from the base sample is relatively long, the number of firms excluded is relatively low. Around 90 % of firms in the databases are of the AS, ASA, ANS or DA legal forms.

Selection criterion 5: Competitive, profit-maximizing industries

Several industries were excluded because affiliated firms are likely to exhibit non-competitive or non-profit maximizing behavior, or otherwise reduce the generality of the sample. The list of excluded industries is given below. The numbers and percentages are from a dataset with no prior cutoffs.

2002 two-digit NACE code	Industry name	Average number	Average percentage
1	Crop and animal production	2023	0.8
2	Forestry	444	0.2
65	Financial services	23748	9.2
66	Insurance	229	0.1
67	Financial support services	845	0.3
75	Public/defense firms	3464	1.3
80	Education	1802	0.7
85	Health and social services	10053	3.9
90	Sanitation / garbage disposal	485	0.2
91	Interest groups	562	0.2
92	Culture / sports	4478	1.7
99	International organizations	0	0.0

Table 1: Excluded two-digit NACE industries

The exclusion of some of these, such as interest groups or cultural or sports organizations, probably speak for themselves. Agricultural industries were excluded because they are subsidized by the government, therefore contaminating the impact of recessions. Financial industries were excluded because of the unique capital structure patterns typically observed among affiliated firms. Banks, for example, can typically operate with debt levels between 90-95% of total assets (Gropp & Heider, 2009). We excluded the health services industry because while some health firms might be private and profit-maximizing, demand for health services are likely to be highly inelastic, even during recessions. The sanitation industry was excluded for the same reason.

Total sample size:

Below is a table showing total sample size for each year as each selection criteria is implemented.

Criteria	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
None	140248	150048	140969	153789	156769	170928	201404	221815	234213	237947	240758	244184	247457
Sales	24252	25381	24896	24357	25971	28452	30462	33774	34762	33850	34661	35472	36283
Salary	15630	16769	16601	16560	17518	19522	21254	23993	25588	25338	25983	26031	26229
Legal form	14763	15964	16003	15997	16925	18597	20324	22984	24357	24088	24689	25290	25891
Industry	14001	14779	15201	14894	15718	17203	18820	21206	21132	22005	21806	22322	22659

Table 2: Criteria and sample size

As we can see, the most drastic reductions in sample size occur when we implement the sales and salary criteria. Excluding the legal forms and industries discussed above removes relatively few firms. There seems to be a clear trend of increasing number of firms in the datasets.

3.2.4 Outliers

When performing regression analysis, it is often appropriate to check for outliers. An observation is defined as an outlier when its omission substantially impacts regression results (Chatterjee & Hadi, 1986). These influential observations have the potential to greatly affect

OLS results (Wooldridge, 2010), and can also cause violation of the normality criteria common in some statistical analysis tools (Keller, 2009). Regressions are susceptible to outliers because residuals with large absolute values are allocated disproportionate weight in the OLS method. Generally, outliers can arise in two different ways, through errors or through unusual characteristics of cases. It is impossible to assert outright that the outliers in our datasets are erroneous, so we must treat them as unusual, but correct, observations. The decision to keep or drop these observations is not trivial. Extreme observations can provide important information by increasing the variation in the independent variables (Wooldridge, 2010). However, as mentioned above, they have the potential to impact analysis results substantially. It is a similar dilemma to the one discussed in section 3.2.2, where we must decide between realism and representativeness. Again, we stress the importance of minimizing the extent of “tampering” with the dataset. Ideally, we would present our analysis results both with and without outliers, but due to our focus on generating a representative sample and scope restrictions, we decided to instead only report results where we remove the outliers. To retain as many observations as possible, we only trim the dependent and key independent variables. In other words, we trim sales and asset growth, debt levels, ROA and EBITDA margins.

When dealing with influential observations there are two possible approaches. We can either create our own limits for accepted values of a variable and trim it accordingly, or we can use statistical techniques designed for identifying outliers. Because we lack extensive experience or expertise in handling large datasets, we decided to use statistical techniques to identify outliers. These should provide a more objective and less arbitrary handling of influential observations.

Our approach is comprised of two steps. First we identify extreme observations using the Cook’s Distance and Leverage techniques. We decide how to handle these outliers based on robustness test where we examine the impact of their omission on our models. Afterwards, we identify observations ± 3 standard deviations from the mean. Similar robustness tests are then performed. The intention behind performing outlier detection first is to smooth variation across years. Some years have outliers with substantially higher values than others, which affect the size of the standard deviations and therefore the trimming in step two. Similar trimming by standard deviations is also performed by Bjørkli and Sandberg (2012), Fjellveit and Humlung (2012) and Brynildsrud (2013), except that these studies use 2 standard

deviations. We argue that this would remove too many observations from the datasets, so we increase the limits to 3.

Implementation of Cook's Distance and Leverage trimming

We included two different methods for identifying outliers so we could cross-check extreme observations. Our strategy for dealing with outliers is to minimize the number of deleted cases.

Cook's Distance indicates whether any single observation has a disproportionately large impact on the regression model. The value of Cook's D is a measure of the change in the regression coefficients that would take place if an observation were omitted from the analysis (Field, 2009). There are differing opinions on the threshold of Cook's D: Hamilton (1992) argues that observations with a value above $4/N$ are influential, while Cook and Weisenberg (1982) advises that observations with a value above 1 should be investigated. In accordance with our outlier handling strategy, we choose to follow Cook and Weisenberg and set our limit to 1.

Leverage is also a measure of an observation's potential influence, and flags observations with an unusual combination of values among the independent variables. We feel this technique fits our sampling strategy and complements Cook's D well, since Leverage is useful in identifying unusual but not necessarily extreme observations. Again, there is no definite threshold value: Huber (1981) argues that values above 0.5 should be avoided, while Hamilton (1992) states that Leverage values below 0.2 is advisable. Using a threshold of 0.2 flags a substantial number of observations in our datasets, so in accordance with our outlier strategy we set the limit to 0.5.

In practice, both values were generated by running the complete regression model with variable generation for Cook's Distance and Leverage values for each observation. Trimmed variables were then recoded on the condition that they satisfied the criteria discussed above. This had to be done for each model, as different dependent variables could incur different outliers. Below is an overview of excluded cases and changes in R^2 upon implementation of Cook's Distance and Leverage. For brevity, we only present results from the sales growth and ROA models. The numbers below are from our sales growth model.

Criteria	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Excluded cases												
Cooks D	2	1	0	1	1	2	1	1	2	1	1	0
Lev	5	3	2	2	3	4	5	2	6	3	2	4
Tot excl.	7	4	2	3	4	6	6	3	8	4	3	4
R²												
Before	.038	.103	.039	.027	.092	.017	.021	.027	.055	.020	.041	.037
After	.055	.116	.040	.031	.102	.038	.031	.032	.093	.022	.045	.041
Change	+.017	+.013	+.001	+.004	+.010	+.021	+.010	+.005	+.038	+.002	+.004	+.004

Table 3: Excluded cases and R2 after implementing Cook's D and Leverage trimming, sales growth model.

To also test the effects of our outlier handling for profitability models, we include the same table for the ROA model.

Criteria	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Excluded cases												
Cooks D	3	1	0	0	1	3	1	1	2	1	2	1
Lev	5	4	7	5	3	3	5	2	7	3	3	4
Tot excl.	8	5	7	5	4	6	6	3	9	4	5	5
R²												
Before	.198	.239	.131	.269	.274	.281	.297	.338	.122	.334	.316	.321
After	.212	.245	.144	.273	.281	.303	.318	.341	.137	.336	.326	.329
Change	+.014	+.006	+.013	+.004	+.007	+.022	+.003	+.004	+.015	+.002	+.010	+.003

Table 4: Excluded cases and R2 after implementing Cook's D and Leverage trimming on ROA model.

Implementation of standard deviation trimming

After we removed the most extreme observations we implemented stage two of the trimming process. This involved removing observations above or below 3 standard deviations from the mean. Trimming by standard deviations offers a somewhat crude but easy and consistent method for removing extreme observations (Cody, 2005).

When reporting the effects of implementing standard deviation trimming, we start with skewedness and kurtosis. Skewedness measures the symmetry of the distribution of the different variables, where a value of 0 indicates perfect symmetry around the mean. An unsymmetrical distribution might indicate extreme observations in one of the tails that displaces the mean. Kurtosis measures how sharp or flat the distribution is. A normally distributed variable will have the kurtosis value of 0. Negative values indicate a flat

distribution, indicating a sample with disproportionately many observations in one or both of the tails (Tabachnick & Fidell, 2007).

The following table shows average kurtosis and skewedness values of variables before and after standard deviation trimming. The before values are after Cook's Distance and Leverage trimming. The table also lists effects on the explanatory power of the different models, as well as the average number of cases excluded across years.

Criteria	Sales growt	Asset growth	Debt level	ROA	EBITDA
Kurtosis					
Before	304.1	425.1	290.7	805.2	250.5
After	3.2	2.1	0.6	12.6	3.3
Skewedness					
Before	8.7	10.8	8.4	-13.9	-9.2
After	0.4	0.6	0.8	0.4	-0.3
R²					
Before	0.052	0.059	N/A	0.270	0.395
After	0.068	0.071	N/A	0.332	0.465
Change	+0.016	+0.012	N/A	+0.062	+0.07
Cases excluded					
Average	95.5	140.7	86.2	30.4	83.9

Table 5: Effects of introducing standard deviation trimming on kurtosis, skewedness, R² and cases excluded.

As we can see, both kurtosis and skewedness values are substantially closer to zero after implementing the standard deviation trimming. Kurtosis values in particular are far closer to the normal distribution. Skewedness values also improve, all of which are close to 0, indicating a far more symmetrical distribution after standard deviation trimming is performed.

The effects on explanatory power are also consequently positive across models. Particularly the ROA and EBITDA models benefit from implementing standard deviation trimming. As a whole, it seems appropriate and justifiable to perform the trimming measures we use.

3.2.4 Data issues

Though the data sets have undergone quality assurance by Mjøs & Øksnes (2012), some issues remain concerning the quality of the data. First, even though the data has been standardized across years, no attempt has been made to correct for the effects of changes in accounting law, accounting practices or other reforms that affect the content of accounting posts (Mjøs & Øksnes, 2012). This renders complete consistency of data over years unrealistic. Some care must therefore be taken in interpreting results from the analyses.

Second, some variables frequently contain missing or even faulty data. This particularly applies to posts where reporting is voluntary, such as the number of employees, which some firms refrain to report or update.

3.2.5 Validity and reliability

Validity and reliability are central measures of research quality. It is difficult to obtain definite conclusions on either of these measures, but we have evaluated the characteristics of this thesis as best we could to evaluate its validity and reliability.

Reliability relates to consistency in data collection and analysis. High reliability means that the sampling and analysis techniques used would generate the same results if performed by others or at a different time (Saunders et al., 2009). Common threats to reliability are bias in data collection. Since we use quantitative secondary data, we consider this threat as very low. We also consider the risk of reaching non-replicable findings to be low. The multiple regression analyses and related sub-methods we apply are commonly used and easily repeatable. We also strive for high transparency throughout the thesis, both in sample generation and in the analysis section. We therefore consider the overall threat to reliability to be low.

Validity is concerned with the causal arguments made in research. It is defined as the degree to which variables used in the analysis actually measure their intended constructs, and the degree to which findings actually represent the stated causal relationships (Saunders et al., 2009). It is common to separate the discussion into internal, external and construct validity.

Construct validity basically relates to how well constructs are operationalized. This is a relevant issue for us, since we can only approximate certain constructs in our analysis. For

example, measuring knowledge intensity in industries is difficult. As we see in the next chapter, we control for this using research and development expenditures, which is unlikely to capture the full meaning of the term ‘knowledge intensity’. Similarly, controlling for ownership structure might inadvertently encompass a range of effects beyond the actual ownership effects. Though the construct validity of such proxies could rightly be debated, we argue that the key variables in our models are adequately operationalized. ROA, for example, is a commonly used measure of profitability among practitioners. Similarly, asset and sales growth are frequently used measures of growth. The construct validity for key variables is therefore likely adequate.

Internal validity concerns the robustness of causal claims, in other words whether findings are correct and tenable. Running regressions is basically an exercise in uncovering correlations, not causations. In other words, we cannot necessarily claim a causal relationship between an independent and dependent variable in a regression model. To assert a definite causal relationship, we would have to prove that there were no correlation between the error term and any independent variables (Keller, 2008). In practice, this is very difficult. Furthermore, as we will discuss later, omitted variable bias and reverse causality could contaminate results. Since our thesis is based on financial statement data, we must also bear in mind that management can manipulate this data. Furthermore, this incentive possibly increases during recessions, where “embellishing” financial data might become necessary to attain funding. However, one thing that works in our favor when arguing for causality is the exogenous nature of recessions. As mentioned in section 2.2.3, they can be thought of as unpredictable shocks applied to the entire population of firms. Combined with theoretical and empirical foundations, this provides some basis for making causal claims, indicating adequate internal validity of results.

External validity relates to how generalizable findings are. As we saw in the theory section, recessions vary in nature, and so will likely their effects. Whether findings are generalizable to future downturns can therefore be debated. Furthermore, it can be discussed whether our results can be generalized to other countries or economies. However, as we discussed in 3.2.2, we have gone to some lengths to ensure generalizability to a core group of average, profit maximizing Norwegian firms. By cross-examining the results from two separate recessions, our findings should also be more robust to the heterogeneous nature of recessions. Neither is

it within our scope to generate results that transfer to other countries. We conclude that the external validity given our purposes and is sufficient.

3.3 Variables

In this subchapter we present our various dependent and independent variables. The chapter also provides a discussion of why we chose the measures we used, and how they are computed. We also discuss some factors that could influence performance outcomes but were not included in our models. First, however, we start with a discussion on separating firm level effects from industry effects.

3.3.1 Separating firm level effects from industry effects

A central challenge in our research was separating industry effects from idiosyncratic firm effects. This is important because a substantial share of firm performance can be attributed to the industry of a firm, and not firm characteristics (McGahan & Porter, 2002). For example, the pharmaceutical industry usually have far higher profit margins than, say, the steel production industry. Similarly, emerging industries such as cloud computing services might experience faster growth than a mature industry like furniture production. Refraining from controlling for industry effects could contaminate our results. Furthermore, prior research has indicated that some industries are far more cyclical than others (Petersen & Strongin, 1996). Durable goods industries, for example, are found to be more severely affected by downturns (Knudsen, 2014, Petersen & Strongin, 1996). This makes controlling for industry affiliation even more important during recessions.

Separating industry-level effects from firm-level effects is therefore crucial, and as a consequence, every explanatory variable has been adjusted for industry average. This was performed by using the aggregate function in SPSS instead of simply taking the mean of for example ROA. Our reasoning was that industries with a few extreme observations could heavily skew average industry profitability. We therefore instead sum industry-wide profits and divide by the sum of industry assets. Similar treatment was performed on all industry ratios we calculated.

The entire endeavor of separating industry and firm effects relies on a realistic definition of industries and subsequent allocation of firms into industry groups. Unfortunately, a clear drawback of the datasets is that industry definition is imprecise. One reason for this becomes apparent when comparing the industry definitions used in the NACE codes to the one in industrial organization (IO) literature. The main focus of IO industry definition is substitutability (Besanko, 2008). NACE codes, however, simply uses the products or services provided by the firm as the basis for segmentation. This means that a carpenter in Finnmark is considered a competitor of his colleagues in Oslo, even when this is very rarely the case. Additionally, the crudity of industry groups might also play a part. Industry 74, R&D, might for example encompass both high-tech subsea solution providers and biotechnology developers, which might respond very differently to recessions.

The imperfect industry codes can be seen by a crude analysis of the variation in profitability explained by industry dummies. In McGahan & Porter's (2002) landmark study, they find that 10.3 % of variation in accounting profitability can be explained by industry affiliation. When we perform regression analysis with dummies for two-digit NACE code affiliation, while also controlling for relevant variables, the explained variation in profits that can be attributed to these industry dummies is around 1 % across datasets. Though dissimilarities in methods and data make ours and McGahan & Porter's results difficult to compare directly, we think this is a clear indicator that industry coding is imperfect in the data sets. Using more detailed NACE codes is not an option, since this quickly generates a large quantity of single-firm industries, and does not solve the substitutability problem. In sum, there is very little we can do about this, except acknowledging that industry effects cannot be perfectly accounted for.

3.3.2 Dependent variables

As mentioned above, we split corporate performance measures into growth and profitability. Our dependent variables will therefore vary across models as we investigate these two aspects of performance. Additionally, we use two separate measures for each performance measure. Growth is measured by sales and asset growth. Profitability is measured by return on assets (ROA) and EBITDA margins.

Growth

There are two basic approaches on how to define corporate growth: absolute and proportional measures (Coad & Holzl, 2012). Absolute measures tend to be biased towards large firms,

while proportional measures lend more weight to small firms (Birch, 1987). Since small firms are largely removed from the sample, and due to the difficulty of comparing absolute growth across companies of different sizes, we will be using proportional growth as our measure, where growth of firm i in year t is

$$\frac{Growth_{i,t} - Growth_{i,t-1}}{Growth_{i,t-1}}$$

Birch (1987) developed the hybrid Birch index to diminish firm size bias on the growth indicator. The index is calculated as

$$Birch\ index = (G_{i,t} - G_{i,t-1})\left(\frac{G_{i,t}}{G_{i,t-1}}\right)$$

Another common way of measuring corporate growth is by taking the log-differences of the growth variable V (Coad & Holzl, 2012). Formally we have

$$\log(g_{i,t}) = \log(V_{i,t}) - \log(V_{i,t-1})$$

There is no ideal way of measuring growth. The appropriate measure depends on data and research question (Davidsson and Wiklund, 2000). We feel using simple relative growth rates as the main measure will increase transparency, and so we will use this measure in our analysis.

Furthermore, firms grow in different ways: in output, total assets, market share and sales, to name some. Delmar, Davidsson and Garner (2003) find that correlations are high between different types of growth, but research results might still differ. According to Davidsson & Delmar (1997) growth in assets and sales are two common approaches in financial statement analysis. They argue that these growth measures are well suited to capture the “real” growth of a firm. Sales growth is the most common measure, and is frequently used in studies with a univariate growth measure (Davidsson & Fitzsimmons, 2005). Additionally, we will also use changes in assets as a growth variable, similarly to Berry (1972) and Jacquemin & Berry

(1979) to further increase the robustness of results. Correlation levels between these measures did not allow us to include both as independent variables. Therefore, when using asset growth as the dependent variable, the same measure will be used as the explanatory variable, and vice versa. No effort will be made to distinguish between organic and acquisition-led growth.

Profitability

A multitude of different estimation methods have been developed to measure firm profitability (Horngren et. al, 2008). A commonly used measure is return on assets (ROA), calculated as

$$\frac{\textit{Net income}}{\textit{Total assets}}$$

i.e. simply the ratio of net income to total assets of a firm (Brealey, Myers & Allen, 2008). ROA is a popular measure because it is easily calculated and allows for straightforward comparison between projects and firms (Horngren et. al, 2008), and should therefore suit our purposes well. Bettis (1981) also supports the use of ROA as a profit measure, showing that it is highly correlated with alternative return measures. Other measures of profitability include return on equity (RoE), residual income (RI) and economic value added (EVA) (Horngren et. al, 2008). The latter two are problematic because they require an estimation of each firm's minimum required return on assets, which in our case would be hard to identify. RoE is naturally susceptible to changes in equity, and Damodaran (2012) demonstrates that the composition of debt and equity is correlated with the business cycle. Total assets are arguably more stable over time and we therefore consider ROA a better profitability measure in a business cycle context.

We have also included the EBITDA/total earnings ratio in our analyses, to complement ROA by capturing the operating efficiency of firms. EBITDA stands for earnings before interest, taxes, depreciation and amortization (Bodie, Kane & Marcus, 2011). These earnings are then taken as the ratio of total income. Formally, this can be stated as

$$\frac{\textit{EBITDA}}{\textit{Total revenues}}$$

The EBITDA/Total revenues ratio is a popular measure because it excludes effects stemming from capital structure, tax rates and collections of assets, therefore effectively capturing the operational efficiency of firms (ibid). A useful characteristic of the EBITDA margin in our setting will be the exclusion of interest payments or tax shield effects stemming from capital structure. This could better expose the EBITDA margin to “external” effects during recessions, such as the flight to quality-mentality of investors and creditors.

In profitability models we had to choose between sales and asset growth as our growth measure, since correlation levels will not allow us to include both. We chose sales growth, since this is the most commonly used measure for growth (Coad, 2009, Davidsson & Fitzsimmons, 2005), and is frequently used in studies with a univariate growth measure (Davidsson & Fitzsimmons, 2005).

3.3.3 Independent variables

Across all models independent variables are lagged by one year relative to the dependent variables. In practice, this was done by importing the dependent variables into the preceding year’s data set. This was done to ensure a plausible causal effect of firm characteristics on performance outcomes. A requisite for causal claims on the effect of X on Y is that X precedes Y in time (Kenny, 1979). It also alleviates some of the endogeneity issues we will discuss in section 3.4.5.

Capital structure

We have assumed a relatively simple approach to measuring overall capital structure of the firms in our sample. We take the debt level of the firm relative to total assets, formally calculated as

$$\frac{\textit{Total debt}}{\textit{Total assets}}$$

This measure will be critical when investigating our hypotheses on how capital structure impacts performance outcomes in recessions. This is also the measure chosen by several major studies (Titman & Wessels, 1988; Harris & Raviv, 1991), and so we adopt the same approach. Additionally, we include the quadratic term of our growth measures as independent

variables. As discussed in the theory section, the effect of capital structure is unlikely to be uniform or linear regardless of the level of debt. Including the squared term allow us to investigate non-linear effects of leverage.

Growth_{t-1}

To measure the effect of previous growth, we include year-on-year growth rate from the preceding year. Growth_{t-1} is measured and calculated in the same way as the dependent variable. This variable is included to test the growth hypotheses discussed in the theory section. Though firms can grow in different ways, primarily organically or through mergers and acquisitions (Coad, 2007), we do not investigate growth paths in detail. Similar to the debt level variable, we include a quadratic growth term in our models.

3.3.4 Control variables

As we will see in the next subchapter when we discuss multiple regression analysis, the robustness of our estimated beta values increase as we control for variation in corporate performance not explained by our independent variables. We have therefore aimed to include as many relevant control variables as possible. When evaluating potential control variables, we used the strategy field's approach to explaining variation in corporate performance. This segments the factors influencing performance outcomes into two groups: firm effects and industry effects (Besanko et al., 2006). This should allow a structured, systematic review of relevant control variables.

3.3.4.1 Firm characteristics

Profitability

We use previous profitability as an independent control variable. This allows for controlling for variation in performance attributable to prior profitability. This makes sense if profits are generated as predicted by resource based theory, where inimitability of valuable resources creates sustained competitive advantages. Profits should therefore be autocorrelated over time (an econometrical problematization of this expectation is presented in section 3.4.5). In empirical findings, profitability is shown to be stable over time (Bharadwaj, 2000; Geroski, 1999), even if the duration of competitive advantages might be diminishing (D'Aveni et al, 2010). Controlling for profitability should therefore allow us to filter out a potentially large degree of variation in next year's profitability. It also makes sense to include these measures

in our growth regressions, since profitable operations might be a favorable or even necessary “platform” from which to grow (Davidsson & Fitzsimmons, 2009). Correlation levels between profitability and EBITDA margins were low enough to allow us to include both in our models.

Age

Age is a popular variable in firm performance models. Bankruptcy rates are higher for younger firms (Geroski, 1995), and they have smaller financial reserves and arguably less well-established products and relationships with suppliers and customers (Knudsen, 2014). There are therefore many potential age-effects coming into effect in recessions. They might exacerbate the marginal-customer mechanism predicted by Lien (2010) if they have poorly established customer relations. Additionally, they might be more severely affected by credit constraints if lenders are unwilling to extend credit to young firms. Controlling for age therefore seems appropriate.

Intuitively, age should have a diminishing impact on performance, as the difference between being, say, 41 and 40 years is likely to have a smaller effect than between 2 and 1 years old. We therefore log-transform the age variable in order to linearize the relationship between performance and age. The variable was calculated by subtracting the year of founding from the year of analysis. We added 1 year to ensure correct log-transformations of firms founded in the current year. Formally, we have

$$\ln((\textit{year of analysis} - (\textit{founding year} + 1))$$

Though a certain correlation is expected between age and size, Ohlson (1980) advises that they should be analyzed separately.

Size

Size is another factor that might become important during recessions. On one hand, larger companies might have easier access to credit, and are viewed as safer by banks and capital owners (Bernanke, Gertler & Gilchrist, 1996), increasing their access to external finance and therefore resilience during economic hardship. On the other hand, size might cause inertia, reducing a firm’s ability to make required adjustments during a recession (Knudsen, 2014; Hannan & Freeman, 1984).

In our thesis, size is measured by two different variables, the logarithm of total income and the logarithm of total assets. The log-transformations were performed in order to linearize the expected relationship between size and the dependent variables, similarly to age. Correlation levels indicate that both can be included simultaneously.

Debt maturity

Debt maturity was included to account for effects stemming from the repayment horizon of corporate debt. Firms with a high degree of current debt relative to long-term debt might be worse off during recessions. We saw in the theory section that the climate for renegotiation of debt is likely to worsen during downturns, particularly for firms with poor current performance. Including this variable makes sense if firms with a high degree of short-term debt suffer more during recessions due to an inability to renew loans. Formally, the variable is calculated as

$$\frac{\textit{Total current debt}}{\textit{Total debt}}$$

Liquidity

Accounting liquidity refers to a firm's ability to pay its debts (Brealey, Myers & Allen, 2008), and usually indicates short-term solvency (Hoff, 2010). Controlling for liquidity also seems natural during recessions. Low liquidity are likely to exacerbate many of the credit constraint issues presented by Campello et al. (2010), discussed in the theory section.

A commonly used measure is Liquidity 1 (L1), which captures firms' opportunity to convert relatively liquid assets to cover short term debt (Brealey, Myers & Allen, 2008). Formally, this ratio is computed as

$$\frac{\textit{Current assets}}{\textit{Current liabilities}}$$

Additionally, we use the ratio of cash holdings to total assets as a further measure of liquidity. Formally, the cash holdings ratio is calculated as

$$\frac{\text{Cash}}{\text{Total assets}}$$

Some argue that the cash to assets ratio in some circumstances works better as a liquidity proxy, since certain assets in the L1 ratio are hard to convert into usable funds, at least in the short term (Goyenka, Holden & Trzincka, 2009). To increase robustness we use both ratios. Correlation levels between the variables allow us to do so.

Fixed assets

Firms with a high ratio of fixed assets to total assets are likely to be able to offer more collateral to banks and lenders. They might therefore be considered “safer” by banks and lenders. This is consistent with the “flight to quality” findings from Bernanke, Gertler and Gilchrist (1993). Similarly they might also be less affected by credit constraint effects as found in Campello et al (2010) and Campello and Fluck (2006). Formally, the variable is calculated as

$$\frac{\text{Fixed assets}}{\text{Total assets}}$$

Credit rating

A potentially useful variable in the datasets is the credit rating post. This is Dun & Bradstreet’s internal evaluation of companies’ credit rating (Mjøs & Øksnes, 2009). This variable should allow us to control for “invisible” factors influencing a firm’s credit worthiness. The advantage of this is of course that we can control for certain firm characteristics that are not captured by the other explanatory variables. Even if a firm has low leverage and high liquidity, there could be issues related to operations, market prospects or legal matters that influence a firm’s ability to access external credit. Ideally, these factors would be captured and controlled for through the credit rating variable. In our models, the post has been transformed to dummy variables, where credit ratings AAA and AA are categorized in the *High rating dummy*; ratings A and B equal *Medium rating dummy*; rating C is *Low rating dummy* and the Not rated and Liquidated categories have their respective dummies. Below is a table showing the distribution of the different variables. The reference dummy in our case is *Low rating dummy*.

Value	Category	Code	Distribution	Dummy
0	Not rated	N/A	11.5%	Not rated
1	Credit not recommended	C	2.4%	Low
2	Credit with collateral	B	16.6%	Medium
3	Credit worthy	A	35.6%	Medium
4	Highly creditworthy	AA	22.8%	High
5	Highest credit rating	AAA	8.0%	High
9	Liquidated	N/A	3.2%	Liquidated

Figure 3.7: Credit rating dummies

However, given that every firm in the datasets has received an individual rating, it seems likely that Dun & Bradstreet have run a standardized model using statement data to calculate a credit rating, rather than performing individual evaluations. Therefore, it is unlikely that many “invisible” firm traits can be accounted for through this variable. Still, there could be explanatory value in including the variable in our model, assuming Dun & Bradstreet has a sufficiently high-quality credit rating model.

Ownership structure

This was included to capture potential effects stemming from the type of ownership. Without launching into another theoretical discussion, there could be potential effects stemming from type of ownership of firms during recessions (McGahan & Porter, 2001). For example: intuitively, listed companies might feel the effects of a financial crisis relatively fast. Changed market expectations of future growth and profitability could quickly impact company value, which could again impact real economic choices of managers. This variable was also transformed into dummies, with listed companies as the reference variable.

Value	Category	Distribution
0	Ownership structure unknown	9.9%
1	Listed	0.2%
2	Corporate ownership	27.8%
3	Private ownership	55.2%
4	Combination private/corporate	1.2%
5	Publicly owned (excluded)	1.2%

6	Joint-stock company, not listed	1.3%
7	Cooperation	0.1%
9	Foreign ownership	4.2%

Table 6: Ownership structure dummies

3.3.4.2 Industry characteristics

In addition to adjusting independent variables for industry mean, we also include industry characteristics variables in our regression. This should allow us to further separate industry effects from firm characteristic effects. Since industry variables are ratios, we needed to take special care in our calculations. If we for example simply took the mean of all individual ROA observations, our industry mean would be biased towards observations with particularly high or low ratios. Instead, we used the aggregate function in SPSS. This allowed us to aggregate both numerator and denominator prior to computing the industry ratio.

Industry growth

Industry growth is calculated as

$$\text{Industry growth} = \frac{\sum_{i=1, j=1}^{n, m} \text{Growth variable}_{ij}(t) - \sum_{i=1, j=1}^{n, m} \text{Growth variable}_{ij}(t-1)}{\sum_{i=1, j=1}^{n, m} \text{Growth variable}_{ij}(t-1)}$$

for all firms i in industry j in time periods t and $t-1$. Controlling for industry growth seems appropriate, as affiliation with high growth industries might induce performance effects during recessions. As we saw in the theory section, industries with high pre-recession growth might have a large share of marginal customers. Firms within such industries could be particularly severely affected during downturns, even if there are no firm-specific characteristics driving the negative performance outcomes.

Industry leverage

Industry leverage is calculated as

$$\text{Industry leverage} = \frac{\sum_{i=1, j=1}^{n, m} \text{Total debt}_{ij}}{\sum_{i=1, j=1}^{n, m} \text{Total assets}_{ij}}$$

Similar to growth, debt levels are likely to vary systematically across industries. Aluminum production, for example, is a relatively capital-heavy industry that might require substantial investments in fixed assets, making high leverage viable. Service firms, on the other hand, might not require much debt at all. Being part of highly leveraged industries might exacerbate the debt mechanisms discussed in the theory section. For example, investors and creditors might avoid entire industries or sectors if they anticipate high industry leverage will induce a particularly severe impact. It therefore seems appropriate to control for this factor.

Industry profitability

We use ROA as our measure of industry profitability. Analogous to industry leverage, this variable is calculated as

$$\text{Industry RoA} = \frac{\sum_{i=1, j=1}^{n, m} \text{Net income}_{ij}}{\sum_{i=1, j=1}^{n, m} \text{Total assets}_{ij}}$$

Accounting for industry profitability is necessary as recessions are likely to affect profits differently across industries. For example, construction firms were particularly heavily affected during the 2008-2009 crisis (SSB, 2009). Furthermore, firms in industries that are characterized by high profitability rates might for example be better suited to deal with credit reductions, as implied by pecking-order theory.

Industry debt maturity

This variable is calculated as

$$\text{Industry debt maturity ratio} = \frac{\sum_{i=1, j=1}^{n, m} \text{Current liabilities}_{ij}}{\sum_{i=1, j=1}^{n, m} \text{Total debt}_{ij}}$$

Similarly to individual debt maturity, the industry level variable is included to account for possible effects stemming from shorter repayment horizons during recessions.

Industry Liquidity 1

Industry Liquidity 1 is calculated as

$$\text{Industry Liquidity 1} = \sum_{i=1, j=1}^{n, m} \text{Current assets}_{ij} / \sum_{i=1, j=1}^{n, m} \text{Current liabilities}_{ij}$$

Controlling for industry liquidity can also be expedient. Industries that operate with low liquidity in normal times might be more severely affected during recessions, even if firms in such industries are only following the industry “norm”.

Industry impairment

This variable is calculated as

$$\text{Industry amortization ratio} = \sum_{i=1, j=1}^{n, m} \text{Amortizations}_{ij} / \sum_{i=1, j=1}^{n, m} \text{Total assets}_{ij}$$

Controlling for industry impairment allow us an additional control for how severely an industry was affected by a recession. Intuitively, industries that are particularly afflicted by downturns are more likely to readjust expectations of earnings or the value of fixed assets, forcing impairment. Controlling for this industry effect should therefore allow us to better isolate firm specific effects.

Industry fixed assets ratio

The variable is calculated as

$$\text{Industry fixed assets ratio} = \sum_{i=1, j=1}^{n, m} \text{Fixed assets}_{ij} / \sum_{i=1, j=1}^{n, m} \text{Total assets}_{ij}$$

This variable was included to control for effects of affiliation in industries with high fixed assets rates.

Industry R&D expenses

This variable is the mean of research expenditures by all firms in an industry, calculated as

$$\text{Industry R\&D expenditures} = \sum_{i=1, j=1}^{n, m} \text{R\&D expenditures}_{ij} / N_j$$

This variable was included to capture effects induced by highly knowledge intensity. As discussed below, firm-level R&D expenditure is not included as an individual variable due to poor data quality. However, when these expenses are aggregated at industry level, the data arguably give a more credible portrayal of knowledge intensity.

3.3.5 Variables not included in the model

A number of variables had to be excluded from the analysis due to incompatibility with the model or data quality limitations. The following is a discussion of variables not included in the model for various reasons. As we will see, the explanatory power of our models will vary substantially, with our growth and profitability models generally having low and high R², respectively. It therefore seems appropriate to spend some time discussing control variables we would have wished to include in our model. The discussion follows the same structure as above, where we review firm level variables first, and then move on to industry level variables afterwards.

Firm level variables

In general, financial statement data is poorly suited to identify intangible assets that are potentially important for understanding competitive advantage. For example, there is a large stream of literature on how knowledge creation, transfer, maintenance and development can serve as foundations of competitive advantages (Argote & Ingram, 2000; Matusik & Hill, 1998; Tallmann et al., 2004; Eisenhardt & Martin, 2000). This human or innovation capital is naturally hard to account for with our data. Arguably, however, some of these advantages will be incorporated and controlled for in the variables for previous growth and profitability.

One way of approximating more directly for knowledge generation is through research and development (R&D) expenditures. There are also several theoretical implications regarding R&D and recessions (Knudsen & Lien, 2012), which could be expedient to control for. There exists an R&D variable in the datasets, but this is unfortunately sparsely reported.

Furthermore, there might be incentives and opportunities for firms to report losses to the R&D post. We therefore conclude that including individual R&D expenditure in our model is unfeasible.

We also wanted to include employee growth as a growth measure, since this is a common method (Coad & Holzl, 2009). Due to flawed data, however, this was not feasible. Reporting number of employees is only mandatory the first time a company files statements the the Entity Registry, leading to missing or faulty data for this variable. To illustrate this, the Pearson correlation coefficient between employee growth and salary growth is on average around 0.4 across datasets, which is a weaker linear correlation than we would intuitively expect between these variables.

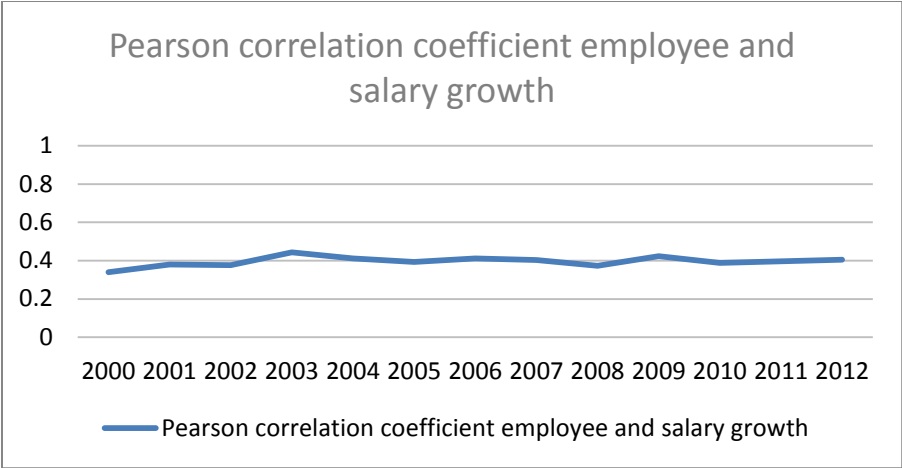


Figure 7: Correlation between salary and employee growth.

We were also unable to find sufficient data to generate variables that could account for access to internal capital markets, which could potentially be important to control for during recessions. Firms with very high leverage and low current performance, for example, would in our model be highly likely to experience severe negative consequences of a recession. However, the negative effects could be mitigated or negated by access to internal financial markets. If the parent company viewed future growth potential of the struggling subsidiary as sufficiently high, they could intervene by lending extra funds. This is a realistic scenario if the parent company has information advantages over external investors, which in some cases is a reasonable assumption.

Furthermore, firm investment is a highly relevant variable, as it is a key determinant of future growth. However, the data sets lack a variable measuring real investment. There exists a variable for short-term investments in various securities, but this is a poor operationalization of the investment construct we are interested in measuring.

Last but not least, as is evident from our earlier discussion of resource-based theory, controlling for idiosyncratic resource stocks would be highly expedient. In an RBT view, these should account for the vast majority of firm performance differences. However, as is also clear from our theoretical discussion, controlling for these resources is very hard to do, particularly with just financial statement data.

Industry variables

There are several industry characteristics we were unable to control for in our analysis. From a strategy perspective entry rates, industry concentration and number of competitors are examples of highly relevant variables (Porter, 1991). These can all shape competitive forces, affecting product market outcomes as discussed in 2.1.3. Measuring market concentrations and number of competitors was unfeasible due to imperfect industry codes.

Another relevant variable is the durability of products of an industry. Knudsen (2014) finds that industries that produce durable goods were particularly severely affected by recessions. There can be several explanations for this, amongst them that customers prefer to delay such purchases when under uncertainty. Naturally, controlling for this would benefit our model, but there is no method we have thought of that allow us to create a proxy for goods durability.

Furthermore, export intensity might affect how severely firms are impacted. The 2008-2009 recession in particular was relatively mild in Norway compared to other OECD countries, as we will see in figure 4.1. Firms that were exposed to the larger international demand shock should therefore be more severely hit than other Norwegian firms. Export intensity is, however, not something we can control for using our data.

Lastly we discuss the use of industry dummy variables. When including industry dummies in the regression, this excludes the use of industry characteristic variables, such as industry ROA and leverage. These variables are incompatible because any industry characteristic effects will be perfectly predicted by the dummy variables. Therefore, we faced a trade-off between fully

accounting for industry effects by using dummies, and using industry characteristics variables to isolate specific industry effects. Since the uses of industry variables allow us a more nuanced view of industry effects, we chose to use this alternative.

3.4 Empirical method

This subchapter discusses the primary statistical tool we used in our analyses, multiple regressions analysis. We present the basics of regression analysis, before discussing non-linearities and interaction terms. Lastly, we present our empirical specifications, and discuss the prerequisites for performing regressions.

3.4.1 Regression analysis

The simple linear regression model can be used to explain how independent variable X affects the dependent variable Y . The equation for the simple ordinary least squares (OLS) model is written as

$$Y = \beta_0 + \beta_1x + \varepsilon$$

Where β_0 is the constant, β_1 is the coefficient of X and ε is the error term, which denotes the effect of any unobserved variables on Y (Wooldridge, 2010). Mathematically, the OLS model fits a straight line through all observations in the sample to minimize the sum of squared residuals. Residuals are defined as the differences between actual sample observations and the fitted OLS line (Keller, 2009). If certain prerequisites are met, OLS can be shown to provide unbiased estimates of β_0 and β_1 , while minimizing the variance in Y . For unbiased estimation of the relationship between X and Y , the error term must be uncorrelated with the independent variable X . The error term would in theory need to have an expected value of zero, regardless of values of X . Breach of this assumption can occur for various reasons, but they all lead to biased estimations of the OLS line (Wooldridge, 2010). Formally, this assumption can be written as

$$E(\varepsilon|x) = 0$$

Multiple linear regression differs from the bivariate model in that it can accommodate any

number of independent variables. Where the bivariate model would only include a single independent variable and leave potential others unobserved, the multiple linear regression model can include an indefinite number of variables. The multiple regression equation

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k + \varepsilon$$

is generalized to accept any number of independent variables. The interpretation of the beta coefficient for any independent variable will be its effect on the dependent variable when we hold all other independent variables constant (Wooldridge, 2010). The major advantage of multiple over bivariate regression analysis is that we can account for relationships between an indefinite number of independent variables and Y. Naturally this is often of interest, as several factors are likely to influence the dependent variable.

The ability to include several explanatory variables can also prevent omitted variable bias (OVB), where unobserved factors in ε are correlated to one or more independent variables. In our case, multiple regression models make sense because many different factors will influence both growth and profitability. OVB will be discussed in greater detail in subchapter 3.5.1.2. At the same time, it is reasonable to assume that some independent variables will be correlated. For example, there might be correlations between Liquidity 1 and the cash to assets ratio. Not accounting for these correlations by including the variables in our model could therefore lead to biased estimations.

Furthermore, multiple independent variables also allow us to test for non-linear relationships between the dependent and independent variables. This is also useful to us, since some of the variables in our models could potentially exhibit non-linear relationships with the dependent variable. For example, log-transforming age and firm size is common in the existing literature on both growth and profitability (Knudsen, 2014; Huynh & Petrunia, 2010; Evans, 1997). Another non-linearity that will be relevant for us is using squared variables. We return to this in the subchapter below. Overall, using multiple regression models seems like a highly appropriate tool given our purpose and data.

Multiple analysis regression can be applied in different ways. In our study, we shift our model across each dataset, in practice running the regression model for each year in our time period. This allows us to test how the relationships discussed in the theory section change over

recessions. To measure the degree of variation explained by our models, we will use adjusted R^2 , as this measure of explanatory power corrects for the number of predictors included (Wooldridge, 2010).

3.4.1.3 Interaction terms

Sometimes the effect of an independent variable on Y might depend on the magnitude of another independent variable. For example, we have argued extensively that the combination of high leverage and high growth induces particularly high vulnerability for firms during recessions. Put differently, the effect of leverage would depend on the degree of growth: the higher pre-recession growth levels are, the larger the marginal negative effect of leverage. In statistical terms, this would mean that there is an interaction effect between debt levels and growth.

Introducing interacted terms in the regression changes the interpretation of coefficients. Assuming we interact X on Y, the coefficient of the main effects (the original individual variables) now provides the effect of X on Y when Z is 0.

3.4.1.4 Quadratic terms

As mentioned above, multiple regression analysis allows testing for non-linear relationships. We utilize this opportunity by log-transforming certain variables, but more importantly we include squared independent variables in our models. This allows us to test for non-linear relationships between growth, capital structure and performance outcomes.

Including quadratic terms in our models changes the interpretation of the main coefficients. Say we include the quadratic term X^2 of the variable X. In this case, the beta coefficient of X is no longer the unique effect on y, since interpreting the effect of X on y while holding X^2 constant does not make sense. β_x is now the instantaneous slope of X when $X=0$ (Wooldridge, 2009). This could make interpretation of β_x problematic in our models, since certain independent variables are unlikely to contain observations of 0. However, all our independent variables have been adjusted for industry mean. This means that the 0 value of any independent variable equals industry average, making interpretation easier. This has the additional advantage of letting us explore developments of firms with average values of the main variables debt levels and growth. The beta coefficient of X^2 measures the change in the

instantaneous slope of β_x . This provides us with insights in how the effects on industry-average firms change as we move away from the mean.

If the beta of X^2 is negative while the coefficient of X is positive, or vice versa, the relationship has a parabolic shape. This means that there will always be some positive value of x where the combined linear and quadratic effects on y are 0. Before this point, denoted X^* , the effect of x on y is positive; after, the effect is negative. In practice this means that inclusion of a quadratic term always includes a “turning point”, at least as long as the signs on the linear and quadratic terms are opposite. What happens if the coefficients of the linear and quadratic terms have the same sign? In that case, there is no turning point. If for example both terms have negative signs, the largest expected y value (given non-negative values of x) will occur when $x = 0$, with increasing negative effects of x on y .

3.4.1.5 Visual binning / percentile analysis

A last submethod of regression analysis we would like to expand upon is segmenting our sample through visual binning. This is a tool in SPSS that allows us to split the dataset into equal percentiles. We use this to segment our sample based on prior growth levels and leverage. The subsequent regression analysis will then provide individual results from each predefined percentile. This should allow us to investigate whether effects of growth and capital structure changes based on the level of these variables. For example, the highest 10 % leveraged firms might behave differently than the 10 % lowest leveraged firms.

3.4.1.5 Model specifications

It is about time to introduce our full specification. The following is an overview of the different regression models we used in our analyses. A brief recap: we had two performance constructs, profitability and growth. Profitability was measured by EBITDA margins and ROA; growth by asset and sales growth.

Since control variables are identical across models, and to conserve space, we grouped these into the bracketed variables.

Our sales growth model specification:

$$\begin{aligned} \text{Sales growth}_{t+1} = & \beta_0 + \beta_1 \text{Sales growth} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} * \\ & \text{Sales growth} + \beta_4 \text{Sales growth}^2 + \beta_5 \text{Debt level}^2 + [\text{Firm level control variables}] + \\ & [\text{Industry level variables}] + \varepsilon \end{aligned}$$

The asset growth specification:

$$\begin{aligned} \text{Asset growth}_{t+1} = & \beta_0 + \beta_1 \text{Asset growth} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} * \\ & \text{Asset growth} + \beta_4 \text{Asset growth}^2 + \beta_5 \text{Debt level}^2 + [\text{Firm level control variables}] + \\ & [\text{Industry level variables}] + \varepsilon \end{aligned}$$

The ROA specification:

$$\begin{aligned} \text{RoA}_{t+1} = & \beta_0 + \beta_1 \text{Sales growth} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} * \text{Sales growth} + \\ & \beta_4 \text{Sales growth}^2 + \beta_5 \text{Debt level}^2 + [\text{Firm level control variables}] + \\ & [\text{Industry level variables}] + \varepsilon \end{aligned}$$

The EBITDA model specification:

$$\begin{aligned} \text{EBITA}_{t+1} = & \beta_0 + \beta_1 \text{Sales growth} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} * \text{Sales growth} + \\ & \beta_4 \text{Sales growth}^2 + \beta_5 \text{Debt level}^2 + [\text{Firm level control variables}] + \\ & [\text{Industry level variables}] + \varepsilon \end{aligned}$$

3.4.1.6 Prerequisites for regression analysis

As mentioned briefly above, there are prerequisites for generating unbiased estimates with OLS models. Failure to meet these criteria can lead to biased estimations which prevents causal inferences. The following is a brief examination of these requirements and their implications for our study.

The first criterion states that the expected value of the error term should be 0. Formally,

$$E(\varepsilon) = 0$$

This is almost a trivial assumption for models with a constant, as the intercept value can be adjusted to fulfill this criterion.

The second criterion states that the variance in the error term is constant for all values of the independent variable. Formally,

$$\text{Var}(\varepsilon/x) = \sigma^2$$

Where σ^2 the constant variance in u . Breach of this assumption is called heteroskedasticity. Heteroskedasticity can also reduce the efficiency of our models through underestimating true variance (Johnston, 1997). In practice, this has greater implications for models with smaller samples. Since true variation cannot be estimated, hypothesis testing on variables in the model is also invalid. On the other hand, OLS regressions will still generate unbiased estimates even with the presence of heteroskedasticity (Johnston, 1997). This can be seen because the $E(\varepsilon|x) = 0$ assumption is not violated by increasing or decreasing variance in the error term.

The third criterion states that the error term of two different time periods should not be correlated with each other (Wooldridge, 2010). Formally, this can be written as

$$\text{Corr}(\varepsilon_t, \varepsilon_s/x) = 0 \text{ for all } t \neq s$$

Where t and s denote different time periods. Violation of this assumption is called autocorrelation and naturally only arises in data with multiple observations of the same cases over time. An example of autocorrelation arises from the predictions by the RBT theory made in subchapter 2.1.1.2. If a firm experiences high profit rates one year, this should occur due to superior resources or capabilities. If these are sustained, profits should therefore be high also the next year. Since we know firm profitability is relatively (though decreasingly) stable on a year-on-year basis (D'Aveni, Dagnino & Smith, 2010), even if growth is not (Geroski, 2001), autocorrelation is likely to be present for key variables in our models. Variance in beta estimations is underestimated, and, similarly to heteroskedasticity, hypothesis tests on variables are invalid. However, also similar to the discussion above, the presence of autocorrelation still allows for unbiased estimation of beta values.

The fourth and last criterion, also mentioned above, is the non-endogeneity assumption of independent error terms regardless of the values of the explanatory variables. Breaches of this assumption are more serious since they create biased estimations, meaning that our beta coefficients are no longer accurate representations of the linear relationship between dependent and independent variables (Wooldridge, 2010). We discuss two key causes of endogeneity.

The first source of endogeneity is omitted variable bias (OVB), briefly mentioned above. OVB is a breach of the $[E(\varepsilon|x) = 0]$ assumption if covariance between values of ε and one or more independent variables exist. The error term can still contain factors influencing Y as long as no correlation with any independent variable exists. We have attempted to include as many relevant variables as possible in our model in order to mitigate OVB. This battery of control variables should go some way towards avoiding omitted variable bias. However, as can be seen from both the discussion on variables not included and the low R^2 in growth models, there are omitted variables in our models. Whether these cause bias depends on the correlation with any independent variables. An exhaustive discussion of potential correlations between omitted and included variables seems unfruitful, but it is reasonable to assume that some OVB exist in our models. There is little to be done about this, except to take care when making interpretations. We simply cannot control for everything.

The second source of endogeneity is reverse causality. Reverse causality or simultaneity bias occurs when any independent variable is potentially affected by the dependent variable (Wooldridge, 2010). As an example, we have shown theoretical mechanisms that argue for an effect of capital structure on profitability. But we have also shown that profitability can affect the capital structure of firms. More specifically, if a firm is highly profitable, they might be able to finance investments with retained earnings, meaning they can operate with low debt levels. However, prior leverage, particularly during recessions, might impact a firm's ability to generate profits after compensating for bankruptcy risk to creditors and customers. In our models, we switch variables from exploratory to explanatory positions, and vice versa. If we are to make causal arguments in every model, we must also concede to reverse causality problems. However, this reverse causality problem can be mitigated through lagging variables (Self & Grabowski, 2003). The problem in any business situation, however, is that firms are likely to base current actions on forecasts. Current capital structure has the potential to influence future profits, but expectations on future profits can also influence capital structure

decisions made today. Therefore, certain causal inferences become problematic because we cannot identify the causal direction. Arguably, however, the combination of lagged explanatory variables and multiple theoretical foundations for causal directions mitigates the reverse causality problem in our case.

A last area of concern we address is multicollinearity. This arises when the independent variables are no longer independent of each other, which can lead to imprecise estimates of coefficient values (Tabachnick & Fidell, 2007). There are various methods for testing the presence of multicollinearity. Probably the most robust methods would be to run VIF- tests on individual predictors (Wooldridge, 2010). However, given the number of variables across different specifications, we found it more practical to use correlation matrixes. This is a somewhat crude approach, but the advantage is that correlations only have to be investigated once per dataset/year, instead of after each regression. Different thresholds for allowed correlation exists. Field (2009) operates with ± 0.9 , but Tabachnick and Fidell (2007) argues for a limit of 0.7. To minimize the presence of multicollinearity, we follow Pallan (2007), who use a threshold of 0.5. Given this limit, we found that multicollinearity was not a large problem in our datasets. We found that high and medium credit rating dummies were frequently highly correlated, but we did not have to remove them. Sales and asset growth frequently exceeded the limit and were consequently not simultaneously included, as mentioned above. We had to remove industry EBITDA in 2008 due to high correlation with industry impairment. For a full correlation matrix for that year, see appendix A.4.

What are the practical implications from the discussion on OLS requirements? We argue that the worst problems arise from endogeneity issues. If we cannot trust our beta coefficients, this thesis has little value. However, as we have seen above, both reverse causality and OVB problems are mitigated through our research design. In the case of autocorrelation and heteroskedasticity, we could have spent time on econometric techniques that account for these issues. However, the purpose of this study is to perform a broad, exploratory investigation of growth and capital structure mechanisms during recessions. Whether our p-values are spot on is not our primary concern. We rather invest our time in mapping how the relationships develop.

4 Analysis

In this chapter we examine the results of our analysis. We will start with examining the overall economic conditions in Norway from 2000 to 2012, to get a better impression of how the dot-com crisis and the 2008-2009 recession affected the Norwegian economy. We also attempt to identify the specific years that were more severely impacted. We then provide descriptive statistics for key variables before presenting the findings from our regression models. Before presenting our main findings, we provide an overview of our models and their explanatory power. The presentation of findings follows the same structure as the theory section: first we analyse the effects of growth on corporate performance, before investigating the impact of capital structure. Lastly we present our findings from the interaction effect.

4.1 Norway during the recessions

In order to investigate the effects of firm characteristics during recessions, we have to identify when the Norwegian economy experienced downturns.

Below is a graph indicating real GDP growth for Norway, the U.S. and the EU. We can see clear dips in GDP growth around 2001-2003 and 2008-2009, the latter being more prominent. Particularly 2009 seems to be a severely affected year. The dot-com crisis appears to have impacted the U.S. first, with the deepest through in Norway occurring in 2003. In earlier chapters, we have stated that the 2008-2009 recession hit Norway relatively less severely than many other countries. Data from the World Bank show that the Norwegian economy was indeed less severely afflicted than the EU and the U.S.

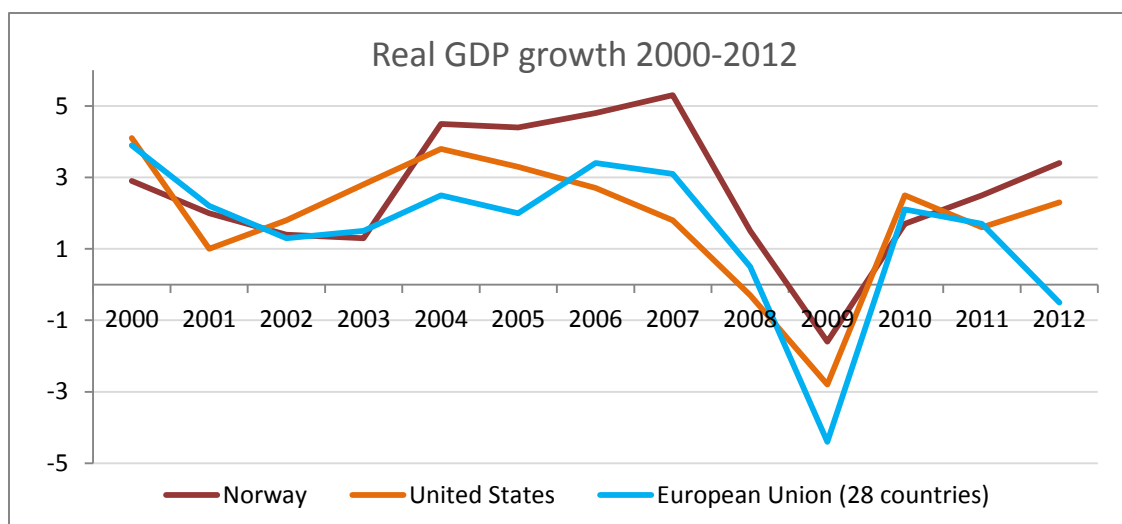


Figure 8: Real GDP growth for Norway, the European Union and the U.S. 2000-2012. Source: Statistics Norway (2015); OECD (2015)

As we saw in the theory section, a recession is “... a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP...” (NBER, 2010). Based on the findings in figure 4.1, both the dot-com bubble and the 2008-2009 recession fits this definition well. We see clear reductions in real GDP growth lasting over time.

In order to further investigate the downturns, we combine GDP growth data with findings from Brynhildsrud (2013), who estimated a polynomial trend line for Norwegian GDP between 1999 and 2012. This trend line can be thought of as the potential GDP in Gartner’s (2009) definition of business cycles. When comparing this trend line to annual GDP levels, we can more clearly see the business cycles during the 2000s. We segmented the graph into the four business cycle phases identified by Benedictow and Johansen (2005). As we can see, the real GDP level clearly fluctuates around the GDP trend line. In 2000, real GDP lies above the trend line, but is falling relative to the long-term trend. GDP drops below the trend in 2001, indicating that this year can be classified as a slowdown phase. The negative distance between GDP level and trend line is largest in 2003, so we classify this year as the downturn. Between 2004 and 2005, GDP keeps rising back towards the trend line, making this the retrieval period. 2006 and 2007 sees GDP levels rise above the trend line, indicating an expansion or boom phase. Another slowdown occurs in 2008, where GDP falls back toward the trend line. A new trough then takes place in 2009, indicating a new downturn phase. A new retrieval occurs in 2010 and 2011, with 2012 seemingly starting a new expansion phase.

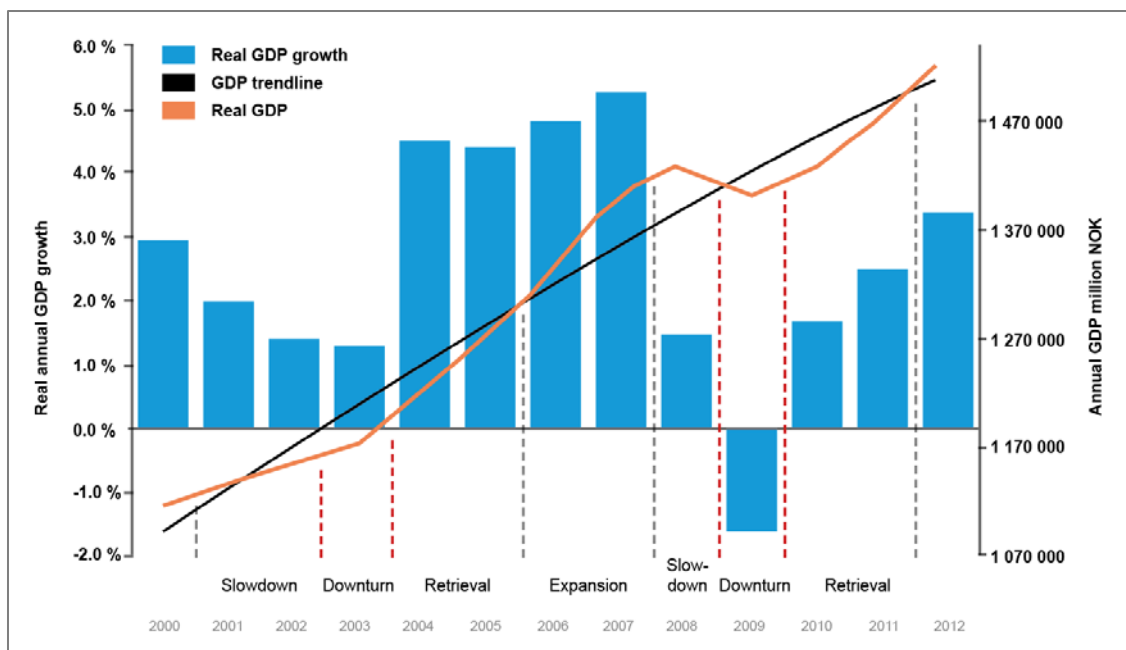


Figure 9: Business cycle phases in Norway, 2000 – 2012. Source: Statistics Norway, 2015; Brynhildsrud, 2013

This brief comparison of GDP levels and trend line reveals that there were clear downturns in the Norwegian economy during the 2000s. It has also revealed 2002-2003 and 2009 as the years where the Norwegian economy was most severely affected.

4.2 Descriptive statistics

Before presenting our regression findings, we provide some descriptive statistics on our main variables. We use mean and median values to illustrate overall developments in growth, profitability and debt levels in our time period. Since mean values can be susceptible to extreme observations, we remove observations that lie more than four standard deviations from the mean, in addition to including the median. We also present developments in standard deviations, which measures the variation or dispersion in the variables we present. We felt that adjusting for industry-affiliation was less appropriate in the descriptive statistics, as we wanted to convey the aggregate developments in the Norwegian economy. The numbers used below have therefore not been subject to industry adjustments.

4.2.1 Corporate growth

Sales growth mean and median generally follows the previously discussed business cycle patterns. There is a noticeable through during the dot-com crisis. Growth rates picks up again during the retrieval and boom periods, with the peak of the boom in sales growth occurring in 2007. Sales growth rates display a sharp decline during 2008 which continue into 2009, with a mean growth reduction of 102.5% (0.1781 to -0.0045) over these two years. The retrieval can be seen in 2010-2011, as growth started to pick up again. As we can also see, median values are consistently somewhat lower than mean values.

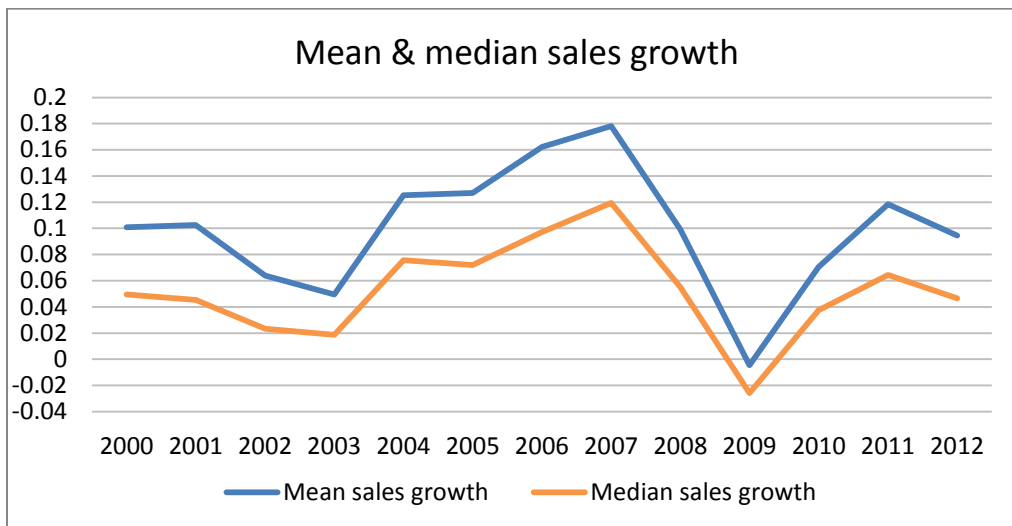


Figure 10: Mean and median sales growth

Asset growth largely follows the same pattern as sales growth. There is a clear through in 2002-2003, while the peak in asset growth comes one year earlier, in 2006. The start of the new recession is evident in 2008 as we see asset growth rates falling 86% (0.1809 to 0.0254) from its 2007 level to the through in 2009. Similarly to sales growth, there appears to be a slight dip in growth in 2012. Another similarity in the two graphs is the disparity between mean and median. However, this is also as expected based on Gibrat's law, which predicted a lognormal growth distribution of firms. Thus, a long tail of high growers draw the mean upwards, potentially causing the difference between mean and median.

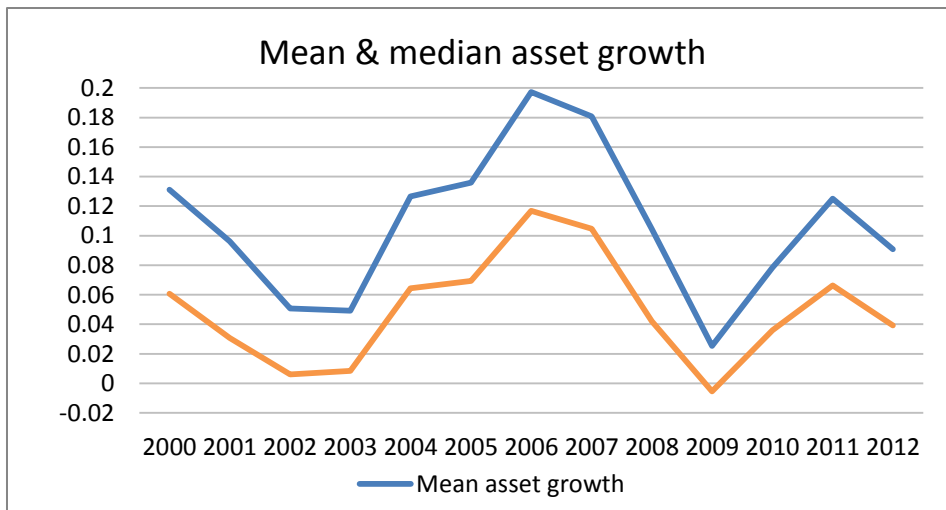


Figure 11: Mean and median asset growth

Intuitively, we would expect standard deviations of growth rates to spike during recessions, as some industries and firms might grow counter-cyclically, while others are highly vulnerable. To the contrary, however, the general pattern seems to be reduced standard deviations in recessions. This pattern is clearest in asset growth, with sharp “negative spikes” in 2003 and 2009, the most severely affected years. Additionally, the peaks in standard deviation for asset growth are in 2000 and 2007, two boom years. While the spread in sales growth seems to get smaller during the period as a whole, there also seems to be dips in standard deviation during downturns and higher values during boom years. Combined with the sharp reductions in average growth above, this might indicate that there is a uniform growth reduction across firms in recessions. In other words, there are few counter-cyclical growth “winners” during downturns.

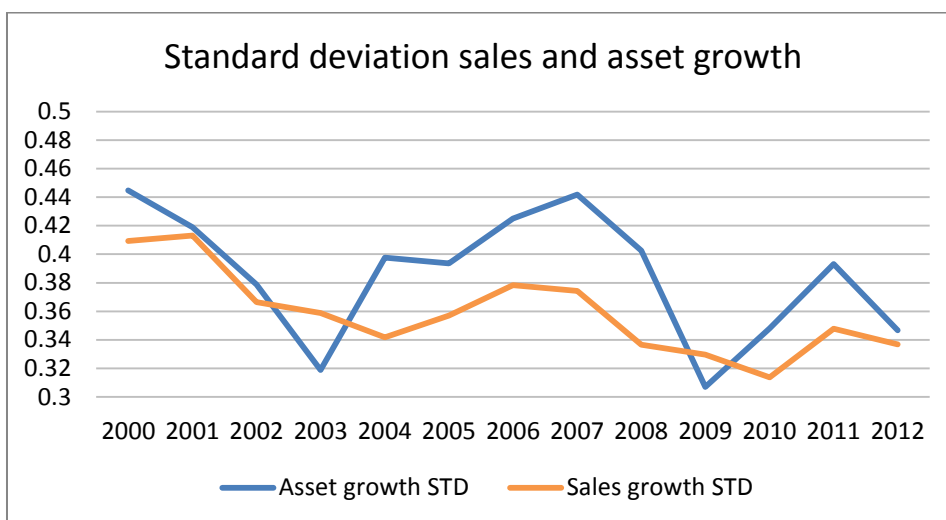


Figure 12: Standard deviations sales and asset growth

4.1.2 Corporate profitability

We now turn to how our other performance measure, profitability, developed during the recessions. Return on assets (ROA) displays low levels during the dot-com crisis. In contrast to GDP and growth developments, the increase in ROA seems well underway in 2003, but the low ROA in the 2001-2003 period can still be linked to the dot-com crisis. Through the boom period ROA increases steadily year over year, reaching a peak in 2007. After the onset of the financial crisis in 2008, we see a considerable decline in ROA. It is worth noting that the average ROA levels in 2010 were still higher than any year in the pre-boom period of our dataset, which runs contrary to GDP growth developments. Mean and median levels follow each other closely throughout the period, with median values seemingly slightly higher (lower) than the mean in recessions (booms).

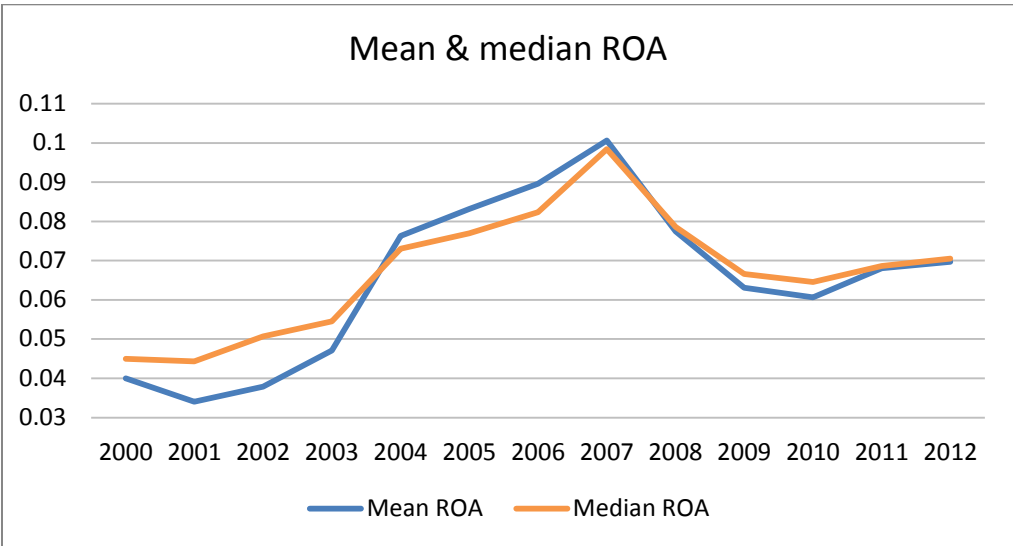


Figure 13: Mean and median ROA

EBITDA levels are low throughout the dot-com crisis. During the boom period margins increases considerably. At the onset of the crisis in 2008, we see a drastic drop in the margins. During the first year of the crisis, margins had dropped by more than 13% (0.0871 to 0.0756), and by 2009 margins had dropped by almost 26% (0.0871 to 0.0646) compared to pre-crisis levels. The retrieval for EBITDA margins comes in 2010, as the margins experienced a mediocre rebound. The retrieval brings margins above their pre-boom levels, although they are still noticeably lower than in the 2004-2007 period.

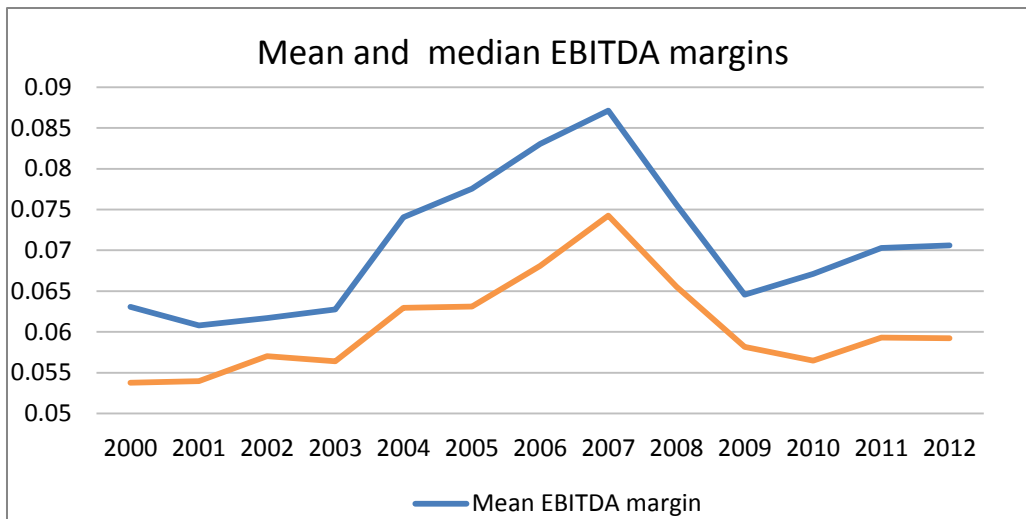


Figure 14: Mean and median EBITDA margins

The standard deviations for EBITDA margins show a pattern that is consistent with the expectation of divergent performance in recessions we discussed above. We see a clear spike during the dot-com bubble, and a declining spread in margins after the recession. The standard deviation is relatively stable at low levels during the boom period, until a new spike occurs during the 2008-2009 recession. This indicates that the differences in margins increased during downturns. In other words, it seems some firms did poorly while others profited from the recessions. Another way to view this is that the difference between “good” and “poor” firms increased during recessions. This is consistent with findings from Knudsen & Lien (2012).

The graph for ROA does not show as clear a pattern, but there seems to be less spread in ROA during the boom period of 2004-2007, and an increase after the onset of both crises. Similar to the EBITDA pattern, we generally see more diversity in performance during downturns.

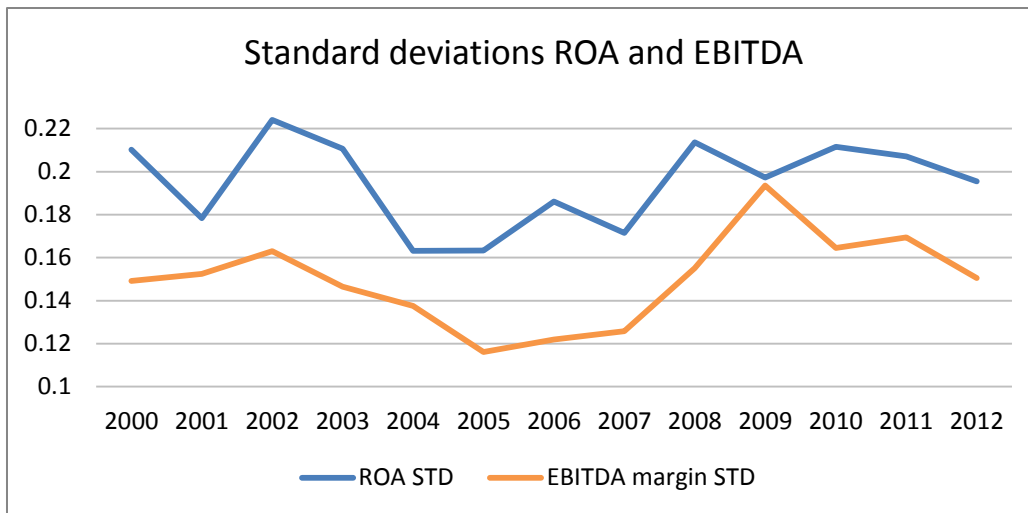


Figure 15: Standard deviations ROA and EBITDA

4.1.3 Capital structure

Given the discussion on capital constraints in the theory section, we would expect firms to attempt to reduce debt levels during recessions. The financial crisis of 2008 was also characterized by a credit squeeze created by the slowdown in interbank lending. Therefore, we intuitively expect the financial crisis to induce lending constraints on Norwegian firms. This should cause overall debt levels to drop during the 2009 recession.

As we can see from the next graph, debt levels increased steadily in the time after the dot-com crisis, with a sharp peak in both mean and median in 2004. Since then, the mean debt level declines steadily. In the years following the onset of the financial crisis, the debt levels stabilize at the lowest observed values in our observed time period, substantially lower than previous years. What is somewhat surprising is the apparent lack of recessionary impact on debt levels. There is little trace of the patterns we saw previously. If anything, debt levels are increasing during the dot-com crisis, and developments in and after 2009, where the reduction in leverage stops and flats out, also run counter to our expectations.

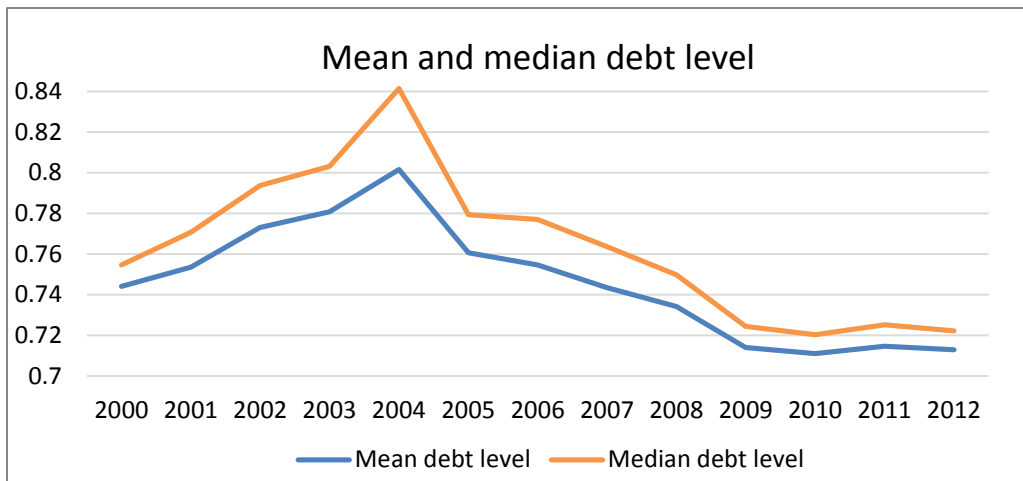


Figure 16: Mean and median debt levels

The standard deviation for debt level have relatively large spikes in 2003 and 2008, which suggests that the dispersion in leverage increased in these two years. We can also see that the difference in debt levels among firms decreased steadily through the boom period, but has increased every year since the start of the crisis in 2008. The largest increase in standard deviation occurs in 2008, potentially reflecting the shock effect on the financial structure of Norwegian firms.

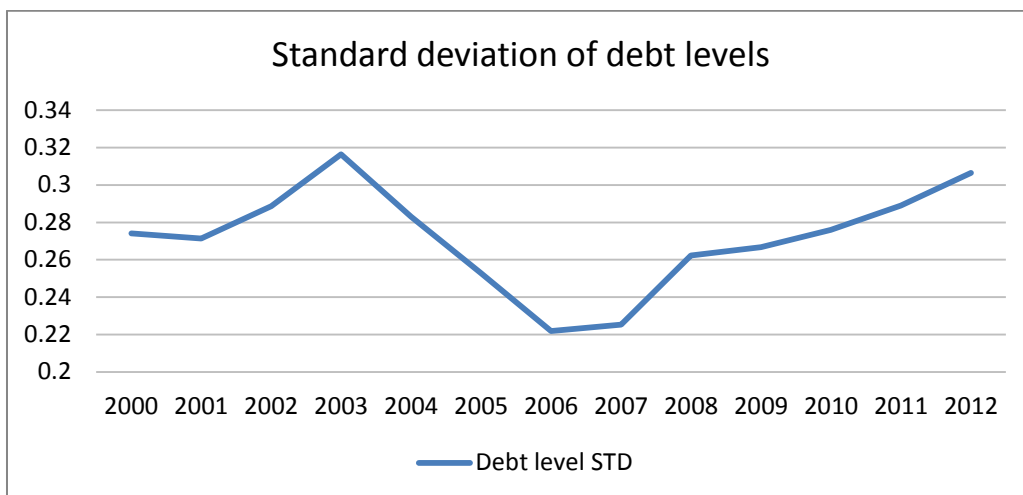


Figure 17: Standard deviations of debt levels

4.2 Model overview

Before we start presenting our main findings, we briefly discuss the explanatory power of the different models we have used. We also provide a discussion of the economic significance of

the main variables. In the following discussion we use numbers from our full specifications as presented in subchapter 3.4.1.5, meaning that we include both quadratic terms and the interaction variable.

We start with the growth models. As we can see from the figure below, the explanatory power of our sales growth model varies somewhat noticeably across years. The year which displays the lowest adjusted R^2 value is 2010, with 3 %. The highest value is found in 2009, where 15.7 % of variation in sales growth can be explained through our model. Furthermore, we can observe three clear spikes, in 2002, 2005 and 2009. The average explained variation in sales growth across all years is 6.79 %.

The explanatory power of the asset growth model largely follows the same pattern and level as the sales growth model, though without the spike in 2005. Again 2009 has the highest adjusted R^2 value, reaching 13.8 %. The lowest value, 4.4 %, is observed in 2011. The average value in the asset growth model is 7.08 %.

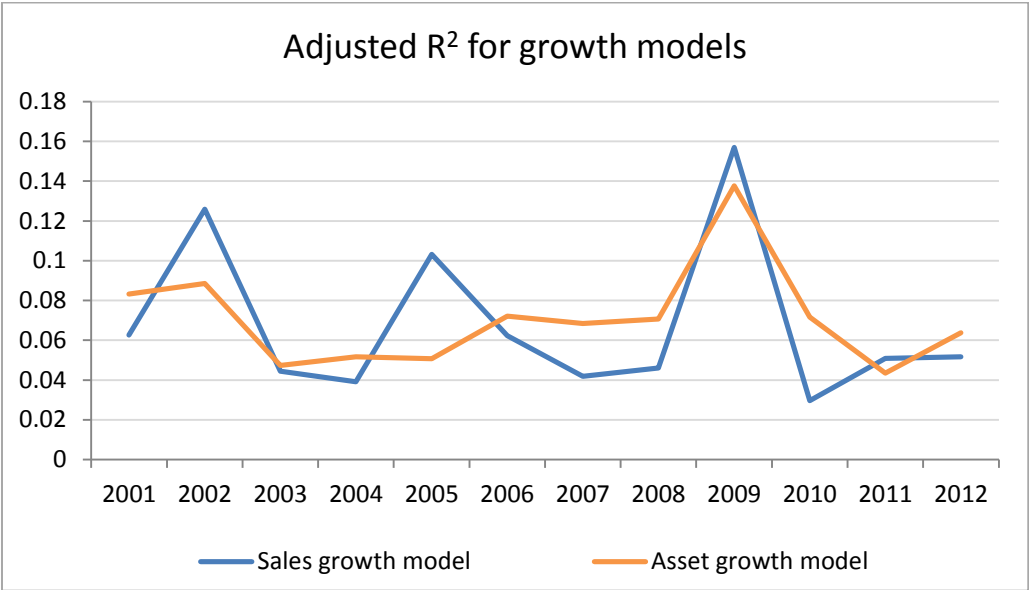


Figure 18: Adjusted R^2 for growth models

Moving on to the profitability models, we can see that these specifications generally account for a larger share of the variation in the dependent variable than their growth counterparts. Particularly the EBITDA model displays high adjusted R^2 values, the lowest value being 40.1 % in 2002, the highest 51.6 % in 2012. In contrast to the growth models, there now seems to

be dips in explanatory power in 2002 and 2009. The average value across all years is 46.5%, indicating that almost half of the variation in EBITDA margins is explained by our model.

The R^2 values for the ROA model are somewhat lower than its EBITDA counterpart. There is a more noticeable dip in 2003, with a value of 18.3 %. The highest adjusted R^2 value occurs in 2011, with 41.7 % of variation in ROA explained. There also seems to be a general positive trend in the explanatory power of the ROA model. The average value is 33.2 %.

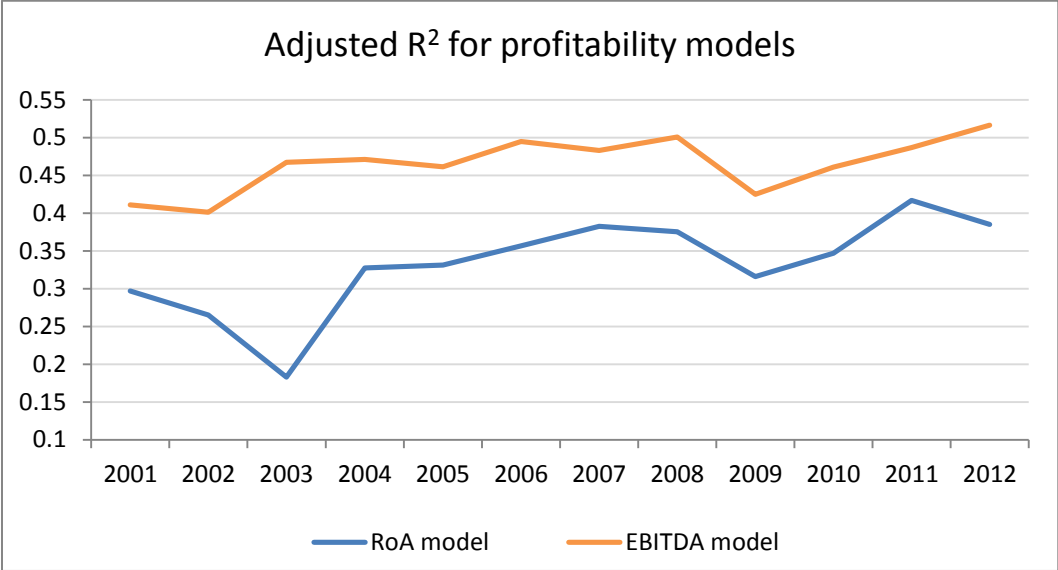


Figure 19: Adjusted R² for profitabiliy models

A key question we also address in this subchapter is what economic or practical significance the main variables contribute to the model. This is worth some attention given the large sample we are left with even after implementing our cutoffs and outlier trimming. Keller (2009, p.376) states that with large samples, the t-test of explanatory variable significance has so much statistical power that even “minuscule” impacts on the dependent variable is registered as significant. We investigate whether statistically significant variables can also be said to be *economically* significant by examining their contribution to overall explanatory power of the model.

The table below displays the average increase in R^2 for each model when including debt level and growth, their quadratic terms and the interaction effect – our main variables.

	Sales growth	Asset growth	ROA	EBITDA
Adj. R² Control variables	.0506	.0583	.2814	.4287
Δ R² incl. debt level	.0009	.0085	.0228	.0104
Δ R² incl. growth	.0017	.0016	.0129	.0152
Δ R² incl. interaction term	.0004	.0002	.0003	-.0002
Δ R² incl. growth²	.0014	.0091	.0101	.0134
Δ R² incl. debt level²	.0009	.0001	.0098	.0129

Table 7: Average increases in adjusted R²

As we can see from the table above, including our main variables in the profitability models generally adds between 1 - 2 percentage point increase in explanatory power. The exception is the interaction term, which adds very little economic significance and even detracts explanatory power in the EBITDA model. This occurs because adjusted R² “punishes” inclusion of economically insignificant terms by adjusting explanatory power based on the number of independent variables (Keller, 2009). The highest economic significance is provided by the linear debt term in the ROA model, where explanatory power is increased by 2.28 percentage points. There is no definite limit on the R²-increase a variable must contribute to be considered practically significant. That being said, the variables that only add around 1 percentage point increase in explanatory power are arguably in the lower range of what we can consider practically significant. It is especially clear that the interaction term has a limited practical impact on profitability throughout our datasets. These findings indicate that we must be careful when interpreting the results of regression results, even when the coefficient is statistically significant.

As we can see in the growth models, the addition of our main variables generally contribute lower explanatory power compared to the profitability models. Arguably, however, investigating these variables could still be of interest. In line with some predictions from the theory chapter, growth seems very hard to explain in our models, which can be seen from the low R². The relative increase in explanatory power when including our main variables, therefore, is arguably substantial. Including the debt level variable in the asset growth model, for example, increases the explanatory power of the model by an average 8.5 percentage points. Thus, our main variables can still explain a consequential share of total variation. There are, however, again some exceptions. The interaction term once more appears to have

very little impact on total adjusted R^2 also in the growth models. Furthermore, the quadratic growth term in the asset growth model also displays virtually no economic significance. This will be discussed in-depth in the discussion chapter.

What becomes of interest in the analysis and discussion chapters is the R^2 added by our main variables in individual years. The appendix therefore has complete tables that display the increase in explanatory power with the inclusion of individual variables for each year. They can be seen in appendix A.2., and we will refer to these tables frequently in the discussion chapter.

4.2 Analysis and hypothesis testing

To briefly recap, our two measures of performance, growth and profitability, are both subdivided into two different measures. Our profitability measures are ROA and EBITDA. Growth is measured through sales growth and asset growth. These four measures will function as our dependent variables in the different regression models.

When interpreting coefficient values we must bear in mind that all variables have been adjusted for industry mean. Therefore, the beta coefficients show the effect on the dependent variable with a one unit increase in the independent variable relative to industry mean. Furthermore, as mentioned in the method section, the presence of a quadratic term means that the coefficient of the linear term provides the instantaneous effect when the linear variable equals 0. This means that the linear debt level term only provides the marginal effect of, for example, leverage on performance for firms with industry average debt levels.

When presenting our results we were faced with a dilemma. We had 6 different specifications across 12 years with 4 separate models, which aggregated to a total of 288 different regressions. We therefore thought that the traditional method of presenting findings through regression tables would amount to an inhumane treatment of the reader. To achieve a more pedagogical presentation of findings, we instead provide graphs of how coefficient values develop across the years in our time period. Since explanatory variables are lagged one year, the graphs show the effects of independent variables in period t_{-1} .

Moreover, we chose to analyze the individual effects of prior growth and capital structure without an interaction term included in the model, to allow for easier interpretation of coefficients. The interaction term is therefore first included in our models in subchapter 5.2.4, which deals specifically with the interaction effect. For the sake of clarity, the specifications we use when investigating the individual effects are therefore

$$\begin{aligned} \text{Performance measure}_{t+1} = & \\ & \beta_0 + \beta_1 \text{Growth measure} + \beta_2 \text{Debt level} + \beta_3 \text{Growth measure}^2 + \beta_4 \text{Debt level}^2 + \\ & [\text{Firm level control variables}] + [\text{Industry level variables}] + \varepsilon \end{aligned}$$

The rest of the analysis chapter follows the same structure as the theory section. First we look at how growth affects corporate performance during recessions. Second, we investigate the influence of capital structure. Third and last, we explore how the possible interaction effect of how growth and debt may affect performance measures. For all graphs we first provide a brief description of how the coefficient values develop, before turning to the implications for our hypotheses. In the discussion of the individual effects of capital structure and growth, we present developments in both the linear and quadratic terms. This should provide insights into how industry-average levels of debt and growth affected performance, as well as how highly leveraged and rapidly growing firms performed during recessions.

5.2.1 The impact of growth

The impact of prior growth on growth performance

The hypotheses we are testing regarding the impact of prior growth on growth performance during recessions are

H.1.a: *Prior firm growth has negative effects on growth performance during recessions.*

H.1.b: *During recessions the negative effect of prior growth on growth performance increases exponentially with prior growth levels.*

Sales growth model

The linear term of prior sales growth on sales growth is only sporadically significant throughout the period. However, when the relationship exists it displays a consistently negative effect on future growth. Overall, this indicates that industry-average growth has a sporadically negative influence on future growth. As an example, a 1 % increase in sales growth in 2000 reduced sales growth in 2001 with 0.035 %. The coefficient value then drops to - 0.06 in 2002, and displays a (non-significant) spike in 2003. After 2004 the negative effect of previous growth seems to decrease. Between 2006 and 2008 there are no significant relationships, though we observe a positive coefficient value in 2007. After 2008, the coefficients values are negative and declining, in other words the negative effect of prior growth on growth performance is increasing.

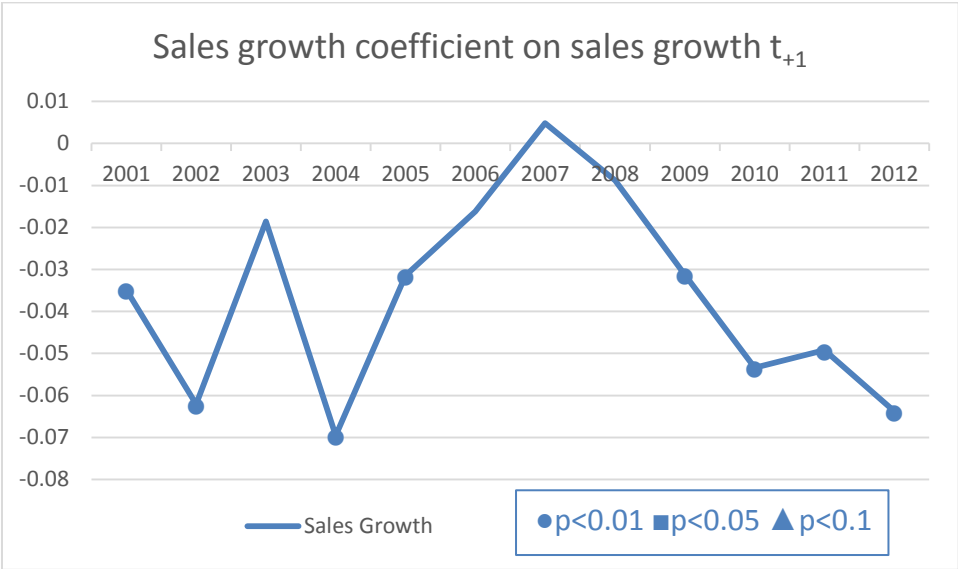


Figure 20: Linear sales growth coefficient development in sales growth model

We now turn to how these results relate to our hypothesis. The hypothesized negative effect of pre-recession growth does not seem to be present during the dot-com crisis for industry-average growers. In the discussion above we identified 2002-2003 as the most severely affected years during this recession. We observe an increase in the negative influence of prior growth in 2002, which is in line with our expectations. However, 2003 sees a positive, albeit non-significant, increase in the coefficient value. This runs contrary to our expectations. It is also unexpected that firm growth in 2003 should have such a large negative and significant impact in 2004, which we identified as a retrieval year. The developments between 2005-2007 are more in line with expectations. Based on our theoretical predictions regarding the effect of growth in normal years, this boom period should induce a positive relation for growth on

growth. As mentioned above, 2007 has a positive coefficient value, which coincides with the peak of the boom period. The 2006-2008 coefficient values are, however, not statistically significant. The coefficient value drop in 2009 provides some support for our hypothesis. On the other hand, this finding is confounded by the increasingly negative relationship in 2010-2012. These last years were identified as retrieval and boom years, and given our theoretical predictions we should have expected a similar development as in 2004-2007.

Overall, though we can identify a very crude pattern with decreasing coefficient values in and after recessions, this pattern is disrupted by the persistence of low beta values in retrieval periods. Taken together, the evidence is poor for hypothesis H.1.a in the linear term. We cannot conclude that recessions induce a particular negative effect of prior growth on industry-average growers.

We now turn to the quadratic term in the sales growth model. As mentioned in the methods section, the quadratic function of sales growth explores the possibility of a non-linear relationship between prior growth and growth performance. If such a relationship exists, then sales growth would be interacted with itself, and the effects of prior growth depends on its magnitude. There are highly significant non-linearities in sales growth in 2002, 2005, 2011 and 2012, with additional significant observations in 2004 and 2007. The squared sales growth have positive values for all the significant coefficients, which indicate a u-shaped shaped (convex) sales growth curve when combined with the negative coefficient values of the linear term. This finding changes the prediction from the discussion of the linear term above. The convex nature of sales growth indicates a positive relationship between sales growth and sales growth $_{t+1}$ for particularly fast growers. In other words, high growth firms manage to sustain positive momentum in sales growth, while medium and low growth firms are unable to maintain above-industry growth.

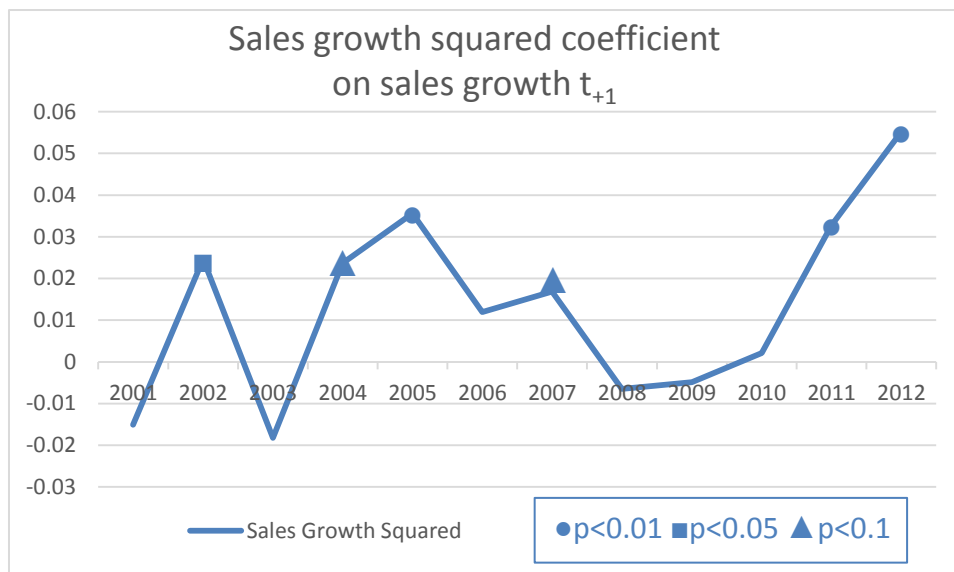


Figure 21: Quadratic sales growth coefficient development in sales growth model

The finding in the quadratic term is relevant for our hypotheses. As we can see from the graph above, the occurrence of significant non-linearities largely coincides with retrieval and boom years. No significant non-linear relationship is found at any level of significance during the crisis period 2008-2010, or during two of the years in the dot-com crisis, 2001 and 2003. This is interesting, as it indicates that the convex relationship between prior and future growth we identified above disappears during recessions. Our analysis shows that the quadratic term is no longer significant during the downturns in 2003 and 2008-2009. In other words: When recessions hit, even high growth firms are unable to sustain a positive growth momentum. The finding is supported by squared coefficient values dropping towards zero, providing further evidence of the disappearance of the quadratic effect.

This finding does not directly support hypothesis H.1.a or H.1.b, since the quadratic relationship is neither negative nor significant during recessions. Thus recessions do not appear to induce a strictly negative impact of prior growth. But our findings reveal a related effect: Recessions seem to deprive high growth firms of their growth momentum.

Asset growth model

We now turn to the second growth measure - asset growth. The coefficient of asset growth on asset growth t_{+1} follow a similar pattern as the sales model, but is less volatile during and after both recessions. The coefficient is again negative in all years with a statistically significant relationship. In 2001-2005 it fluctuates between -0.04 and -0.06, with alternating high and low

values. In 2006 and 2007 we observe noticeable increases in coefficient values, with the 2007 value almost reaching zero. Neither of these are, however, statistically significant. After the start of the 2008-2009 recession, coefficient values drop and displays an increasingly negative relationship towards 2012.

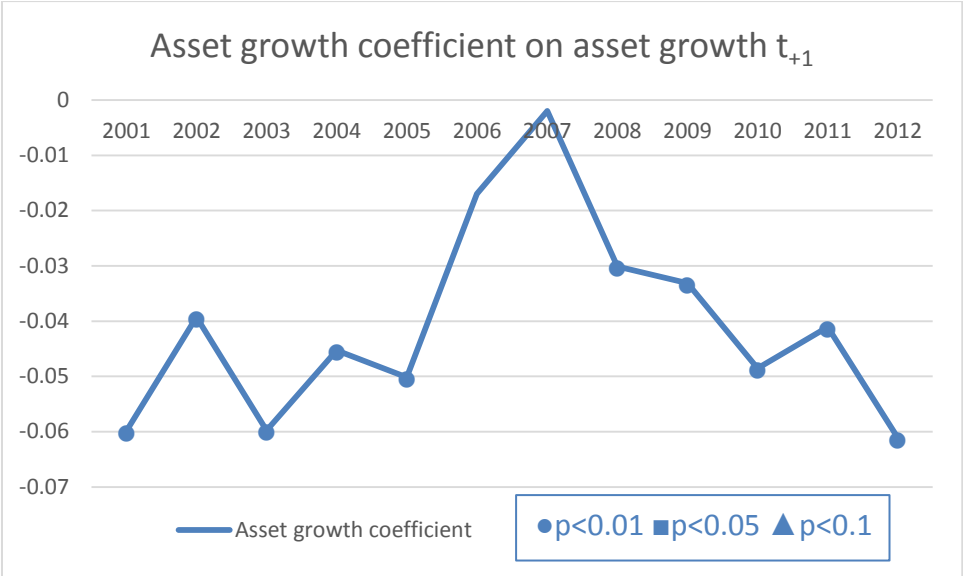


Figure 22: Linear asset growth coefficient development in asset growth model

The results from the linear term provide mixed support for hypothesis H.1.a for industry-average growers. There appears to be no evidence of the dot-com crisis exacerbating the negative growth effect we generally observe. There is a small increase in coefficient values from 2001 to 2002, which runs contrary to expectations. While there is a drop in coefficient values from 2002 to 2003, the levels do not fall below that of 2001, and not substantially lower than 2004 and 2005. That coefficient values remain low for these last two years indicate that there was either no growth effect during the dot-com crisis, or that effects lasted longer than we would intuitively expect. There is, on the other hand, some support for our hypothesis of a negative growth effect during the 2008-2009 recession. As we can see, coefficient values drop noticeably in 2008 and 2009. Similarly to the results from the sales growth model, however, this finding is somewhat confounded by the continued drop in beta values in 2010 and 2011. Again, there seems to be limited support for hypothesis H.3.a when investigating the linear term. We cannot conclude that industry average growers experienced particularly negative growth effects during recessions.

Similar to the analysis above, we now include the quadratic term in the discussion. The quadratic term for asset growth follows a similar pattern to the squared growth variable. In non-recession years, there are significant, positive non-linearities in asset growth. The coefficient values are also higher in retrieval and boom years relative to slowdown and downturn years. There are clear peaks in 2001 and 2006, and the retrieval starting in 2011 and 2012 shows a notable increase in both coefficient values and significance of the quadratic relationship.

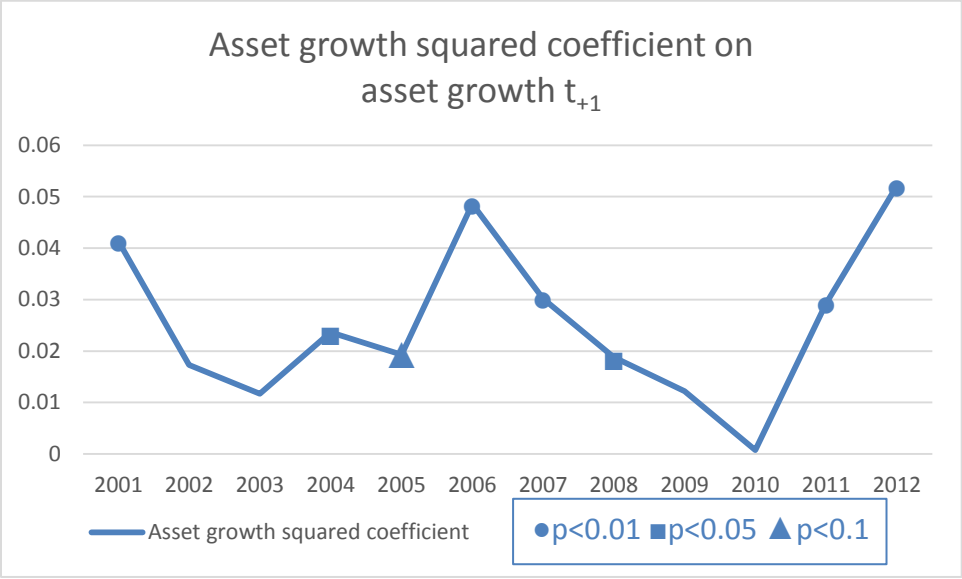


Figure 23: Quadratic asset growth coefficient development in asset growth model.

The implications from the quadratic term are similar to our findings in the sales growth model. In normal years, firms with particularly high growth are able to sustain their momentum over time. More modest growers are unable to preserve positive growth levels. Similarly to the findings in the sales growth model this non-linear relationship disappears during recessions. This provides further support for the fact that high growers are unable to maintain positive growth effects during recessions. However, even though coefficient values dip during recessions, they do not turn negative. Therefore we arrive at the same conclusion regarding our hypotheses as above. We find no support for hypotheses H.3.b from the asset growth model.

We briefly sum up the analysis on the effects of prior growth. The accumulated discussion of the linear terms in the sales and asset growth models indicate moderate to little support for H.3.a. However, including the quadratic term in the analysis provided additional insights. We

have seen that high growth firms are able to sustain positive growth momentum in normal years. Introducing recessions seems to remove this growth momentum. In other words, though recessions apparently do not punish average firms noticeably, they punish high growers by removing their growth momentum effect. The overall conclusion for H.3.a is therefore that even though recessions do not induce strictly negative effects of prior growth on growth, they do seem to remove the positive effects of growth for fast growing firms.

There is, however, no evidence in favor of hypothesis H.1.b, where we expected an exponential negative relationship between prior growth and growth during recessions. As we have seen, the conclusion from the sales growth model suggests that there is no such negative effect of growth on growth in a crisis, rather a removal of positive effects. The overall conclusion is therefore a rejection of the hypothesis.

The impact of prior growth on profitability

We now turn to how prior growth affects our second performance measure, profitability. We start by analyzing the effect on EBITDA margins, before moving on to effects on ROA.

The hypotheses we test in this subchapter are

H.2.a: Prior firm growth has negative effects on profitability performance during recessions.

H.2.b: During recessions the negative effect of prior growth on profitability performance increases exponentially with prior growth levels.

EBITDA model

Sales growth on next year's EBITDA margins is consistently negative, as evidenced in the graph below. The observed effects of growth on EBITDA margins are less negative in 2002, 2005 and 2009, but none of these observations are statistically significant. The first significant relationship occurs in 2003, where an 1 % increase in prior growth reduced EBITDA margins by 0.025 %. Coefficient values then increase somewhat in 2004, before dropping back towards 2003 levels in the next significant year, 2006. Between 2007-2011 coefficient levels remain relatively constant. The exception is 2009, where sales growth did not have a

significant impact on EBITDA. Somewhat surprisingly, the largest negative effect of growth on EBITDA margins is found in 2012.

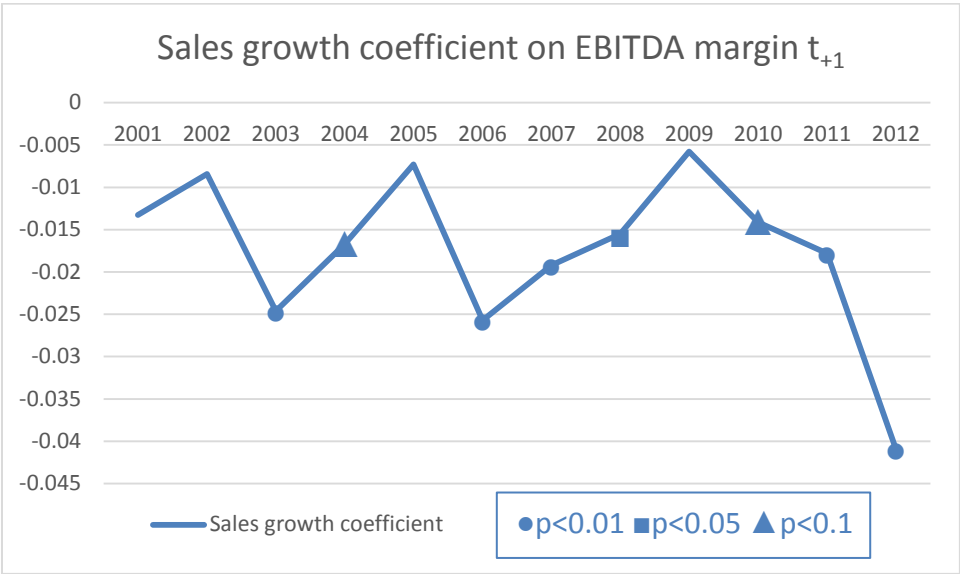


Figure 24: Linear sales growth coefficient development in EBITDA model

Overall, these findings provide little support for hypothesis in the linear term. There is a reduction in coefficient values in 2003, indicating that industry-average growth in 2002 might have a negative impact during the dot-com through the year later. However, the 2003 coefficient value is higher than its 2006 counterpart, a year we identified as part of an expansion phase. Similarly, there is little evidence that the 2008-2009 recession induced a particularly negative relationship between growth and EBITDA margins, a finding that is strengthened by the substantial drop in coefficient values in 2012. In sum, there is little indication that industry average growth induced a negative impact on EBITDA during recessions. Overall, these findings provide little support for hypothesis H.4.a.

We now turn to the quadratic sales growth term. The squared sales growth coefficient in the EBITDA model is negative for the first year of the dot-com crisis, indicating an exponentially increasing negative relation, before turning non-significant during 2002 and 2003. In the retrieval and expansion years the quadratic term has positive values, which combined with the linear term indicates that growth has a convex effect on EBITDA margins. The only year breaking the pattern in the boom period is 2005, where the exponential relationship for growth behaves similar to a recessionary year. The relationship turns negative again during the

entirety of the 2008-2011 period, which indicates the presence of a similar relationship as in 2001.

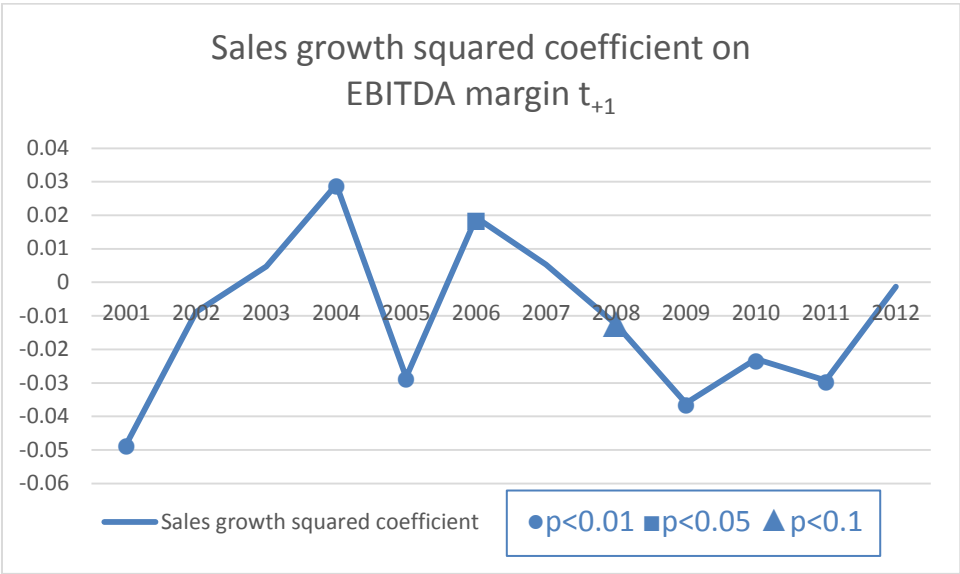


Figure 25: Quadratic sales growth coefficient developments in EBITDA model

Once again, including the quadratic term changes the conclusions from the linear term. The results from the squared variable provide findings that are in line with hypotheses H.4.a and H.2.b. The negative quadratic term during 2001, the first year of the dot-com crisis, indicates that high pre-recession growth has increasingly negative impacts on EBITDA margins. The quadratic relationship is not significant in 2002 and 2003, however, which weakens the argument somewhat. The negative spike in 2005 is also hard to explain, but a recurring theme in our other main variables is that 2005 often display unexpected findings. Henriksen and Kvaslerud (2012), using the same datasets, also finds that 2005 coefficients frequently return highly discrepant values. This might indicate that there are issues with the 2005 dataset, so we chose to ignore the output in 2005 when values are highly discrepant. Moving on to the 2008-2009 recession, a clear pattern in the quadratic term emerges. In 2008-2009 the term turns negative, indicating an exponential negative effect of growth on EBITDA margins. This relationship continues in 2010 and 2011.

Overall, disregarding 2005, we can identify a pattern across the business cycle. The squared growth variable shows a concave (u-shaped) growth relationship in recessions, and a convex (inverse u-shape) relationship in normal years. The exponentially increasing negative effects on next year’s EBITDA margins from growth during recessions provides support for

hypotheses H.2.a and H.2.b. Recessions seem to induce a negative effect of high prior growth on profitability performance, and this negative relationship is non-linear.

ROA model

We now turn to our ROA model. When examining the linear term, prior growth generally appears to have a negative impact on ROA throughout the period. The lowest coefficient value is observed in 2001. The coefficient then increases in 2002 and 2003, though the latter is not statistically significant. Coefficient values are then relatively stable between 2004 and 2008, with the exception of a non-significant spike in 2006. There is another non-significant spike in 2009, after which the coefficient dips in 2010, remaining relatively low in 2011 and 2012.

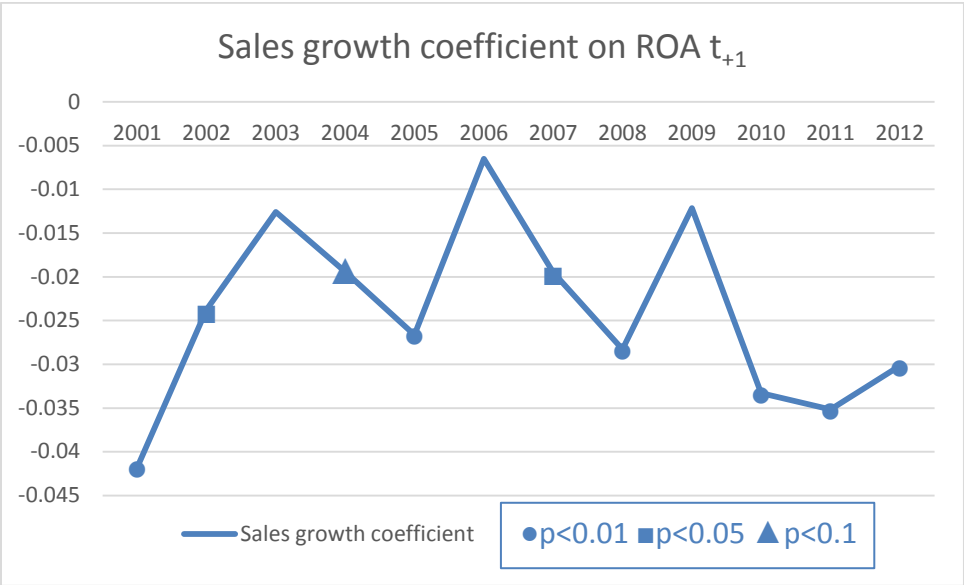


Figure 26: Linear sales growth coefficient developments in ROA model

Again we find little evidence for hypothesis H.2.a when investigating the linear term. In support for our hypothesis, the start of each crisis, 2001 and 2008, display negative spikes in coefficient values. However, there are positive spikes in coefficient values in 2003 and 2009, even though we identified these years as the most severely affected in terms of GDP growth. This finding therefore runs contrary to hypothesized results. Furthermore, the two years following the start of the dot-com crisis do not display expected coefficient developments. Overall, therefore, support for H.2.a is limited. There does not appear to be an effect of prior growth on ROA for industry-average growers during recessions.

We now turn to the quadratic variable. The squared growth effect on ROA t_1 shows some interesting results. As we can see, there is no quadratic relationship in the boom period 2004-2007. The presence of a quadratic effect only occurs in 2002, during the dot-com crisis, and in the 2009-2011 period. The relationship displays the highest level of significance in 2002 and 2009, which coincides with sharp negative spikes in the coefficient values of the quadratic term. This indicates the presence of an exponential negative effect of growth on ROA. The negative effects of high growth on ROA t_1 persists with significant values through 2010 and 2011.

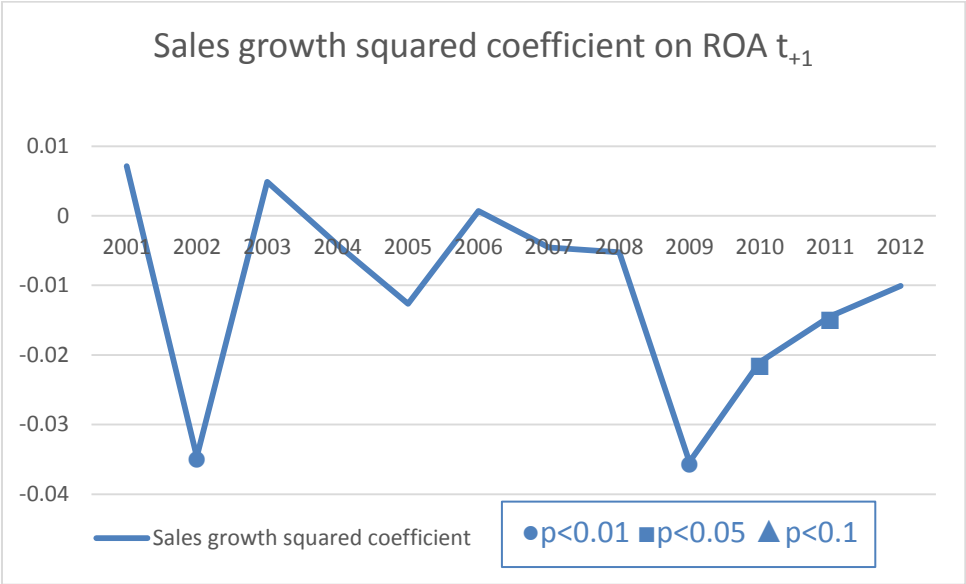


Figure 27: Quadratic sales growth coefficient developments in ROA model

The quadratic term shows clear support for both our profitability hypotheses. The squared sales growth coefficient values and significance levels indicate that high growth in the year before the onset of recessions may induce an exponentially increasing negative relationship with profitability. This finding is similar to the conclusions we arrive at in the EBITDA model, but appears to be even more prominent in the ROA model. We argue that this offers support for hypotheses H.2.a and H.2.b. Firms with high pre-recession growth appear to have suffered negative profitability performance outcomes during downturns.

We briefly sum up the analysis of growth on profitability. Developments in coefficient values and significance levels for the linear terms in both EBITDA and ROA models lend little

support to hypothesis H.2.a. There seems to be no identifiable pattern where recessions induce negative growth effects on profitability for industry-average growers. As with the growth models, however, introducing the squared term provides additional insights. There is a clear pattern, particularly in the ROA model, of a negative non-linear relationship between high prior growth and profitability in downturns. This indicates that recessions induce a negative relation between growth and profitability for rapidly growing firms. This lends support to hypothesis H.2.a.

As implied above, the overall support for hypothesis H.2.b is also strong. Based on EBITDA model there is evidence of a negative quadratic relationship during recessions. The ROA model displays an unambiguous pattern of negative and significant squared coefficient values in most of the crisis years. We therefore accept the hypothesis H.2.b: there appears to be an exponentially increasing negative effect of growth on profitability during recessions.

5.2.2 The impact of capital structure

We now present our results on how capital structure affects corporate performance in recessions. As with growth, we explore the effects of debt across our four performance measures sales growth, asset growth, EBITDA margins and ROA. We again investigate both the linear and the quadratic relationships.

The impact of capital structure on growth

Similar to above, we start with the sales growth model before discussing asset growth. The hypotheses we test are

H.3.a: *Debt has a negative effect on corporate growth performance during recessions.*

H.3.b: *During recessions the negative effect of debt on growth performance increases exponentially with debt levels.*

Sales growth model

As we can see in the figure below, debt level appears to have a positive and statistically significant relationship with next year's sales growth after 2006. Prior to this, however, coefficient values are not significant and fluctuate around zero. 2006 also displays the highest observed coefficient value. In 2007 we observe a decline in the positive debt effect that last

until 2009. 2010 does not display a significant relationship, but we can observe an increase in coefficient values in 2011 and 2012, both of which are statistically significant.

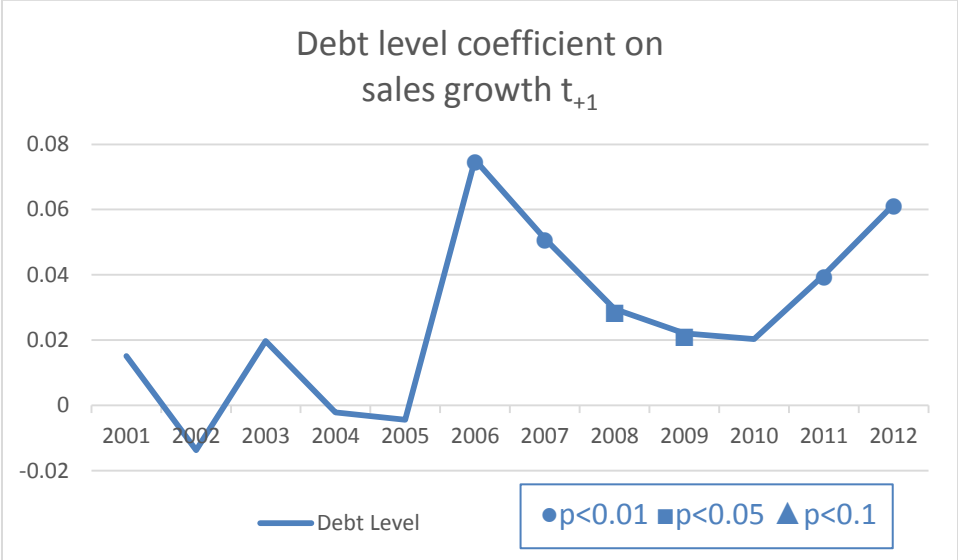


Figure 28: Linear debt level coefficient development in sales growth model

The findings provide partial support for hypothesis H.3.a. Coefficient values prior to 2006 indicate that there was no debt effect on growth for averagely leveraged firms during the dot-com crisis. Compared to the boom period in 2006-2007, coefficient values are noticeably lower during the dot-com crisis, but the relationships are not statistically significant. However, the pattern of reduced coefficient values repeats during the 2008-2009 recession, now with statistically significant relationships. Signs of the retrieval phase can be seen in 2011 and 2012, as the positive effects on sales growth t_1 from increasing debt rises. Though the effects of debt on growth remains positive during the recession, the reduced coefficient values during the 2008-2009 recession indicate a relative decrease in the positive impact of leverage. Strictly speaking, this is not the negative relation we hypothesized, but it indicates that recessions still have a negative impact on the effects of capital structure. We therefore conclude that partial support for hypothesis H.3.a is provided. Firms with industry-average debt levels appear to have experienced reduced positive effects of leverage on growth during the 2008-2009 recession.

The squared debt level coefficient reveals two findings on capital structure's effect on performance. First, the quadratic variable of debt level's effect on next year's sales growth is

highly significant in the entire period except 2006. This indicates a consistent interaction effect of debt on debt. Second, all observations are in the negative range of values, implying a decreasing positive effect of debt on sales growth, and that sufficiently high leverage eventually causes negative growth. In other words: Increasing debt levels above industry average may have positive marginal effects on sales growth when leverage is relatively low. At some point, however, increases in debt level will eventually entail negative effects on sales growth. Combined with the linear term, this creates a reverse u-shaped (concave) relationship between debt and growth after 2006, and a negative exponential relationship before. Moreover, there are also developments in the coefficient values. As we can see from the figure below, these values decrease from 2001 to 2004, before a spike in 2005 and 2006. A sharp reduction in coefficient values then occurs in 2007, after which there is a continuous increase towards 2011.

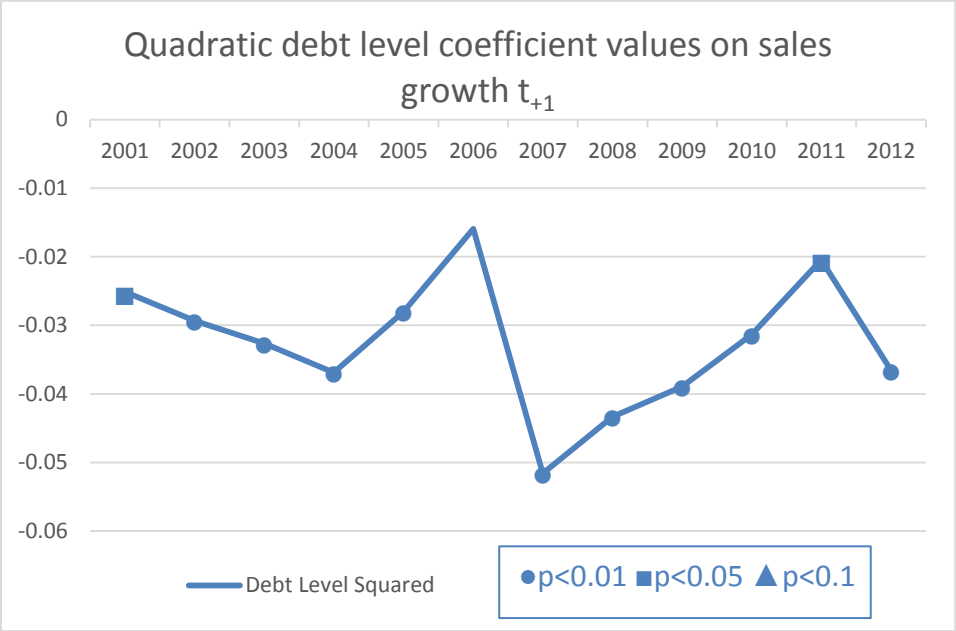


Figure 29: Quadratic debt level coefficient development in sales growth model

We argue that the findings from the quadratic variable support our findings from the discussion on the linear term. The non-significant linear term combined with the significant quadratic effect creates a negative exponential effect in and immediately after the dot-com crisis. The development in the coefficient values indicate that this effect worsened through the crisis, before starting to improve in 2005 and 2006, which we identified as boom years. That the relationship turns non-significant during 2006 indicates a complete removal of the negative leverage effect for high-debt firms. The findings so far are in line with our

theoretical predictions. The sharp negative spike as early as in 2007 is somewhat surprising, but the subsequently low quadratic coefficient values in 2008 and 2009 provides support for our hypothesis that recessions induce a negative effect of leverage. The general pattern seems to be increased negative coefficient values in or around recessions, with higher values in boom periods. This provides clear support for hypotheses H.3.a and H.3.b. It seems recessions reduce the threshold for ‘harmful’ leverage effects on growth.

Asset growth model

We now turn to capital structure's effect on asset growth. Debt levels show highly significant relationships with asset growth throughout all years in the period. Contrary to findings in the linear sales growth term, the coefficient values are all negative, indicating that marginal increases above industry-average leverage decreases asset growth. Regarding the developments in coefficient values, there appears to be a slight dip in 2002 relative to 2001 values. There is then a retrieval in 2003, bringing the effects of debt close to 2001 levels. The effect remains stable in 2004. After 2004, coefficient values steadily increase towards a peak in 2006. There is then a noticeable drop in 2007 and 2008, with a larger negative spike in 2009. As we can see, 2009 brings coefficient values even lower than the dot-com crisis. 2010 displays a marginal increase in coefficient levels. A more pronounced retrieval is evident in 2011, continuing into 2012.

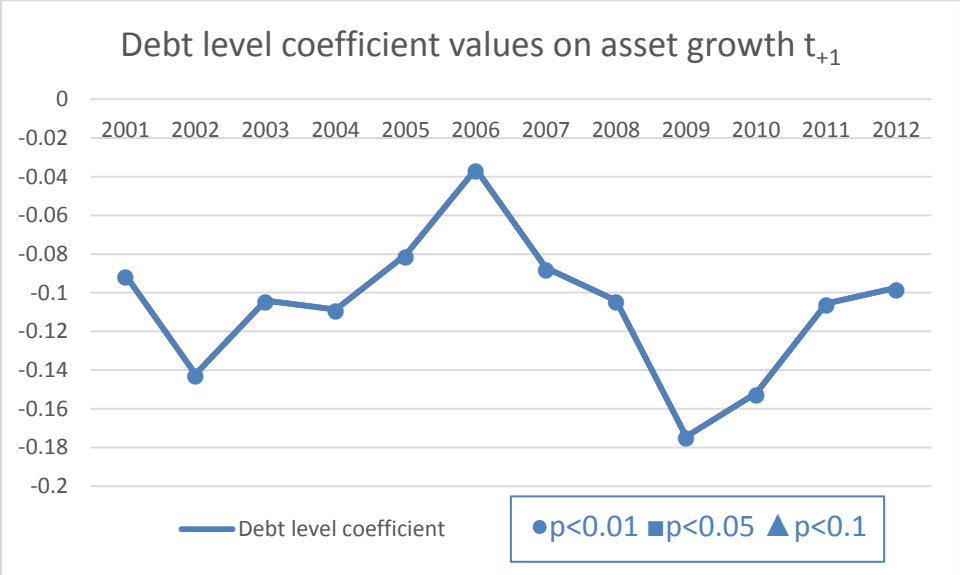


Figure 30: Linear debt level coefficient development in asset growth model

Again we argue that there is support for hypothesis H.3.a in the linear term. The general pattern appears to be an increasingly negative relationship between leverage and growth during recessions. The dip in 2002 coincides with one of the most severely affected years of the dot-com crisis, even if the subsequent increase in coefficient value in 2003 is unexpected. The peak in coefficient values in 2005-2007 is also in line with expected developments during boom years. Furthermore, the 2008-2009 recessions appears to induce a sharp increase in the negative leverage effect. Again, however, we can observe an early decline in coefficient values. The larger decline in 2009, however, still provides strong support for hypothesis H.3.a. Recessions appear to exacerbate the negative effect of debt levels on growth for firms with industry-average debt levels.

We now include the quadratic term in the discussion. The squared debt level coefficient shows consistently high levels of significance throughout all years in the dataset. The quadratic term does not, however, follow the pattern of the squared sales growth term. Generally, coefficient values appear to fluctuate around 0 until 2008, after which there is a spike in 2010. The coefficient values are negative in 2005 and 2007. There are also smaller spikes in 2003 and 2006. 2011 and 2012 sees two consecutive and sharp reductions in coefficient values. In 2012 the coefficient level is again close to zero.

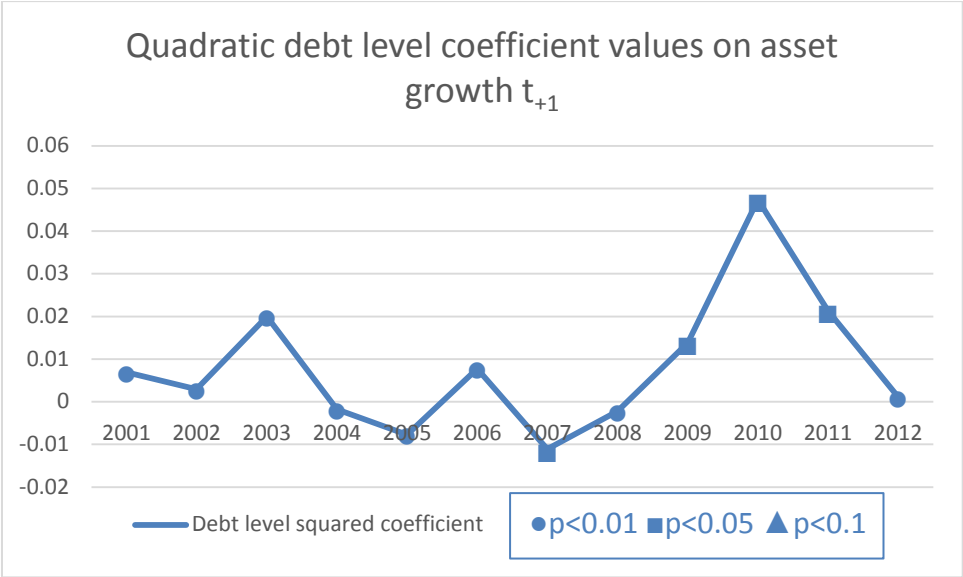


Figure 31: Quadratic debt level coefficient development in asset growth model

The findings from the squared variable stand in sharp contrast what we hypothesized in both H.3.a. and H.3.b, and what we found in the sales growth model. Largely, we find positive

squared debt variable values during recessions. Combined with findings from the linear term, the results indicate that sufficiently high leverage can cause a positive effect on asset growth in recessions, creating a u-shaped relationship. This directly contradicts our hypothesis. It is also hard to reconcile the peak in 2010 with our expected findings. However, as we saw in the model overview subchapter, and as can be seen in detail in appendix A.2, the economic significance of the quadratic debt term was either close or equal to zero across all years. Thus, we chose to lend little weight to the quadratic leverage effect in the asset growth model. We are then left with the linear term, which largely provided support for hypothesis H.3.a. The lack of economic significance in the squared term, however, means that there is no support for hypothesis H.3.b when investigating asset growth.

We briefly sum up the analysis on capital structure effects on growth. From the sales growth model we found no effect of leverage on growth prior to 2006, but a sharp reduction in the positive values of the linear model during the 2008-2009 recession. The linear leverage effect on asset growth is negatively affected by both recessions. Both linear terms therefore provides support for hypothesis H.3.a, indicating that recessions induced a negative growth effect for firms with industry-average debt levels. When including the quadratic term in the analysis, we the ROA model indicated that leverage had increasingly negative effects on growth during downturns. The quadratic term in the EBITDA model, however, provided results that contradicted this finding. However, the squared debt did not contribute economic significance. In total, both the linear and quadratic terms in the sales growth model provided support for hypothesis H.3.a. The same applied for the linear asset growth term, but the findings from the quadratic term contradicted this hypothesis.

Moving on to hypothesis H.3.b, the findings from the quadratic term displayed clear support in favor of the hypothesis. As we saw above, however there was no practically significant squared EBITDA variable. The overall findings on hypothesis H.3.b are therefore somewhat inconclusive in our growth models.

The impact of capital structure on profitability

We now discuss the effects of leverage on our profitability performance measures. The hypotheses we test are:

H.4.a: *Debt has a negative effect on corporate profitability performance during recessions.*

H.4.b: During recessions the negative effect of debt on profitability performance increases exponentially with debt levels.

EBITDA model

Industry-average leverage is generally positively related with EBITDA margins. As we can see in the figure below, coefficient values are also rather volatile throughout the period. The first few years display no significant relationship, with coefficient levels close to zero. In 2003, we see a sharp increase in coefficient values, after which all years display a statistically significant relationship. From 2003 and onwards, the effect of leverage fluctuates between 0.05 and 0.02, with negative spikes in 2005, 2007 and 2010. Values outside these years are relatively stable at 0.05.

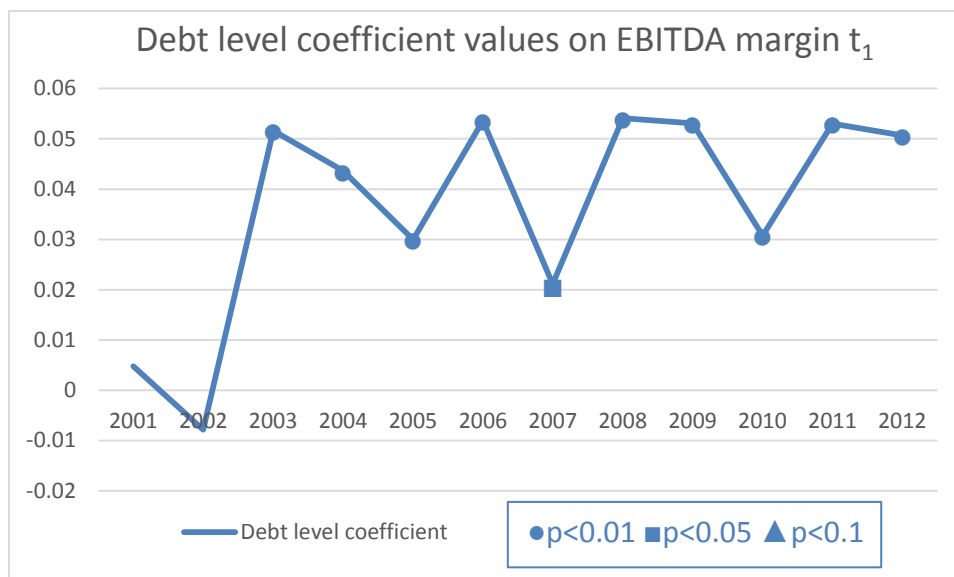


Figure 32: Linear debt level coefficient development in EBITDA model

According to our hypothesis H.4.a, recessions should negatively impact the effects of debt on EBITDA margins. Looking at the dot-com crisis, it seems that the debt level's influence on EBITDA margin is neither significant nor negative. To the contrary, in 2003 there is a large, positive and significant increase in the coefficient value. During the 2008-2009 recessions, there are also significant and positive effects of increasing debt levels on EBITDA margins. This provides further evidence against our hypothesis. When analyzing effects on EBITDA

margin performance for firms with industry-average debt levels, hypothesis H.4.a does not seem to hold.

We now include the quadratic term in the discussion. The coefficient value of the squared debt level term lies close to zero in both 2001 and 2002, before dropping into negative values in 2003. The effect remains relatively stable and negative in 2004 and 2005, which combined with the linear term indicates a reverse u-shape during this period. The coefficient value then increases sharply and turns positive in 2006. 2007-2009 displays a continuous decline with a new trough occurring in 2009, where we again see a negative quadratic effect. This indicates that the concave relationship from 2003-2005 returns. Similarly to the asset growth model, the squared debt variable peaks sharply in 2010. We then observe an almost equally abrupt drop in the coefficient value in 2011, before a modest increase in 2012.

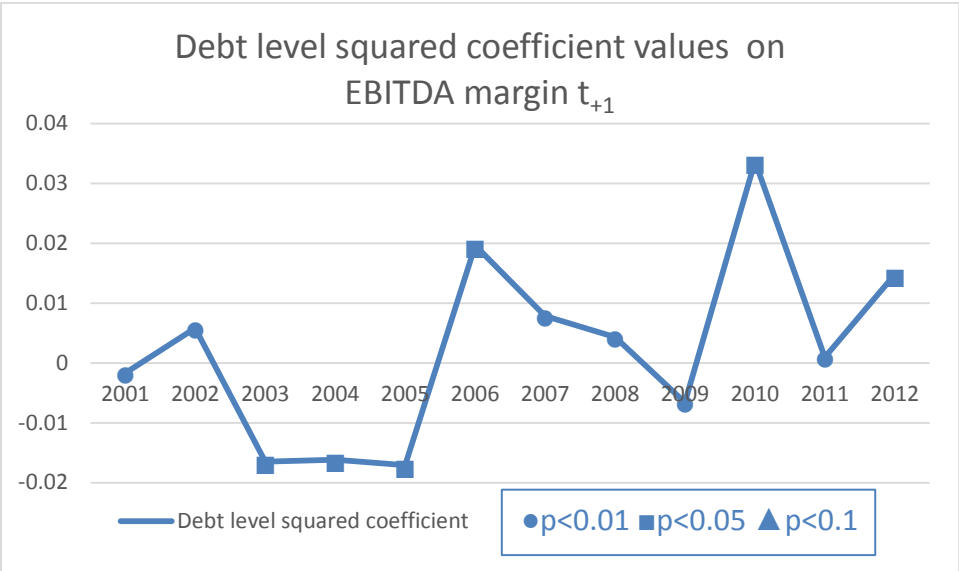


Figure 33: Quadratic debt level coefficient development in EBITDA model

The squared term provides some evidence for our hypotheses. The concave relationship we identified in 2001 and 2003-2005 indicates that the dot-com crisis induced a negative effect of high leverage on profitability. However, if the dot-com crisis is the real cause of this effect, it is surprising that the concave relationship lasts until 2005. It is also hard to explain why 2002 displays a positive value. Evidence in support of our hypothesis is clearer during the 2008-2009 recession. The decrease in coefficient values after 2006 coincide with the onset of the financial crisis, and the negative quadratic variable in 2009 occurs simultaneously as the trough in GDP growth we identified above. These findings therefore provide support for

hypothesis H.4.a. The 2008-2009 recession appear to have induced a negative effect of debt on growth for particularly highly leveraged firms. This finding is, however, only moderately supported in the dot-com crisis. Since the quadratic term is driving the negative effect of leverage during recessions, we also find support for hypothesis H.4.b.

ROA model

As we can see in the graph of the linear term below, industry-average debt levels show consistent positive effects on ROA. The relationship is also highly significant throughout the period. Compared to other years, coefficient values are relatively low between 2001 - 2003. There is then an increase in 2004, after which values fluctuate between 0.06 and 0.10 until 2009. The positive effect of debt on ROA t_1 all but vanishes in 2010, which sees a sharp negative spike in the coefficient value, which renders the effects of debt comparable to 2001-2003 levels. Coefficient values then rebound in 2011 and 2012.

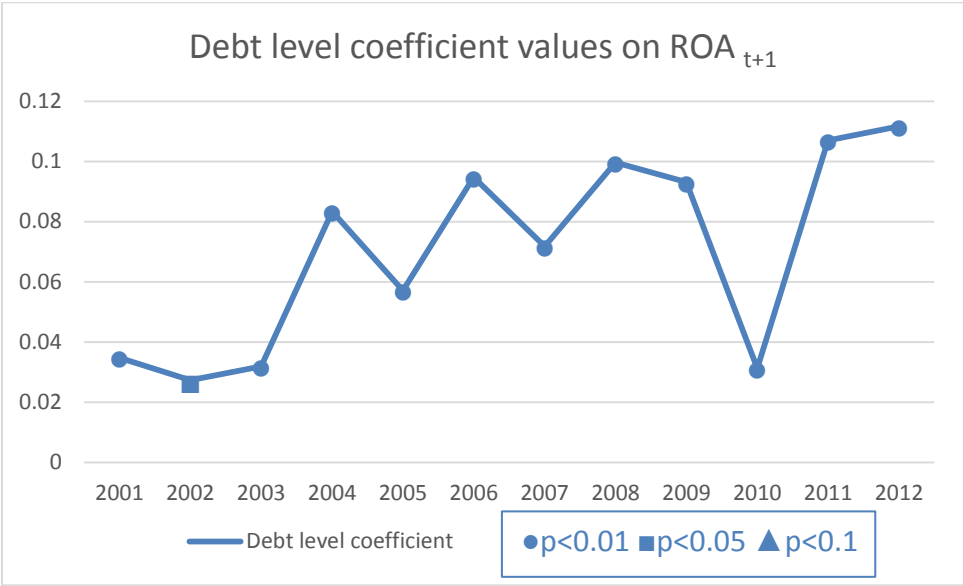


Figure 34: Linear debt level coefficient development in ROA model

These findings offer some support for hypothesis H.4.a. Though the relationship remains positive, the effects of leverage on profitability were somewhat lower during the dot-com crisis relative to most other years. This could indicate that the dot-com crisis reduced the positive growth effects of leverage. However, this pattern does not repeat itself during the 2008-2009 recession. The large negative spike in coefficient value in 2010 arrives too late to be assumed induced by the recession. Overall, there is moderate to limited support for H.4.a. Though a negative effect might be observed in the dot-com crisis, it appears recessions induce

a limited negative effect of leverage on profitability for firms with industry-average debt levels.

We now include the squared debt level in the discussion. During 2002 and 2003 we can observe negative coefficient values, which combined with the positive linear term indicates a reverse u-shaped (concave) relationship between debt and profitability. 2005 show a highly significant negative spike in the effect of leverage on ROA, which is then reversed in 2006. Again we point out that 2005 continues to display disparate results. The quadratic term turns insignificant in 2007 and 2008, before the concave relationship from 2002 - 2003 returns in 2009. The relationship then turns positive again in 2010, with relatively stable values in 2011 and 2012.

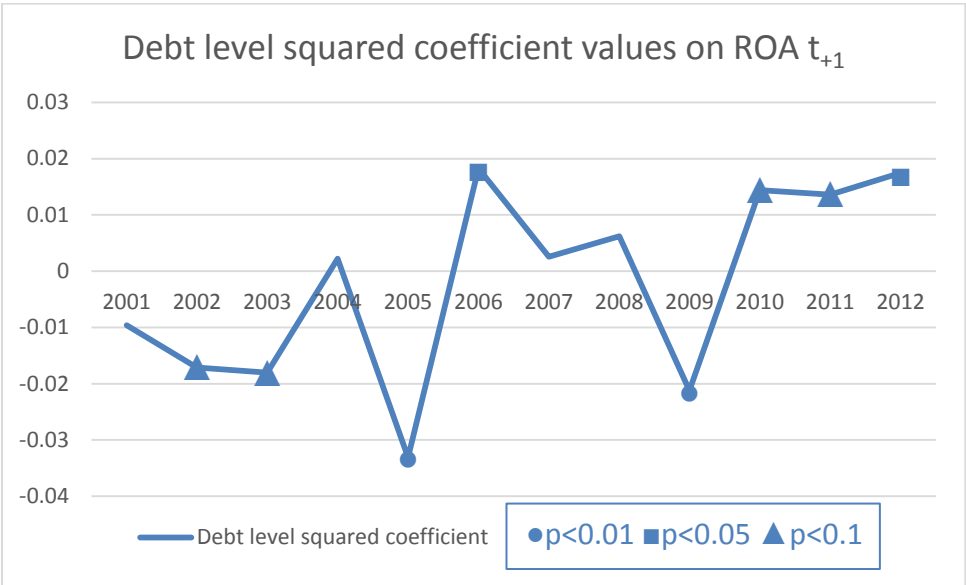


Figure 35: Quadratic debt level coefficient development in ROA model

We argue that these results provide support for our hypotheses H.4.a and H.4.b. In the two most severely affected years of the dot-com crisis, the presence of a negative quadratic term indicates that high levels of leverage had a negative effect on profitability. A caveat here is the significance level of 10%, which is above the conventional threshold of 5 %. However, the pattern repeats itself in 2009, now with high statistical significance. Disregarding 2005, it seems that recessions punish high debt levels in terms of ROA performance. This provides support for both hypothesis H.4.a and H.4.ab. We document that recessions induce a negative effect of leverage on profitability for firms with high debt levels, and that this negative effect increases exponentially.

As before, we provide a brief summary of our profitability hypotheses. In the EBITDA model, we found that the linear debt level term did not appear to systematically affect margins negatively during recessions. Including the quadratic term, however, indicated that recessions did induce a negative effect on EBITDA for highly leverage firms. In the ROA model, we found lower coefficient values during the dot-com crisis, indicating a potential effect. Including the quadratic term again provided evidence of a negative effect of debt in recessions. These findings show support for hypothesis H.4.a. We document a negative effect for firms with particularly high leverage. Our findings also show strong evidence in support of hypothesis H.4.b: There seems to be a negative exponential relationship between leverage and profitability during recessions.

This concludes our analysis of the individual effects of growth and capital structure during recessions. We now turn to the interaction between these two.

5.2.3 Interaction effects of debt and growth

Going back to the red thread in our overall structure, we now explore the possibility of an interaction effect between debt and growth on firm performance. The econometric specification we use then reads

$$\begin{aligned}
 \text{Performance measure}_{t+1} &= \beta_0 + \beta_1 \text{Growth measure} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} \\
 &\quad * \text{Growth measure} + \beta_4 \text{Growth measure}^2 + \beta_5 \text{Debt level}^2 \\
 &\quad + [\text{Firm level control variables}] + [\text{Industry level variables}] + \varepsilon
 \end{aligned}$$

The hypotheses we test are:

H.5: *There is a negative interaction effect between prior growth and debt levels on growth performance in recessions.*

H.6: *There is a negative interaction effect between prior growth and debt levels on profitability performance in recessions.*

Interaction effects in the growth models

We start with the interaction effect on growth. As we can see in the graph below, the effect on next year’s sales growth is generally positive, with the exception of 2002, where the interaction coefficient displays a negative spike. We can also see that the effect is only sporadically significant. After 2002, the coefficient values seem relatively stable for the years where we observe a statistically significant effect. When the effect is not significant, it displays small dips in coefficient values. There also appears to be an increase in coefficient value in 2012.

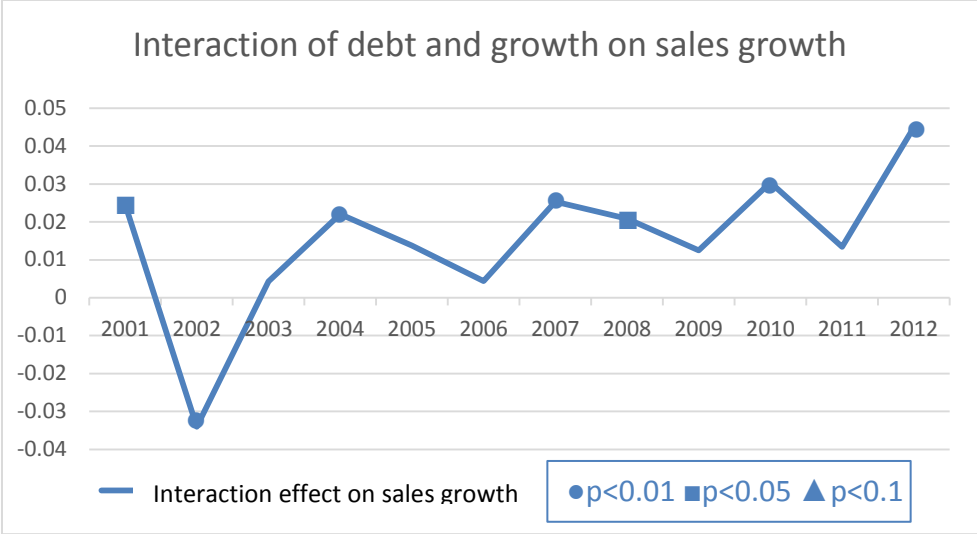


Figure 36: Interaction effect in sales growth model

Based on the discussion and the figure above, there seems to be limited support for hypothesis H.5. The pattern in the Dot-com crisis indicates that there could be a negative interaction effect between growth and leverage, since we see a clear drop in coefficient values during 2002. Here, our findings indicate a negative effect of prior growth on sales growth when leverage increases. However, this pattern does not repeat itself during the 2008-2009 recession. At the start of the financial crisis in 2008, the interaction effect between debt on growth is actually positive for next year’s sales growth. Additionally, as we can see in appendix A.2, the interaction term in the sales growth model contributes very little to the overall explanatory model, indicating that the interaction has limited economic significance. In sum, though we appear to observe the expected interaction effect during the dot-com crisis, the lack of economic significance leads us to conclude that evidence for H.5 is limited in the sales growth model.

We now turn to the asset growth model. The interaction effect on next year’s asset growth is generally negative, again with only sporadically significant relationships. As we can see below, there is a highly significant interaction effect in 2001, which persists in 2002 and 2003. There is then a (non-significant) spike in coefficient value in 2004, followed by a negative spike in 2005. After 2005, the interaction coefficient seems to be less negative overall, but only 2007 displays a significant interaction effect.

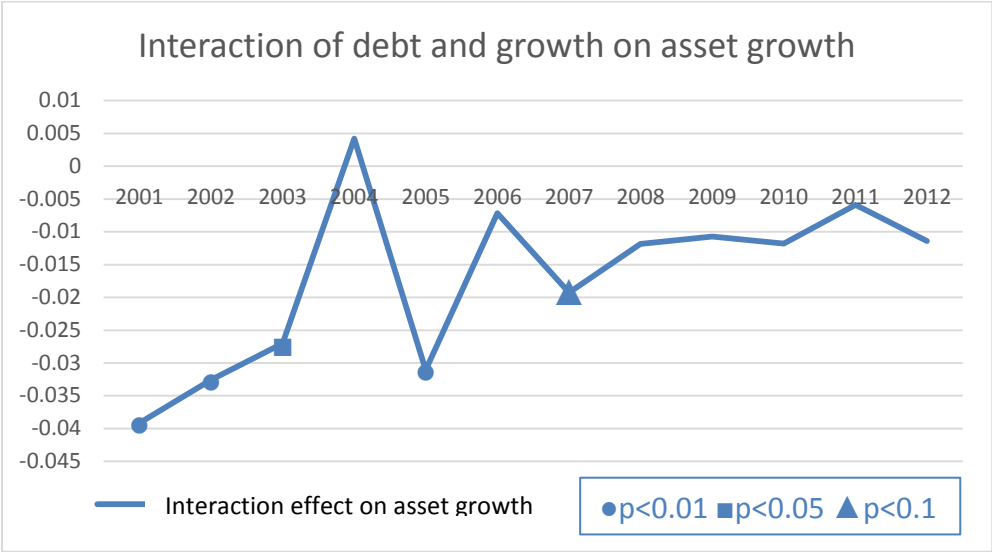


Figure 37: Interaction effect in asset growth model

Regarding hypothesis H.5, there again appears to be a negative interaction between growth and leverage in the dot-com crisis. As we frequently saw in the analyses of the individual effects, this finding is somewhat confounded by a sharp negative spike in 2005. Similar to the interaction effect in the sales growth model, the pattern from the dot-com crisis does not repeat itself during the 2008-2009 recession. Disregarding the potentially misleading result in 2005, these results lend support to the findings above: there seems to be a negative interaction effect during the dot-com crisis. However, the caveat once more is that the economic significance contributed by the interaction term was virtually zero. The conclusion in the asset growth model is therefore that evidence in support of hypothesis H.5 is at best modest.

Interaction effects in the profitability models

The interaction effect of debt and growth on next year’s EBITDA margin is negative for all observed values of the coefficient. This indicates that the moderation effect between debt and growth reduces EBITDA margins. In 2002 and 2003, the interaction effect is highly

significant. The surprising observation is again 2005, where we find the largest negative interaction of debt and growth on EBITDA margin t_1 , as well as highest level of significance. After 2005 significant coefficient values are rather stable, although positive spikes occur in years without statistical significance.

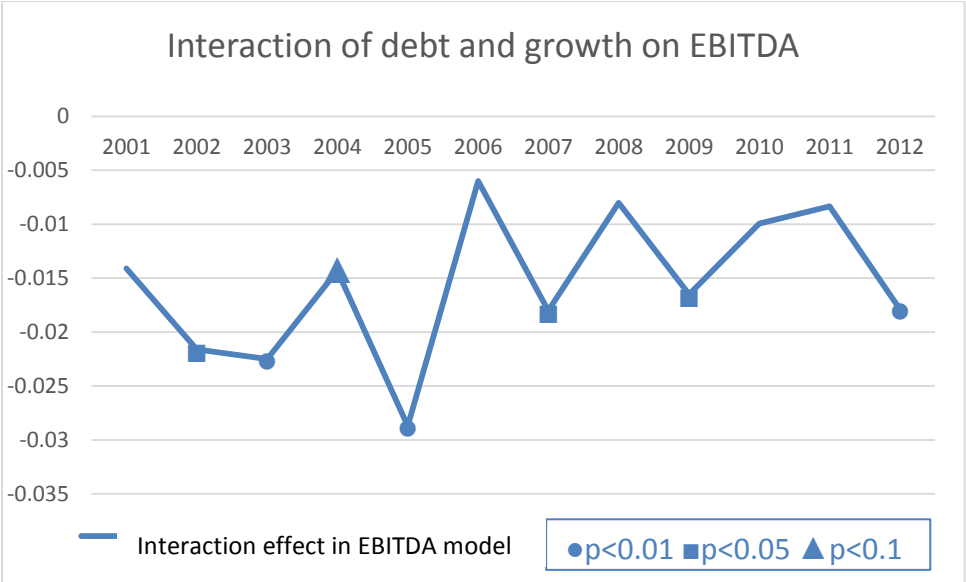


Figure 38: Interaction effect in EBITDA model

Regarding H.6, there is little support for our interaction hypothesis in the findings discussed above. If we disregard 2005, coefficient values in the dot-com crisis are marginally lower than the rest of the period, but the difference seems too low to justify support of our hypothesis. Furthermore, there does not seem to be any identifiable pattern in the 2008-2009 recession. In sum, the EBITDA model does not provide any support for hypothesis H.6.

We now turn to the ROA model. The interaction effect of debt and growth on next year's ROA follows the general pattern as in the EBITDA model. We observe a negative interaction term for all significant observations. The lowest value of the interactional effect was in 2001, after which the coefficient value increases in 2002. Coefficient values are then relatively stable when statistically significant. The exception is 2007, which sees a slight increase in coefficient values. When not significant, the values are generally somewhat higher. The second lowest observed value is at the start of the financial crisis in 2008, when the interaction effect is highly significant.

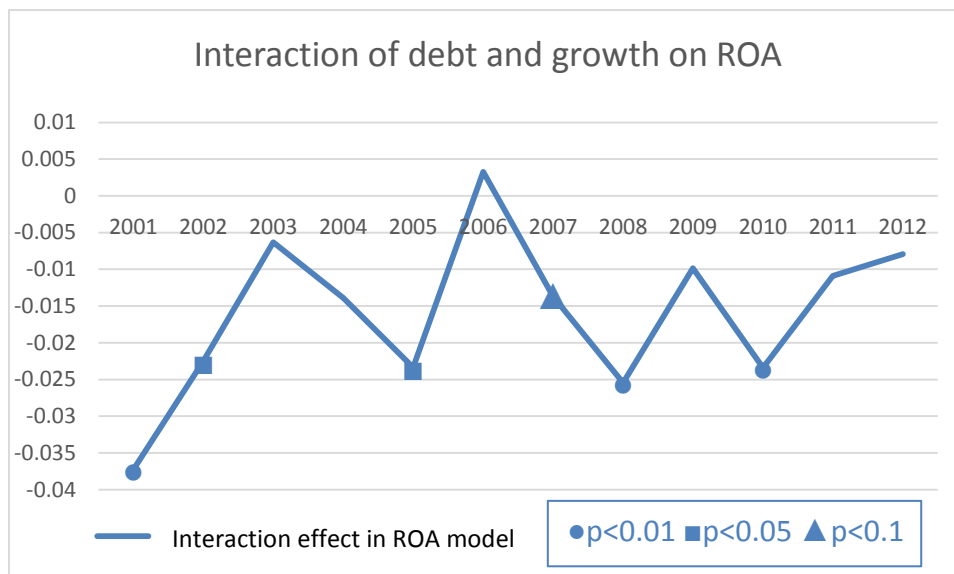


Figure 39: Interaction effect in ROA model

Similar to our findings above, there seems little evidence of a particularly negative interaction effect during recessions in the ROA model. Both 2003 and 2009, the most severely affected years, display statistically insignificant interaction terms. Moreover, recessionary years that do display a significant interaction effect, such as 2002 and 2008 do not show noticeably different coefficient values than normal years. The exception is 2001, which might provide further support for the presence of a negative interaction effect during the dot-com crisis. However, if the negative effect induced in 2001 was induced by a recession, we should expect the coefficient values to either remain low or drop during the more severely affected years of 2002 and 2003. Moreover, we again found that the interaction term had very little economic significance. The conclusion for the ROA model is therefore that highly limited support for hypothesis H.6 is found.

We briefly summarize the findings from our analysis of the interaction term. From our growth models we found partial evidence of a negative interaction term during recessions. It appeared that the dot-com crisis might have induced a negative interaction effect between debt levels and growth. The profitability measures are somewhat divided, with EBITDA margins showing no support, while the ROA model provided some evidence of an effect during the early stages of the dot-com crisis. Any inferences we make, however, are confounded by the highly limited economic significance of the interaction term across models. For example, as we can see in appendix A.2, the adjusted R^2 in the EBITDA model actually decreased upon including the term.

Accounting for non-linearities among the interaction effects

The findings above indicated little evidence of an interaction effect during recessions. However, we are not quite ready to give up on the interaction term yet. When investigating the individual effects of capital structure and growth we repeatedly found non-linearities in their effects on corporate performance. It seems reasonable to expect similar non-linearities in the interaction term. In other words, the interaction effect between our two main variables might depend on their levels. There are multiple approaches to testing for this. We chose to segment our sample based on the levels of prior growth and leverage. We did this by using the visual binning function in SPSS, as discussed in the methods section. We first split our datafiles into 10 equal percentiles based on prior growth levels, before doing the same based on debt levels. We subsequently ran multiple regression analysis for each percentile. Since non-linearities should be adequately captured by segmenting the sample into percentiles, we dropped the quadratic terms from the specification. The general specification therefore now reads

$$\begin{aligned} & \text{Performance measure}_{t+1} \\ &= \beta_0 + \beta_1 \text{Growth measure} + \beta_2 \text{Debt level} + \beta_3 \text{Debt level} \\ & \quad * \text{Growth measure} + [\text{Firm level control variables}] \\ & \quad + [\text{Industry level variables}] + \varepsilon \end{aligned}$$

We then compared interaction coefficient outputs of firms within the 10 %, 50 % and 90 % percentiles of debt and growth levels. When aggregating the developments for the three different percentile groups, this left us with 8 different graphs, one for each performance measures for both debt and growth percentiles.

Accounting for different levels of prior growth and debt yielded a small degree of support for our hypothesis. Below we present the models where we did find statistically significant and clearly identifiable patterns across business cycles. The other models are presented in appendix A.3. The orange lines represent interaction coefficient values of firms among those that have higher leverage or faster growth than 90 % of the rest of the sample. Conversely, the blue line indicates firms that are among the 10 % lowest leveraged or slowest growing firms. The dotted black line represents firms that have average debt or growth levels.

The first graph displays developments in the interaction coefficient values in the ROA model when the sample is split into different growth percentiles. As we can see, there is a significant negative interaction effect for both fast and slow growers during 2003, while industry-average growers experienced a positive effect. The negative interaction also occurs during the 2008-2009 recession, but now only for highly leveraged firms. Companies with the lowest growth levels now experience a positive interaction effect. Particularly the findings from the 90th percentile provides support for our interaction hypothesis, as we do not find an effect outside the recessions, and since these firms display different performance outcomes than firms in the 50th percentile. However, again the R² contributed by the interaction term is relatively low. For 90th percentile firms, the presence of the interaction effect increased explanatory power by an average of 0.03 percentage points in the four years it is statistically significant.

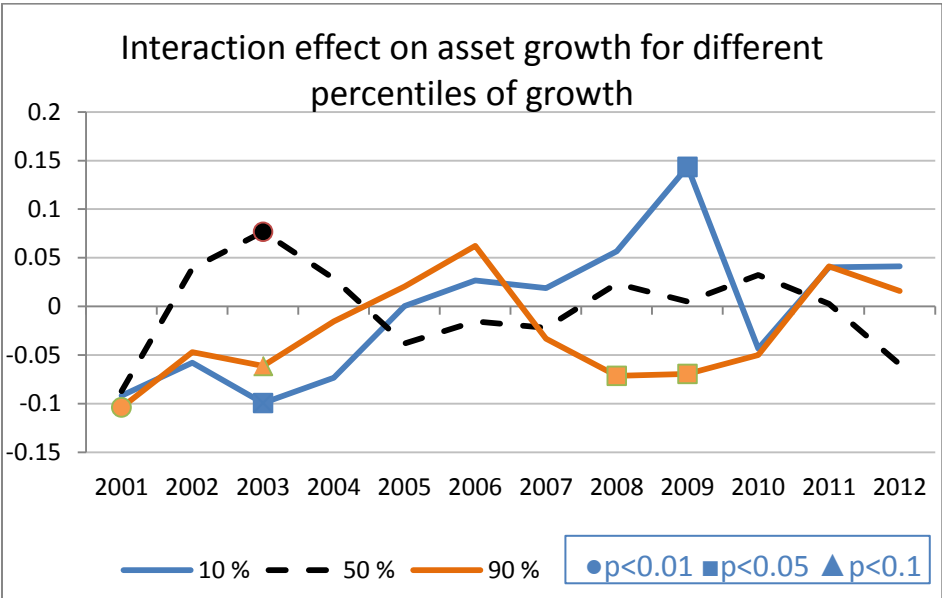


Figure 40: Interaction effects on asset growth for different percentiles of growth

The second figure displays developments in the interaction term’s coefficient values in the ROA model, now with the sample segmented into percentiles based on debt levels. As we can see, the highest leveraged firms (orange line) experienced a statistically significant and negative interaction effect of debt and prior growth in both 2003 and 2009. This interaction does not appear in any other year. This provides support for our hypothesis, which is further bolstered by a relatively high contribution to R². On average, the three significant coefficient values for 90th percentile firms contributed 1.29 percentage points to explanatory power. However, it is unexpected that we find a positive interaction effect in 2008. Furthermore, our

finding is somewhat confounded by a similar development in the firms with lowest leverage (blue line).

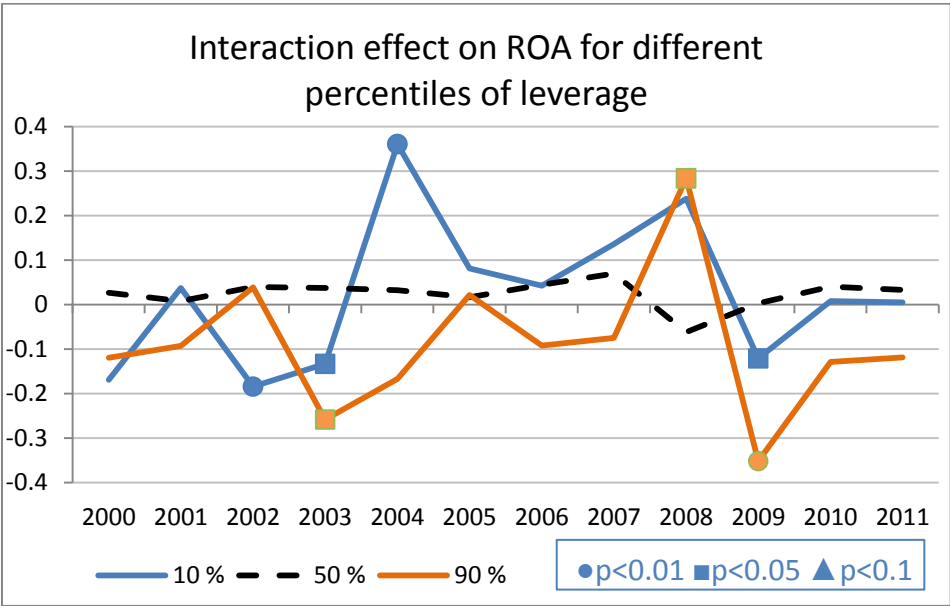


Figure 41: Interaction effect on ROA for different percentiles of leverage

In sum, these two models generated some support for the presence of an interaction effect during recessions. However, in the rest of the percentile graphs we find that the interaction term was statistically insignificant in most years, and did not yield any distinguishable patterns across business cycles in the majority of our models. Overall, therefore, only 2 out of 8 models provided any support for our hypothesis. Neither did we find any further evidence of a local interaction effect in the dot-com crisis, as indicated in the main interaction models. In sum, therefore, we have to conclude that attempting to account for non-linearities in the interaction term only yielded marginal support for our hypothesis.

When aggregating our analyses of the interaction effect between capital structure and growth, our conclusion is therefore that there is limited evidence in support of our interaction hypothesis.

5 Discussion

The previous chapter provided the findings from our analysis on the effects of growth and capital structure during recessions. We now provide a more in-depth discussion on how our findings can be interpreted, and the implications that follow. Again we follow the same structure as in the theory and analysis sections: First growth, then capital structure, and finally the interaction effect between the two.

5.1 Overall developments in recessions

As we could see in subchapter 4.2, the explanatory power of our models seemed to vary systematically during recessions. In the growth models, adjusted R^2 spiked during recessionary years, indicating that our models were better able to explain sales growth during downturns. This might make sense, since all explanatory variables were included on the basis that they covered a firm or industry characteristic that was important during recessions. In a model designed for explaining performance in recessions, then, increased explanatory power during downturns is as expected.

This argument, however, is confounded by the opposite effect on R^2 in the profitability models. There appears to be dips in explanatory power during downturns. This disparity in adjusted R^2 developments is highly interesting. One possible explanation could lie with the model for recessionary impact we presented in subchapter 2.2.1.2. Here we saw that the net effect of recessions is the sum of performance impacts, firm responses and an error term. Our point is that we are unable to differentiate between impact and firm response. Many of the measures firms undertake during recessions are likely to negatively impact their profitability, such as investments in human capital for temporarily superfluous workers (Lien & Knudsen 2013). These measures impact ROA and EBITDA margins, but we are unable to account for firms response. This could explain the dips in adjusted R^2 during recessions for our profitability models.

5.2 The effects of growth

In line with the structure of the analysis chapter, we start with the effects of prior growth on growth performance. To provide a theoretical foundation with which to discuss the effects of

recessions, we start by discussing mechanisms that could explain the general relationships we observe in normal years.

5.2.1 Prior growth on growth

The general effect

The key finding in our analysis of prior growth on growth performance in normal years was a positive growth momentum effect of rapidly growing firms. To briefly recap, we found a convex effect of growth in normal years, where high-growth firms were able to sustain their growth. More modest growers, however, experienced negative effects of prior growth on growth performance. This applied to both the sales and asset growth model. The relationship is visualized in the figure below.

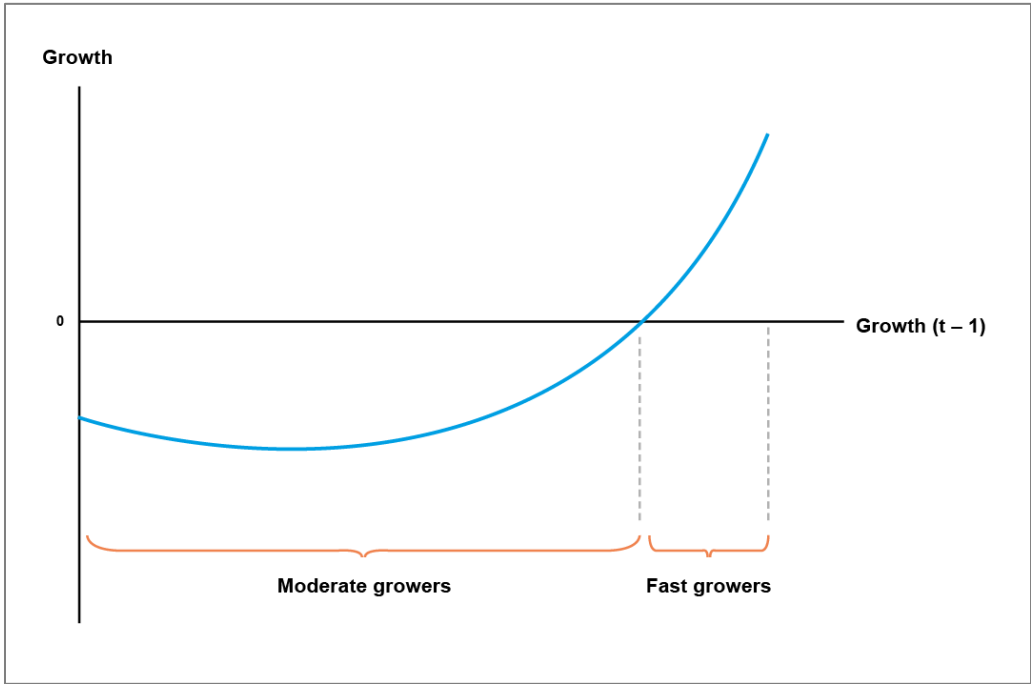


Figure 42: Effects of prior growth on growth performance in normal years

An explanation might be found through the optimum firm size theory. For simplicity we refer to firms in the negative growth effect interval as modest growers. If firms around industry average growth (modest growers), have surpassed their optimum size, we could expect the negative relationship between growth and performance we observed in the analysis chapter. When moderate growers surpass this optimal size threshold, further growth causes a negative performance effect, since increased bureaucracy and agency costs outweigh the economies of

scale realized through greater size. Fast growers could plausibly avoid this if they are relatively small firms, thus far below their optimum size. Our regression results provide some support for this, as our size measures indicate that smaller firms grow faster (size is negatively related to growth the following year). However, this argument seems flawed. We find no obvious reason to expect moderate growers to be particularly susceptible to overshooting their optimum size. If firms act rationally, they should observe diminishing marginal returns to growth, and cease growing when bureaucracy and agency costs exceed scale benefits. We therefore argue that the optimum size theory is unable to provide an adequate explanation.

Another possible explanation lies along the way of Gibrat's law, which stated that growth should be random. Though this theory technically predicts *no* relationship between prior growth and growth, the more general implication is that growth is very hard to maintain. This seems to resonate well with the average firm in our sample. We find that growth is immediately "punished" by a negative impact on growth the following year. This indicates a possible mean reversion effect, where growth rates quickly revert back towards industry average after a high-growth year. Though not quite in line with Gibrat's predictions, this explanation fits well with the general empirical findings on the inconsistency of firm growth rates (Geroski, 1999; Coad & Holzl, 2009).

However, the theory perhaps best suited to explaining our finding is the RBT model presented in subchapter 2.1.1.2. Firms with highly valuable and immobile resources or competencies are able to sustain their growth. Firms with inferior resource stocks, on the other hand, will suffer from the mean reversion effect discussed above. Seen in light of the RBT model then, firms that have $\rho_1 + \rho_2 > 1$ manage to maintain their growth momentum. More moderate growers ($\rho_1 + \rho_2 < 1$), or firms that achieve growth randomly (through $\varepsilon_i(t)$), are unable to maintain their growth rates.

What is still somewhat unexpected is the speed with which growth reverts towards industry mean. This effect occurs "instantly" the following year. This indicates that once a valuable resource base is lost, performance will deteriorate rapidly.

Our resource-based argument is supported by Davidsson, Steffens and Fitzsimmons (2008). They find that sustainable growth should be preceded by high profitability; otherwise both performance measures suffer in the long term.

The effect in recessions

We now turn to our main focus, the impact of recessions. The linear term in both growth models provided little evidence to support the hypothesis that prior growth negatively impacted industry average firms during recessions. Firms growing at industry average did not experience any particularly negative effects from their growth during the most severely affected years, 2002-2003 and 2009. This indicates that firms with industry average growth levels do not suffer from the negative growth effects documented by Knudsen (2014) and Geroski and Gregg (1996).

However, investigations of the quadratic term revealed that recessions negated the growth momentum effect we discussed above. This is visualized in the figure below, which shows the contrast to growth effects in normal years in figure 42.

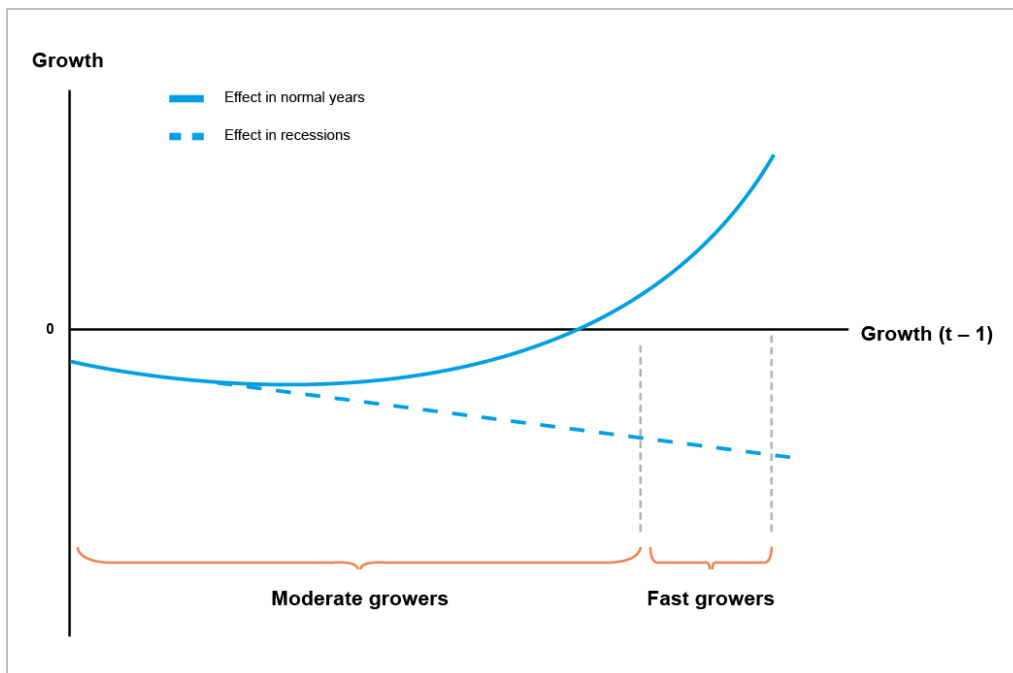


Figure 43: Effects of prior growth on growth performance in recessions

Returning to the discussion on RBT, this might indicate that recessions negate the positive growth effects stemming from superior resource stocks. In other words, even firms with $\rho_1 + \rho_2 > 1$ are unable to sustain their growth. An alternative method of viewing this is that the resource stock threshold for positive growth is raised higher than most (or any firms) are able to attain.

The effect of this is that downturns render even resource rich firms vulnerable to the general mean-reversion effect we discussed above. This has potentially great implications: recessions seem to negate the theoretical predictions from RBT, one of the most widespread theoretical views on competitive advantage. We now turn to discuss possible mechanisms that can explain this negation.

This negation effect might be partly explained by organizational inertia theory. During recessions, firms are faced with the sudden need for adaption. This change might be temporary, given that recessions have limited duration, but adaption might still be required. Fast growers might be particularly vulnerable if their quick growth has induced high inertia pressures. In conjunction with the capital flows model from Knudsen and Lien (2014), this might occur if high growers have large sunk costs in growth investments projects. In light of inertia theory, then, fast growers might be less agile and unable to respond, which leads to them suffering the same fate as their industry-average counterparts. However, inertia theory only brings us so far. According to Hannan and Freeman (1984) size is the main determinant of inertia, so to lend too much weight to growth in an inertia discussion might be ad hoc theorizing. To establish growth as an inertia driver, we would have to interact the growth variable on firm size, but this would fall somewhat outside the main focus of our thesis. We therefore leave this for future researchers.

A more plausible explanation, perhaps, could lie with fitness landscape theory. In normal times, firms with superior resource stocks lie on or close to peaks in the fitness landscape, which allows them to sustain growth. Modest growers lie farther away from peaks and closer to the ‘valley floors’. When recessions hit, the peaks can change shape, be reduced or even be completely removed, and new peaks can arise. In light of Geroski’s resource-based model, the total removal of a peak would involve obsolescence of a previously superior resource stock. If a new peak is created by the recession, reaching the peak could require entirely different resources or competencies. In the resource-based model, this can be modeled by assuming that the required resource stock for sustained growth changes from

$$\rho_1 + \rho_2 > 1$$

to

$$P_1 + P_2 > 1$$

where P signifies a different resource stock or portfolio. The threshold for sustaining growth is then not so much increased as it is changed. This could explain how previous high growers, who are able to maintain their growth, suddenly lose this ability during recessions. Their resource base no longer provides them with a relevant advantage because the downturn has changed the fitness landscape.

Another potential explanation could lie with the marginal customer theorem presented by Lien (2010). He argued that industries which experienced particularly high growth towards the end of boom period could have a large share of marginal customers, who were likely to exit the industry when the economy started contracting. If these marginal customers were the drivers behind fast growing firms prior to a recessions, we would expect to see the negative growth effect we observed above.

5.2.2 Prior growth on profitability

The general effect

In general, it seems prior growth has a negative effect on profitability margins in normal years. This is similar to the findings of Reid (1995), who also found a negative relation between firm growth and profit rates, but dissimilar to Chandler and Jansen (1992) and Mendelson (2000). This is also against many of our theoretical predictions.

A possible explanation could lie once more with diseconomies of scale. It seems, however, to be a somewhat unreasonable assumption that the majority of firms with industry-average and above growth have overshoot their optimum size. A similar argument could be presented against inertia theory. It is difficult to explain the general negative relationship between firm growth and profitability by inertia forces alone. If inertia effects induce negative profitability outcomes, why do firms continue to grow? Another argument against organization inertia in this context is that, given high external and internal inertia pressures, the negative effect of growth should be increased during times which heightens the need for adaption. We have spent some time discussion how recessions likely affect both customer and investor/creditor

preferences. The likelihood of increased adaption requirements during recessions is therefore high. The lack of a significant impact on the negative coefficient for growth on profitability during downturns for industry-average growers therefore speaks against organizational inertia as an explanation for the negative relationship.

A more plausible explanation lies with the capital flows model by Lien and Knudsen (2014). Here we saw that there was a connection between growth potential and capital outflows and inflows. In the theory, more mature and well-established firms are likely to have a solid influx of cash through earnings, but are likely to have fewer growth investment opportunities. Firms with high growth potential, however, are likely to spend the majority of their cash expenditures on growth investments. Their current profitability, on the other hand, might be very low, or even negative. This could explain the negative relationship we observe: Firms must 'decide' between focusing on current growth and future profitability, or on being profitable today. This would indicate that the negative year-on-year effect we observe turns positive in the long term. This would also fit well with the resource stocks-and-flows view we have focused on: it could take years to accumulate a sufficient resource stock to generate superior profitability. A less formal, but similar, explanation could be that growth firms simply do not focus on efficiency and profitability. This could be either because they spend their money and energy on growing, or if high-growth industries lack the market discipline to select away unprofitable firms.

The effect in recessions

As we saw from the analysis section, recessions did induce a negative growth effect when including the quadratic term. During both the dot-com crisis and the 2008-2009 recessions, and for both profitability measures, there was evidence of a negative quadratic effect. The aggregate effect is visualized in the graph below.

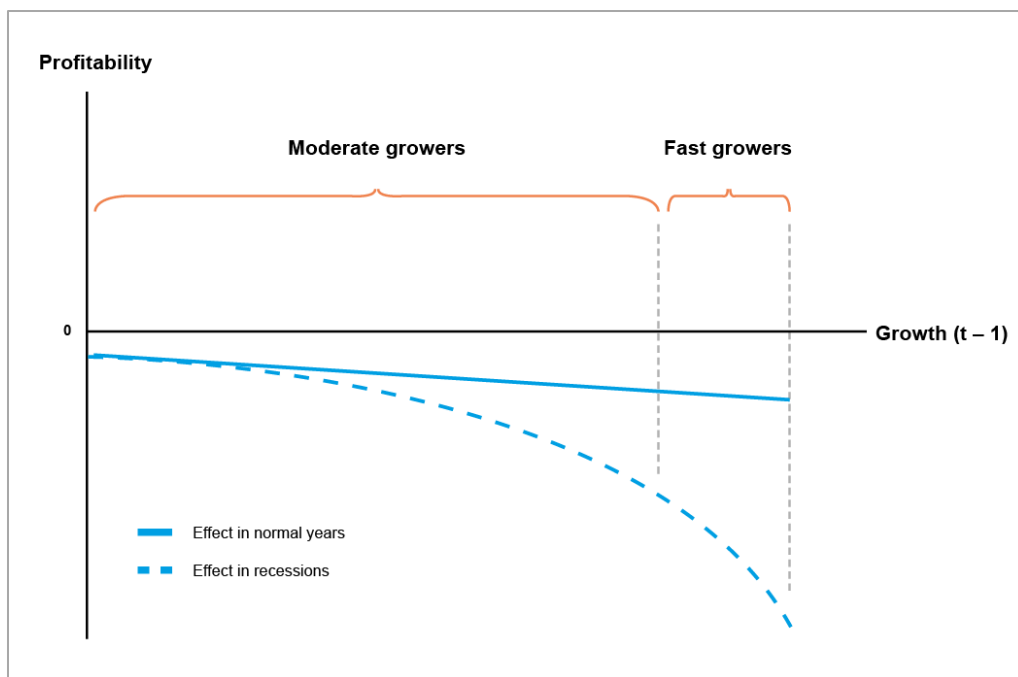


Figure 44: Effects of prior growth on profitability performance during recessions

The implication is that during recessions, the linear negative relationship we discussed above is turned into a concave negative relationship. In other words, recessions seems to punish fast growers relatively more than moderate growers. We again turn to the capital flows model to explain this. A key implication from the theory was that, in normal times, investors and creditors are indifferent to the period in which profitability occurs. Firms that are highly profitable today can be valued the same as firms with low or even negative profitability today, but with perceived high future profitability potential.

As we saw in the discussion on recessions, however, this intertemporal productivity indifference was likely to break down during recessions, when investor and creditor preferences became biased towards current profitability. Our findings provide support for the predictions made by the capital flows model. It seems like investors and creditor's productivity indifference is largely removed during recessions. This would explain the negative relationship between prior growth and profitability induced by recessions.

Another potential explanation could again lie with the combination of resource-based model and fitness landscape theory. As we argued in the theory section: If resources are the driving factor between growth, we can assume they would also cause high profitability. If recessions abruptly remove or reduce peaks in the fitness landscape, as we discussed above, this would

cause a relatively larger impact on firms close to the peak. For example, given the complete removal of a fitness peak, a firm located on the top would suffer a performance drop equal to the entire height of the peak. Firms on lower altitudes would suffer relatively less. If there is a relationship between resource bases, fitness and growth, high performers should therefore suffer relatively more during downturns than other firms. This could explain the negative relation between high prior growth and negative profitability performance in recessions.

5.3 The effects of capital structure

Similar to the discussion on the effects of prior growth, we start with capital structure's effect on growth performance, before discussing effects on profitability. Again we start with the general relationships we observe in normal years, before moving on to the effect of recessions.

5.3.1 Capital structure on growth

The general effect

A surprising finding in the analysis section was the disparity between the coefficient signs in the sales and asset growth models. In the sales growth model, the linear term was not significant until 2006, but afterwards there is a general positive relation between debt and growth, with a negative quadratic term. In total, this indicates a concave relationship where high leverage has a negative effect on growth. However, the asset growth model predicted the reverse general relationship – negative linear values with a frequently positive quadratic term. This created a convex relationship. However, as we pointed out in the analysis chapter, the squared debt level term in the asset growth model adds very little economic significance, so we choose to disregard the quadratic effect in the asset growth model. The statistical significance of the squared term can be attributed to the large sample we used. This can cause the statistical power of our t-tests to register even minimal impacts of the independent variables on performance as statistically significant (Keller, 2009). This leaves us with the linear term, which displayed negative values throughout the period. The relationships are illustrated in the figure below.

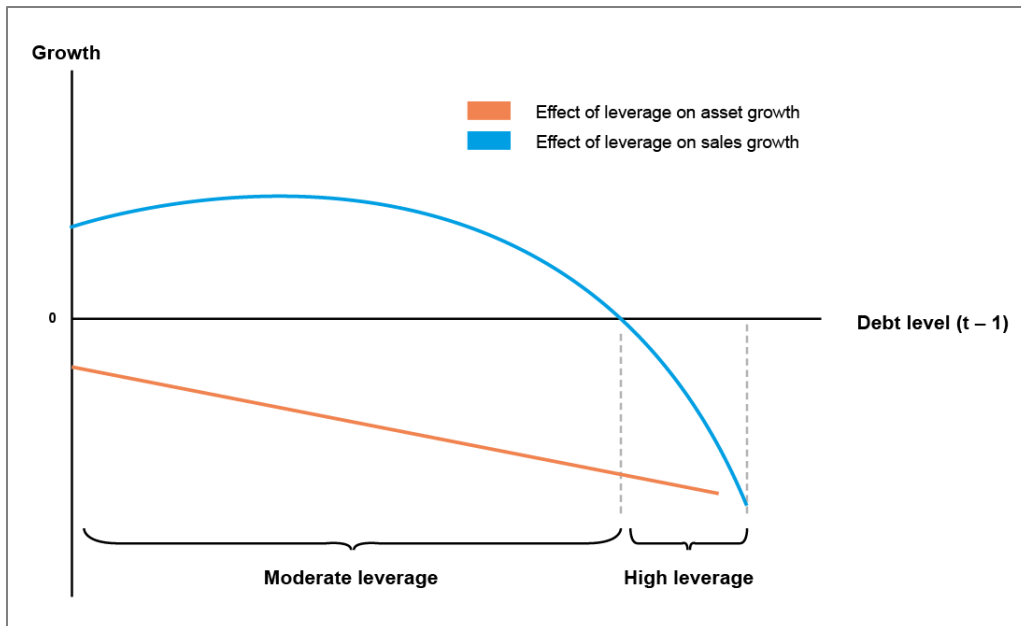


Figure 45: Effect of capital structure in normal years

The positive effect of moderate leverage on sales growth can be partially explained by capital opportunity cost theory. Assuming moderately leveraged firms face profitable growth investment prospects, the opportunity cost of withholding capital should incentivize firms to invest the money in growth. At some point, the ability to finance investments through retained earnings is exhausted. If firms' preferred alternative method of financing investment is through credit, this would explain the positive relationship between leverage and growth we observe. However, this cannot explain the non-linearity that eventually turns the leverage-growth relationship negative.

Potential explanations for the non-linearity can lie with debt overhang theory. An implication from debt overhang theory is that there exists some threshold where debt starts causing underinvestment issues. A fully equity-financed firm, for example, is unlikely to start forgoing growth investments if they increase leverage by, say, 10 percentage points. It is more likely that a substantially higher debt rate would be required for underinvestment to become an issue. This could plausibly occur in the transition between moderate and high leverage, causing the negative effects of high debt levels. Debt overhang theory is therefore fully compatible with our observations.

It is harder to explain the non-significance of the linear debt level variable prior to 2006 in the sales growth model. This indicates that firms with industry-average leverage did not have any capital structure effects on sales growth between 2000 - 2005. This finding is, of course, consistent with the Modigliani-Miller theorem, but it is hard to explain why these particular years should display such a relationship. Furthermore, this pattern does not replicate in the asset growth model, and the presence of a significant quadratic term during the period indicates that as we move away from industry average, this finding no longer holds.

Moving on to the asset growth model, we now have to explain the overall negative effect of leverage on growth. The negative relationship is incompatible with capital opportunity cost theory and the capital flow model. It is, however, in line with findings from Rajan and Zingales (1995) and Titman and Wessels (1998), who also found a negative relationship between debt and growth. That high levels of debt have a negative effect on growth could be explained by debt overhang theory, but given our reasoning above, it cannot reasonably explain the negative relationship for moderately leveraged firms. A possible explanation could lie with pecking-order theory. Contrary to debt overhang theory, this theory implied that underinvestment problems can arise at any debt level. The overall negative relationship could for example arise if firms have to disclose proprietary information or pay flotation costs, causing them to forgo investment opportunities and therefore reducing growth.

The effect in recessions

Our finding in recessions was that recessions exacerbated the negative effect of debt found in normal years. Since the findings in the asset and sales growth model were somewhat disparate, we discuss them separately. We start with the sales growth model. Though the linear debt term was not significant in the sales growth model during the dot-com crisis, the squared term was significant and negative throughout the downturn. This indicated an increasingly negative relation between debt and sales growth during the dot-com crisis. The developments in the linear term from 2006 and onwards also provided support for our hypotheses. Though the relationship did not turn negative, we saw a sharp decline in coefficient values during the 2008-2009 recession. Simultaneously, the negative value of the quadratic coefficient value increased in downturns. In sum there is a combined effect on sales growth: the positive slope of the linear term is reduced, while the threshold for negative leverage effects is lowered. This is illustrated in the figure below, where the dotted line signifies the impact of recessions.

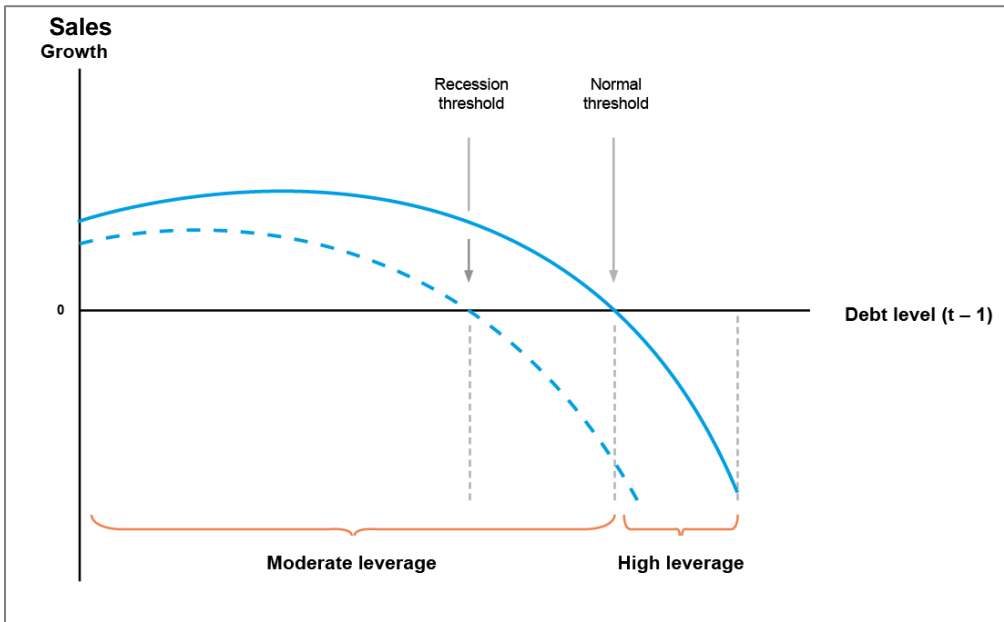


Figure 46: Effect of debt on sales growth during recessions

Turning to the asset growth model, we have a similar effect for the linear term. We observed a clear decrease in coefficient values during recessions. Since we disregard the quadratic term in the asset growth model due to low economic significance, we can model the effect of recessions in the graph below.

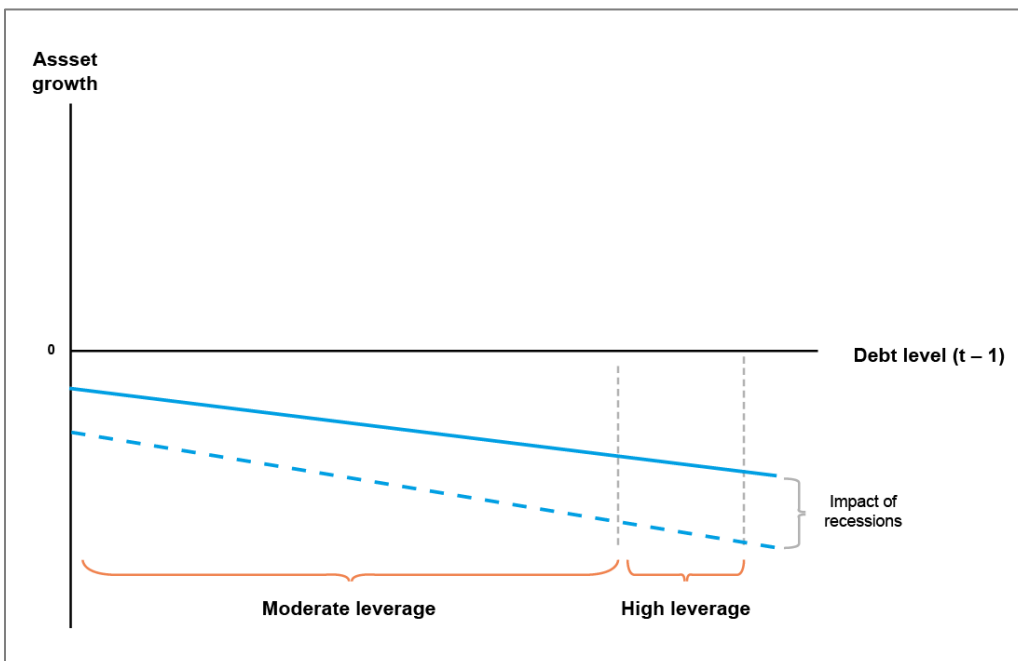


Figure 47: Effect of debt on asset growth during recessions

How can we explain these effects? An explanation might be that downturns exacerbate the mechanisms of debt overhang and pecking-order theories mentioned above. We start with debt overhang theory. If creditors increase their requirements for providing credit to highly leveraged firms during a recession, this would provide further incentive for managers to forgo investment opportunities. This seems a reasonable assumption if creditors base their lending conditions on perceived risk, as uncertainty increases during recessions (Schaal, 2012). Managers either delay growth investment decisions, or they discard them completely, because investments would basically transfer value from shareholders to creditors due to the disproportionately high interest rates or unfavorable debt covenants. In essence, then, recessions lower the threshold for 'harmful' leverage in the debt overhang theory, effectively causing underinvestment problems to occur for lower levels of debt.

The reduction in the linear term can be explained by pecking-order theory. As recessions reduce customer demand, so will they reduce the internally generated funds of firms. As we saw, the preferred option is then to seek external credit. However, with a tightening of credit availability, they might instead be forced to issue new equity. This would only be done as a last resort, and might cause underinvestment issues if firms anticipate a reduced valuation due to negative market responses. In sum, recessions could force firms down the pecking-order, to the point where they refrain from investing in growth opportunities due to the lack of internally generated funds, and the likelihood of being punished by market forces. This could occur for all levels of debt, which would explain the uniform increase in the negative effect of debt.

Another explanation could lie with the theories we presented on capital structure's implication for product market outcomes. One of the predictions was that as debt increases, so does the vulnerability to predation from other firms. This could be a plausible explanation for the worsening negative relationship between debt and growth we observe during downturns. Recessions are likely to exacerbate the vulnerability of highly leveraged firms to predatory moves. Such firms are poorly equipped to deal with, say, prolonged price wars in the first place, since they are dependent on maintaining margins to continuously service and renegotiate loans. Downturns are likely to induce some reduction in growth by themselves, as we saw in the descriptive statistics chapter. Predation might then exacerbate this effect. Moderately leveraged competitors can exploit the weakened high-debt firms, either to capture market shares or completely drive them from the market. The end result is that highly

leveraged firms end up with reduced market shares or go bankrupt. In practice, this could occur if for example heavily leveraged firms are unable to match price cuts by competitors over time due to low financial reserves. This seems reasonable in light of capital opportunity cost theory, which predicted that highly leveraged firms should have lower financial reserves because the alternative cost of hoarding capital was greater. This can cause leveraged firms to lose market shares, and experience negative growth as the end result. Another mechanism could be that leveraged firms have to maintain a certain price level to service debts, preferring to forsake market shares to price-cutting competitors over a reduction in profitability. These effects could explain the developments we observe in the effects of debt on growth. This explanation is in line with findings in Chevalier (1995a; 1995b), Titman and Parsons (1988) and Zingales (1998).

A related effect that could also explain the pattern we observe are risk compensation costs paid to suppliers and customers. Suppliers may view the highly leveraged firm as risky may demand a premium as compensation for higher risk, due to potential asset specificity in mutual investments. This could cause leveraged firms to forgo investment opportunities, if they are unable or unwilling to accept supplier risk premiums. Suppliers could also choose not to enter into asset specific investments with risky firms. The same argument might apply to customers, especially for products with high switching costs. Customers who purchase such goods might instead turn to companies they anticipate have a better chance of surviving. They therefore minimize anticipated losses from switching costs. This could then lead to reduced markets shares, particularly for highly risk-averse customers.

5.3.2 Capital structure on profitability

The general effect

We found a general positive linear effect of leverage on both EBITDA and ROA across the period. The squared debt level on EBITDA margins show that, outside recessions, there is an increasingly positive relationship with debt and profitability. The squared debt level on ROA was also frequently significant and positive outside relationship. The combined linear and quadratic effects therefore indicate a convex relationship in normal years, where the positive marginal effects of leverage on profitability are increasing. The relationship is illustrated in the figure below.

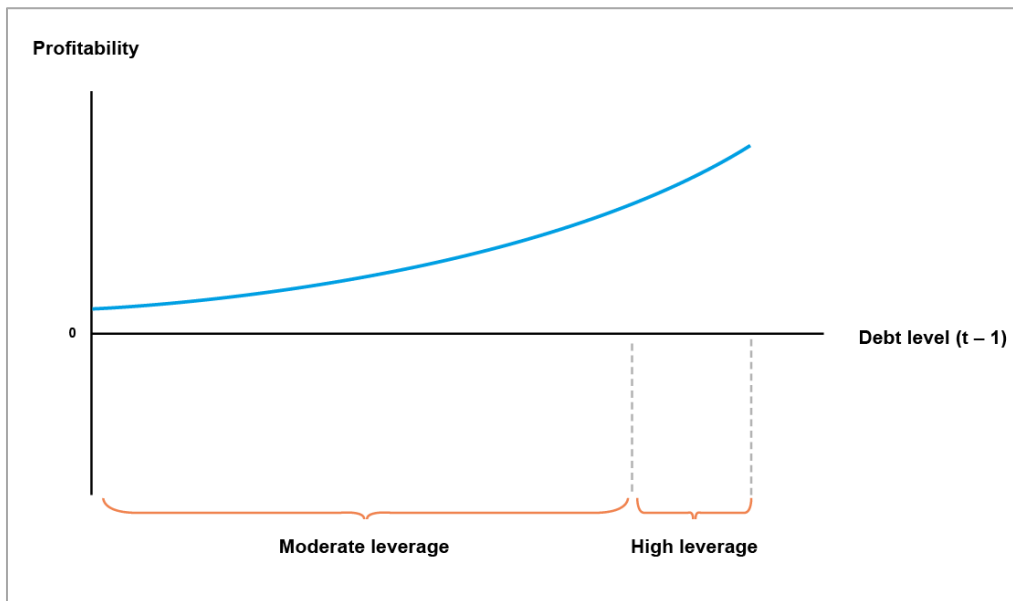


Figure 48: Effect of debt on profitability in normal years

This is somewhat unexpected given our theoretical predictions. Our findings seem to fit poorly with the Modigliani-Miller theorem, but this is not too surprising given the wide range of market imperfections that could arise. However, many of our theories predicted a negative relationship between debt and profitability. Our findings seems to run contrary to pecking-order, debt overhang and product market outcome theories. In light of the capital flows model of Knudsen and Lien (2014) this is also a surprising finding. Our findings also run contrary to the empirical findings of Hurdle (1974) and Shubita & Alsawalha (2012), but are consistent with Abor (2005) and Gill, Biger and Mathur (2011).

One theoretical explanation could lie with the capital opportunity cost theory, which stated that firms with a large amount of profitable investment opportunities would often need to rely on external financing. Given that these projects provide above-average returns, this would explain the positive relationship between leverage and profitability we observe.

It could also be partially explained by trade-off theory. We know from Gartner (2009) that boom periods typically involve positive outlooks in capital markets. This might reflect an overall reduction in perceived firm bankruptcy risk of creditors. According to trade-off theory, as perceived bankruptcy risk decreases, the optimal debt ratio of firm increases. In retrieval and expansion phases, the presences of decreasing bankruptcy costs could explain

the positive relationship between debt and profitability: it becomes less costly for firms to issue more debt, allowing them to reap further tax shield benefits. Some evidence for this can be seen in the wake of the financial crisis, where the interest rates in Norway were relatively low (even though this was hardly solely caused by optimistic creditors). However, trade-off theory has its limitations in this application. It seems unreasonable that reduced risk perceptions of creditors should induce an increasingly positive relationship between debt and profitability.

Though we struggle to explain the positive effect we saw above, we now turn to the more central issue: how the relationship changed during recessions.

The effect in recessions

As we saw in the analysis section, the positive quadratic effect of debt on profitability was reversed in both profitability models during recessions. This means that the relationship turns from convex to concave, indicating that firms with sufficiently high leverage suffered reduced profitability in downturns. This finding is illustrated in the figure below.

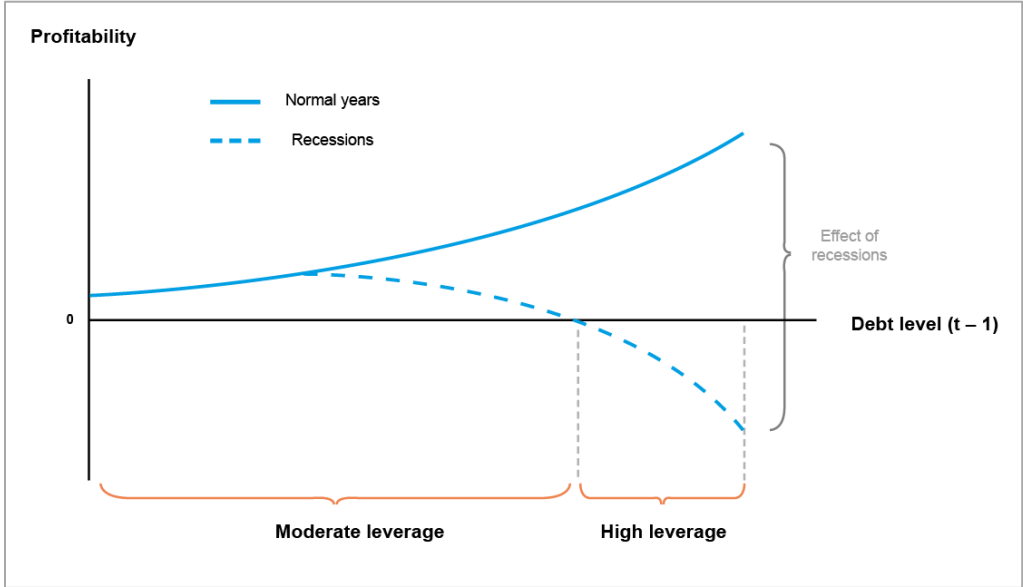


Figure 49: Effect of debt on profitability in recessions

Similar to the sales growth model, we find a threshold effect where leverage has positive influence on growth until a critical debt level is reached. After this point, debt has a negative effect on performance.

How can we explain this finding? Debt overhang theory can again provide a potential explanation. The underinvestment problems associated with exceeding the leverage threshold can credibly be thought to also reduce profitability. If firms are faced with a more or less stable portfolio of potential positive NPV projects, the introduction of a recession can cause several of these projects to become unfeasible. As we argued above, downturns are likely to increase creditors' perceived risk, therefore increasing lending rates, incurring stricter debt covenants and generally making debt more costly for firms (Bernanke, Gilchrist & Gertler, 1991). In light of debt overhang theory, this would exacerbate managers' incentives to avoid investments, even in positive NPV projects, because potential profits will accrue to creditors. Effectively, it causes a uniform reduction in the estimated returns on investments, which increases as creditors' perceived risk (i.e. leverage) increases. This could explain the decline in profitability for highly-leveraged firms during recessions. However, it seems counterintuitive that this effect should occur so quickly. A sudden increase in underinvestment problems should intuitively take several years to affect the profit margins of firms.

We argue that more plausible explanations might lie with trade-off and product market outcomes theories. We start with the latter. The arguments we provide here are largely analogous to the effects of leverage on growth. Predatory moves by competitors are likely to also affect profit margins. Price wars in particular can be used as an explanation for our observations. Our reasoning is similar to above: Highly indebted firms should be more vulnerable and unable to sustain lower profit margins over time. The effect of reduced margins might be compensated by increased sales volume. However, we know from Knudsen and Lien (2014) and Gartner (2009) that recessions are likely reduce overall demand, so a large increase in sales quantity following a price reduction is unlikely. The net effect of a price war should therefore be reduced profit margins, where highly leveraged firms are particularly vulnerable.

Risk compensation costs to suppliers and customers might also affect profit margins. Similar to the discussion above on growth, high perceived default risk among potential suppliers might cause underinvestment problems in mutually beneficial projects with high asset specificity. This might force highly leveraged firms to turn to more expensive supplier options, where the need for relation specific investments is lower. Suppliers could plausibly also stop delivering services and goods on credit, or charge premium credit rates. One recent

example could be the Radioshack bankruptcy, where suppliers started demanding extra compensation because of their high perceived risk of default (Forbes, 2015). The net effect is reduced profitability during recessions.

As mentioned, another explanation could be found with trade-off theory. Assuming most firms have identified and reached their optimal capital structure prior to a recession, introducing a negative shock on bankruptcy costs would cause a uniform decrease optimal capital structure. This could for example occur through an increase in perceived risk of creditors, as discussed above. This would in turn increase the marginal cost of holding debt, as firms would have to provide additional compensation to creditors in exchange for higher bankruptcy risks. If bankruptcy risk increases disproportionately for highly leveraged firms, it could also explain the negative quadratic effect.

This concludes our discussion of the individual effects. We now turn to the interaction effect between capital structure and growth.

5.3 Interaction effects between growth and capital structure

As we could see in the analysis chapter, we found little evidence of an interaction effect between growth and capital structure in recessions. In the main interaction analysis, without splitting the sample into percentiles, we found some evidence of a negative interaction effect during the dot-com crisis. However, this pattern did not replicate itself during the 2008-2009 recession, and the finding was further weakened by low economic significance.

We then split our sample into percentiles based on prior growth and debt levels to account for non-linearities in the interaction effect. Even though this generated some findings that supported our expectations, 6 out of 8 models did not yield results that supported our hypothesis of a negative interaction effect between debt and growth during recessions.

This is somewhat surprising. Our theoretical predictions regarding the combination of these factors predicted the presence of a negative interaction effect during recessions. Furthermore, our empirical findings above indicate that both high growth and high leverage, when studied

in isolation, could affect performance negatively during recessions. The lack of findings on the interaction effect is therefore unexpected.

A possible explanation for why we do not find an interaction effect is, of course, that there is none. However, because of the many theoretical and empirical indications that there should be an interaction between debt and growth, we have explored some possibilities for why we might have been unable to document its presence. One explanation could lie with survivor bias. In short, this is a flaw in our research design that leaves us unable to account for firms that go bankrupt, engage in voluntary liquidation or otherwise cease operations. Therefore, the impact of our different independent variables on corporate performance is only measured for firms that “survive” from one year to the next. It could be argued that heavily indebted, fast growing firms might have experienced sufficiently negative impacts from recessions that they go bankrupt before we were able to register the negative interaction effect. However, while this might underestimate the interaction effect, it seems unlikely that it should remove it completely. It seems unlikely that the majority of fast growing, high-leveraged firms should go bankrupt. Survivor bias can therefore only partly explain the lack of an interaction effect.

Another partial explanation might lie with the recessionary impact model we presented in 2.1.2.2. A limitation of our research design is that we are unable to separate the impact of recessions from the responses of firms. The error term in the model further illustrates the difficulty of accurately measuring the impact of recessions. Our point is that the measures firms during various recessions could affect their performance to such a large degree that we are unable to identify an interaction effect. A related argument is the difficulty of identifying the precise time of impact of recessions. As we have argued before, firms can be severely affected during the second and first half of two consecutive fiscal years, but otherwise perform well. The effect on annual data is then contaminated by this ‘distorted’ performance drop. However, we again arrive at the conclusion that while this might influence our results, it seems far-fetched that such effects should completely remove the interaction term with such a large sample.

A final explanation for the lack of an interaction effect we present is the possibility that capital structure and prior growth influence performance at different stages during a recession. Knudsen and Lien (2014) identified two main effects of recessions: a change in investors and creditors’ preferences, and a change in customers’ preferences. Particularly during the 2008-

2009 recession we had a severe financial crisis before the real economic crisis developed. This might have caused creditors and investors' preferences to change before customer preferences. This implies that the effects of capital structure impacted firms before the negative impact of prior growth. In other words, the mechanisms of debt overhang and pecking order theory might occur before, say, inertia effects and marginal customer effects. This would indicate that the worst effects of high debt have already impacted firms by the time customer preferences changes starts affecting performance. If this holds, and the 2008 financial crisis was worse than the onset of the dot-com crisis, this would also explain why we found traces of an interaction effect in 2001-2003 but not in the 2008-2009 recession.

A brief summary of the discussion

What have we learned from the discussion of our findings? It seems that both capital structure and prior growth have negative impacts on performance of firms during recessions, at least when studied as isolated variables not interacted with each other. A recurring theme in our findings is the presence of non-linearities in the relationships between our main variables and our performance measures. The results of these non-linearities all indicate that particularly fast growers or highly leveraged firms either are the only ones affected by the negative effects we document, or are more severely affected than their more 'moderate' counterparts. As a rule, we seldom found effects in the linear terms, indicating that industry-average growth or leverage was not sufficient to experience particularly severe impacts from recessions. The exception to this was debt's effect on growth performance, where firms with industry-average leverage also suffered negative consequences during recessions. As we saw from the recent discussion, we struggled to document an interaction effect between capital structure and growth.

5.4 Causal mechanisms

As stated in the methods sections, this thesis has a descripto-exploratory focus. This means that the causal pathways growth and capital structure take when impacting firm performance have not been explored in great detail. We have compared our findings to the theoretical predictions we arrived at in the theory section, but we have not tested whether our findings can be attributed to specific mechanisms. There could therefore be alternative, "unseen" mechanisms that are the real causation behind our findings.

Scope restrictions aside, there are two mechanisms we would like to briefly explore under an explanatory lens. First, we wanted to investigate one of the key theoretical predictions our thesis is based on: the removal of the “intertemporal productivity indifference” theorem of investors during recessions, as presented in Knudsen and Lien’s (2014) capital flow model. Second, we have spent a great deal of energy on separating industry effects from idiosyncratic firm effects. The second question we would like to have answered was therefore: To which degree does industry affiliation provide a path for recessionary impact?

We start with the first question. A natural way to test the intertemporal productivity indifference thesis would be to investigate how prior profitability affects performance in recessions. In the cash flow model, firms with high recent or current profitability would likely be considered safe and therefore attractive for investors during recessions. In contrast, firms of equal value, but low current profitability would likely be punished by investors and creditors in downturns. However, previous profitability likely encompasses a host of different effects, including the general “proficiency” of firms, as well as their resource base. The number of effects captured by the profitability variable confounds a clear interpretation. Therefore, we instead use the ratio of fixed assets to total assets as a proxy for firms’ attractiveness during recessions. We argue that fixed assets could be an appropriate proxy if future growth investments in the current period are intangible or uncertain. This assumption seems especially justifiable for R&D-intensive growth projects, or long-term investments that rely on favorable forecasts to be attractive. Given our assumption, this means that firms with high growth potential and modest performance today have little current collateral to offer creditors. If the indifference theorem holds, we should expect a positive relation between the ratio of fixed assets and firm performance during recessions, but not in normal times.

Below we have graphed the coefficient of the fixed assets ratio variable against our different performance measures. The results are from the full specifications presented in subchapter 3.4.1.5. When looking at the fixed assets ratio impact on performance, we see an unambiguous relationship during both crises. In three of four performance measures it appears that the ratio of fixed assets positively impact firms during recessions. The positive relationship between fixed assets and performance is consistent for both the Dot-com crisis and the financial crisis of 2008. As we can see below, the general picture painted in the sales growth, asset growth and ROA models seems to be positive significant values in both crises,

and weak or no relationship in normal years. This effect does, not replicate in the EBITDA model. The unexpected effect in the wake of the 2008 financial crisis is that the favorable effect on performance from increasing fixed assets seems to persist in the retrieval period as well. This might be contributed to the turmoil created by the crisis, and the fear of a “double dip” scenario for the world economy.

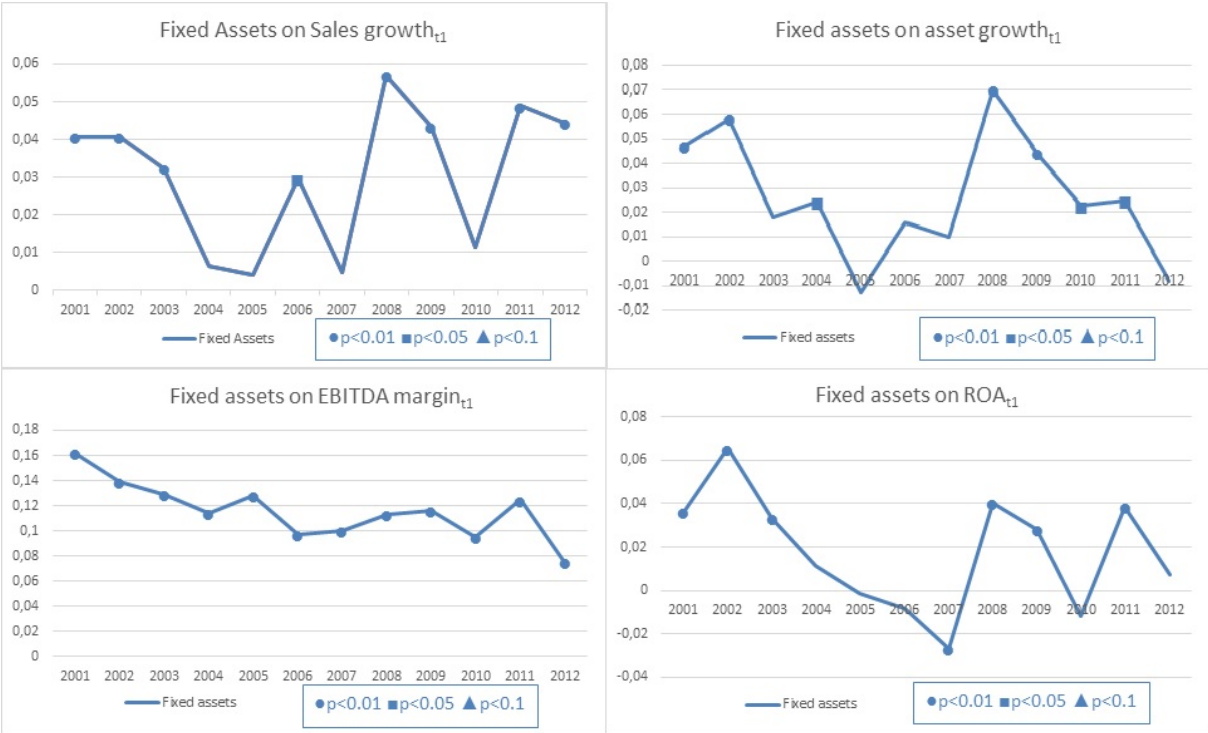


Figure 50: Effects of fixed assets ratio on performance

Overall these findings provide solid support for the removal of the intertemporal productivity indifference theorem during recessions. We see that the downturns during the 2000s appear to induce a positive relationship between short term solidity and performance, which otherwise is not present. The removal of this effect could therefore be an important causal pathway for capital structure and growth effects during recessions. The removal of the intertemporal productivity indifference of investors and creditors also indicates that recessions have a myopic or shortsighted selection effect, which punishes firms with high future growth potential but low current performance.

The second question we wanted to explore was the degree to which industry affiliation provided a pathway for recessionary impact. Since we use aggregated industry-level impairments as a control variable for how severely an industry was impacted by recessions,

we are able to explore this in further detail. These results are also collected from the full specifications. As we can see, the coefficient values for industry impairment in the sales growth, ROA and EBITDA models display a sharp negative spike in 2009, the most severely affected year of the 2008-2009 recession. An interesting finding is that this effect does not replicate as clearly during the dot-com crisis. This leads us to believe that the financial crisis in 2008 differs from the dot-com crisis in the way recessions were channeled by industry affiliation. The industry impairment effect on asset growth is more nuanced, and show negative effects of industry affiliation on asset growth in the start of the dot-com crisis, as well as before and after the 2008-2009 recession. What these findings do clearly indicate is that firms in high-impairment industries were likely to suffer performance issues during the 2008-2009 recession. This indicates that, at least during the 2008-2009 recession, industry affiliation provided an important channel for recessionary impact. This is an interesting finding, as it indicates that some industries are inherently more vulnerable to recessions than others. Firms affiliated with such industries might have to take additional counter-recessionary measures.

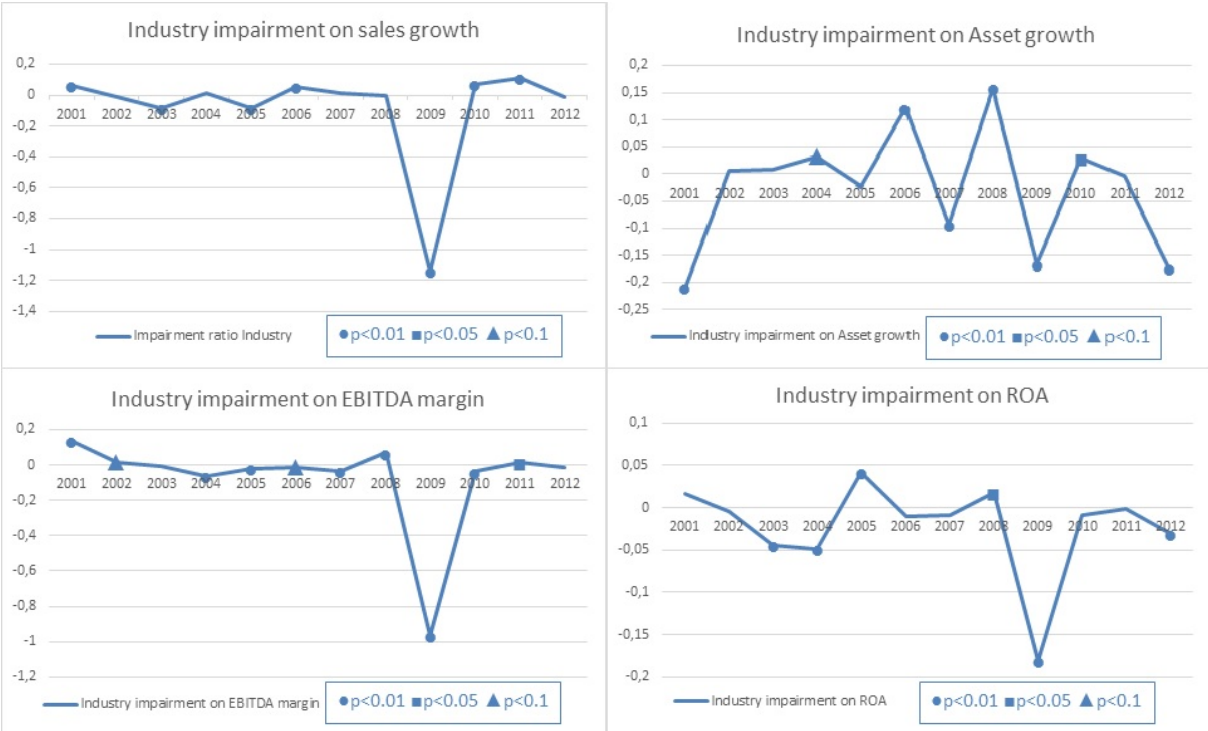


Figure 51: Effects of industry impairment on performance

The third causal mechanism we wanted to investigate was the effect of credit constraints on corporate performance. Since the databases included Dunford & Bradstreet's internal credit rating of all companies, this is also something we can explore in greater detail. Credit rating effects on performance can give us some insights into how the lack of access to external finance influenced firms' performance during recessions. Unfortunately, the data is only available after 2005. The reference variable for the credit rating dummies is low credit rating, and the results in our graphs are therefore the effect on performance from having high credit rating, relative to having low credit rating. As we can see in the figures below, the sales growth, asset growth and EBITDA models do not significant effect before the 2008-2009 recession. When the brunt of the real economic downturn hits the Norwegian economy in 2009, we find a significant, positive effect of high credit rating on all performance measures. This provides an expansion on the finding we introduced in the descriptives, that the crisis created increased standard deviation in the debt levels of firms. When access to credit got restricted during the financial crisis of 2008, the firms qualifying for high credit ratings had easier lending constraints and better access to credit than firms with low credit rating. For firms with high credit rating, this induced better performance than for their low rating counterparts. Another interesting finding is that the positive performance effects of high credit rating does not end after the recessional years, as high credit rating continues to significantly outperform low credit rating in the years after the crisis. Although we are not able to fully explore the causal reason for this continued relationship, we see that it fits with the findings from fixed assets argument, which also persisted in the retrieval period.

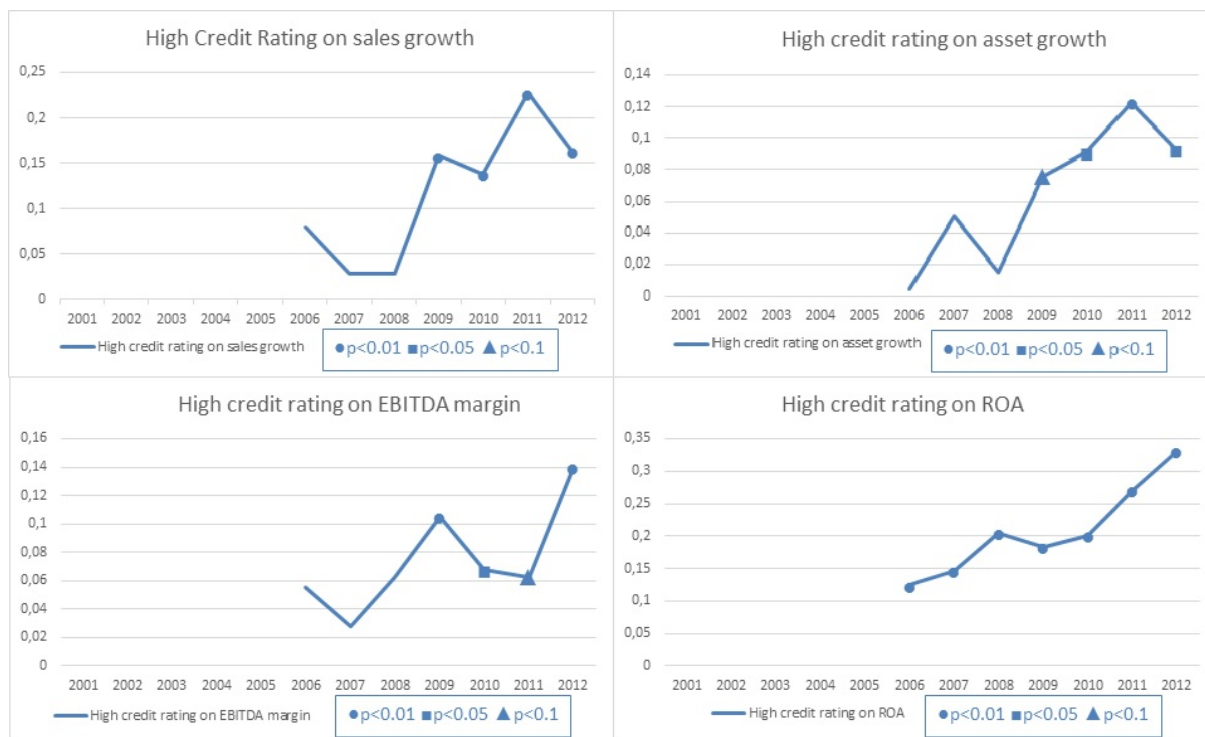


Figure 52: Effects of high credit rating on performance

This finding provides support for credit constraints as a causal pathway for reduced performance during recessions. According to Campello et al. (2010), credit constraints could influence performance of firms through forcing them to reduce their number of employees, marketing expenditures, or paying premium interest rates on debt.

However, using credit ratings as a proxy for credit constraints suffer from severe reverse causality bias. We argue that the credit rating of a firm has a causal impact on performance, but a firm's prior performance could very plausibly also influence credit ratings. Therefore, the causal conclusions we can make based on this variable is somewhat limited.

5.5 Limitations

In this subchapter we sum the limitations of our thesis. Most have been mentioned before, so this serves mostly to collect the strands. One of the drawbacks with our method of shifting the regressions across individual annual databases is survivor bias. We cannot account for firms that for various reasons go bankrupt. This might have incurred an underestimation of the effects of debt and growth during recessions, and confounded our attempts at identifying an interaction effect between the two.

Another weakness is that the impact of recessions is not uniformly implemented. Firms are affected at different times. For example, export-oriented industries such as fish farming might have experienced effects relatively quickly. The shipbuilding industry, however, might ‘feel’ the impact of recessions in financial statement data only when back orders are completed and fresh orders have stopped coming in. This is exacerbated by only having access to yearly data. A firm might, for example, do very well in the first half of 2009, and then suffer a severe drop in performance during the last half of the year. On a yearly aggregate, this would only register as a moderate drop in performance.

Moreover, as we saw from the model of recessionary impact presented in subchapter 2.2.1.2, we cannot account for the measures or responses firms take when hit by recessions. These actions can influence the total impact of recessions positively, negatively or not at all, but with our data we are unable to control for them.

Another limitation regarding our data is the low precision of industry NACE codes. As we demonstrated in the methods section, these are of moderate quality, and since all our data are adjusted for industry average, this could potentially impact our results substantially.

5.6 Future research

We would like to point out that we have only scratched the surface of the effects of capital structure and growth. Though we have established some broad patterns, we believe much can be gained from testing specific causal mechanisms that channel the impact of recessions. Are the negative effects of recessions caused by managerial underinvestment problems, as posited by pecking-order and debt overhang theory? Or can it be attributed to the removal of the intertemporal productivity indifference of creditors and investors? We have provided some brief explorations of a few causal pathways, but we have not given them the attention they deserve.

We also believe future research could benefit from using different approaches to generating or acquiring data. One method could be to aggregate the individual datasets and use panel data techniques to investigate the effects of capital structure and growth further. An advantage of this would be to eliminate survivor bias, since panel data could account for firms going

bankrupt. Another approach that would also alleviate survivor bias in estimations would be to investigate the effect of capital structure and prior growth on bankruptcy rates. A third potentially fruitful approach could be to combine survey and financial statement data, similar to Knudsen (2014). This could generate more precise estimations on the time of impact of recessions, and allow for controlling for many of the firm and industry characteristics we had to exclude from our analyses, such as durability of products or industry concentration.

We also believe much gain be gained from conducting analyses on individual industries. Though the NACE codes are far from perfect, we saw above that industry affiliation is an important pathway for recessionary impact. Furthermore, the fact that certain industries are more vulnerable to downturns merits further investigation. Though the subject has been explored internationally (Petersen & Strongin, 1996) and domestically (Lien, 2010; Knudsen, 2014), it can still be investigated further.

Furthermore, while we have identified some clear effects of growth and capital structure during recessions, we also saw in the discussion of model R^2 that they account for a modest share of the variation in our performance measures. We know from the descriptive statistics that all performance measures suffered noticeably during the recessions we investigated. An important direction for future research will therefore be to identify which variables are the ‘main actors’ in this context.

Moreover, our research indicated that particularly fast growers or highly leveraged firms either were the only ones experiencing negative debt or growth effects during recessions, or they experienced these negative effects more strongly. We believe a fruitful approach could be to investigate these subsets of firms in greater detail. This approach has received some attention, for example Brynhildsrud (2013), but could benefit from improved econometric methods.

Although our interaction variable showed little promise in our model, future research could further and explore the possibility of interaction effects between other variables of interest. One possibility could be to test interaction effects between the quadratic debt level and growth variables. Interacting size on growth is another option, which would allow for testing the effects of inertia theory in greater detail.

As previously mentioned, we have only scratched the surface with this thesis, but this was also the intention of this thesis. Hopefully we have provided a useful foundation for future research, as well as some directions for which it can take.

6 Conclusion

The purpose of this thesis was to investigate empirically the effects of prior growth and debt level on corporate performance in recessions. We found that combined studies of growth and capital structure had seldom been performed before, even though these are central and mutually determining attributes of firms. Furthermore, and arguably an even greater omission, was that existing literature has been relatively quiet on the subject of firms performance outcomes in recessions. We therefore aimed at performing a broad exploratory study on how debt and prior growth affected firm outcomes during the two economic downturns in the 2000s. Our sample was a selection of approximately 20 000 Norwegian firms over the period 1999-2012. The sample was analyzed using multiple regression analysis, with subsequent comparison of developments in coefficient values across the business cycles in our period. A large part of our research involved testing for interaction effects and non-linearities in our main variables. To our knowledge, testing for interaction effects and non-linearities in capital structure and growth's effect on corporate performance has never been done before.

In our analysis of prior growth on growth, we find that a negative linear term combined with a positive quadratic term creates a convex effect in normal years. This indicates that fast growers are able to maintain their growth momentum, but that more modest growers are subject to a mean-reversion effect where prior negatively affects growth the following year. The interesting finding during recessions is that the momentum effect of fast growers disappears, rendering them vulnerable to the general mean reversion of the rest of the sample. We argue that this finding is consistent with implications from the resource-based model, fitness landscape theory and the capital flow model.

Regarding the effects of growth on profitability, we find that in normal years there appears to be a general negative relationship between prior growth and both ROA and EBITDA margins. Our finding in recessions is that downturns appear to exacerbate this negative effect. We again found a non-linear relationship, which indicated that growth had an exponentially negative effect on profitability outcomes during recessions. We found that this result could be explained with the capital flow model and combined insights from resource-based theory and fitness landscape theory.

When we analyzed the effects of capital structure on growth we found slightly disparate results in our asset and sales growth models for normal years, as these predicted negative and positive relationships, respectively. Both models were, however, predicted a negative effect of recessions. Again we find evidence of a non-linear relationship, where highly leveraged firms suffered exponentially increasing negative effects on growth. We argued that this finding was consistent with debt overhang, pecking-order and product market outcome theories.

Investigating the effects of capital structure on profitability we found a generally positive and convex relationship in normal years, where debt had an increasingly positive effect on both our profitability measures. We find that recessions completely reverse the positive quadratic effect of leverage on ROA and EBITDA, indicating that downturns punish highly leveraged firms. We argued that this finding could be explained by product market outcomes theories, debt overhang and trade-off theory.

We did not find definite evidence of an interaction effect between prior growth and capital structure during recessions. There were indications of the expected negative interaction effect during the dot-com crisis, but a lack of a similar effect during the 2008-2009 recession coupled with low or negative contributions to R^2 led us to conclude with the lack of an interaction effect. Given our theoretical discussion and empirical findings on the individual variables this was somewhat surprising, since both indicate a negative relationship with corporate performance in recessions. We therefore expected an interaction effect. In an attempt to explore possible interaction effects further, we split our sample into 10% percentiles based on firm debt and prior growth levels. This was done to account for possible non-linear relationships in the interaction effect. However, this method too yielded only marginal support for our interaction hypotheses. We therefore conclude that we were unable to document any interaction effect between capital structure and growth during recessions.

In our causal mechanisms subchapter, we briefly explored some potential theoretical mechanisms that could explain the negative effects of prior growth and leverage on performance outcomes in recessions. We found that the fixed assets ratio does not show any significance relationship with performance in normal years, but during recessions there is a significant positive effect of possessing fixed assets. The finding indicates discrimination against intangible assets by creditors and investors during crises, and provides support for the removal of the intertemporal productivity indifference theorem. We also found evidence that

industry affiliation provides an important causal pathway for recessionary impact during the 2008-2009 recession. Our results indicate that there was no real performance effect from industry affiliation until 2009, where a substantial negative effect from being affiliated with high-impairment industries can be observed. Our third finding on causal mechanisms was that credit constraints appeared to induce a significant negative impact on firms during recessions. After the onset of the crisis, firms qualifying for high credit rating experienced positive effects on performance, compared to firms with low credit rating.

We conclude that both growth and capital structure have been shown to substantially impact firms during recessions. A recurring theme in our findings is the presence of non-linear effects. Our findings indicate that many of the negative effects of recessions are either only experienced by high growth or leverage firms, or that these firms experience more severe effects. The second general conclusion is that we were unable to document the presence of an interaction effect between capital structure and growth. Finally, we wish to round off by stating that we have only scratched the surface of the effects of capital structure and growth in recessions, and we hope that this thesis can provide a platform for future research.

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Appendix

A.1 Inflation rate index

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
0.8895	0.9165	0.928	0.9511	0.9553	0.9705	0.9924	1.0000	1.0379	1.0599	1.0860	1.0995	1.1079

A.2 R² increases for different specifications

Sales growth

R ²	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Control variables	.051	.107	.040	.035	.080	.040	.037	.042	.133	.026	.037	.033
Δ Incl. debt level	.001	.001	.000	.001	.001	.002	.001	.001	.001	.001	.001	.003
Δ Incl. sales growth	.001	.006	.001	.002	.002	.002	.002	.001	.002	.002	.002	.002
Δ Incl. Interaction term	.000	.000	.000	.001	.001	.000	.003	.000	.000	.000	.000	.000
Δ Incl. sq sales growth	.000	.001	.000	.002	.002	.001	.001	.002	.000	.001	.001	.003
Δ Incl. sq debt level	.001	.002	.002	.003	.003	.002	.003	.002	.003	.002	.000	.002

Asset growth

R ²	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Control variables	.073	.069	.033	.040	.042	.068	.063	.063	.118	.056	.038	.053
Δ Incl. debt level	.004	.016	.011	.011	.006	.002	.005	.006	.012	.008	.004	.006
Δ Incl. sales growth	.004	.003	.003	.001	.004	.002	.002	.003	.005	.002	.001	.004
Δ Incl. Interaction term	.002	.000	.000	.000	.000	.000	.000	.002	.000	.000	.000	.000
Δ Incl. sq asset growth	.002	.003	.002	.003	.002	.002	.001	.002	.002	.003	.001	.002
Δ Incl. sq debt level	.000	.000	.000	.000	.001	.000	.000	.000	.000	.001	.000	.000

ROA

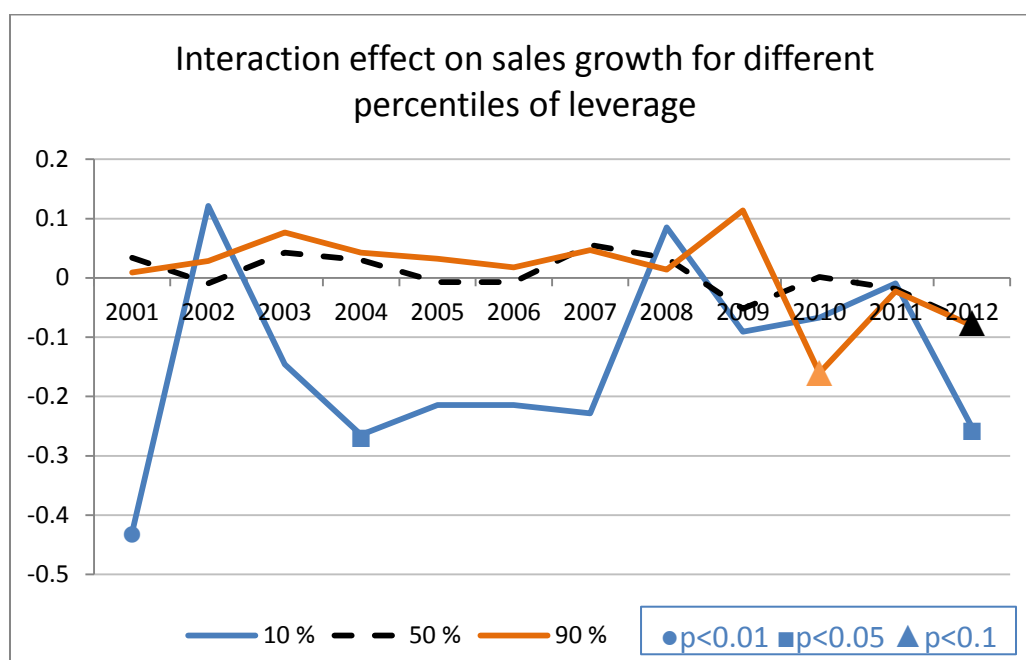
R ²	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Control variables	.262	.225	.144	.273	.271	.323	.338	.325	.257	.316	.376	.339
Δ Incl. debt level	.009	.017	.017	.025	.031	.011	.022	.030	.033	.018	.026	.031
Δ Incl. sales growth	.010	.009	.019	.013	.008	.006	.005	.009	.019	.005	.005	.007
Δ Incl. Interaction term	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Δ Incl. sq sales growth	.020	.033	.001	.012	.001	.003	.005	.001	.042	.001	.002	.003
Δ Incl. sq debt level	.003	.009	.011	.002	.014	.017	.001	.004	.026	.013	.005	.006

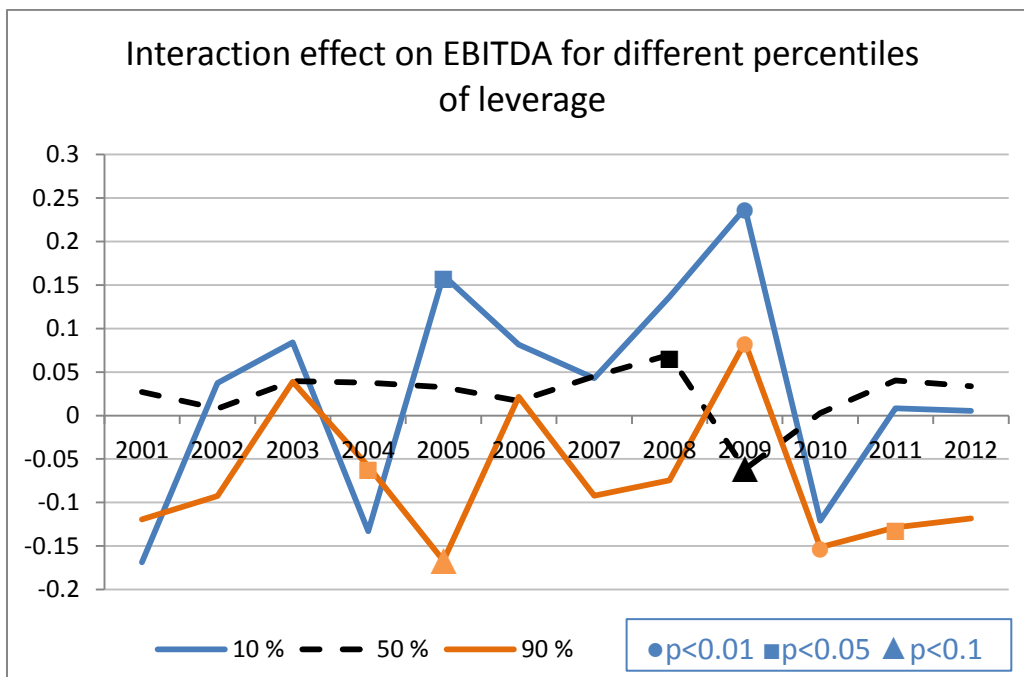
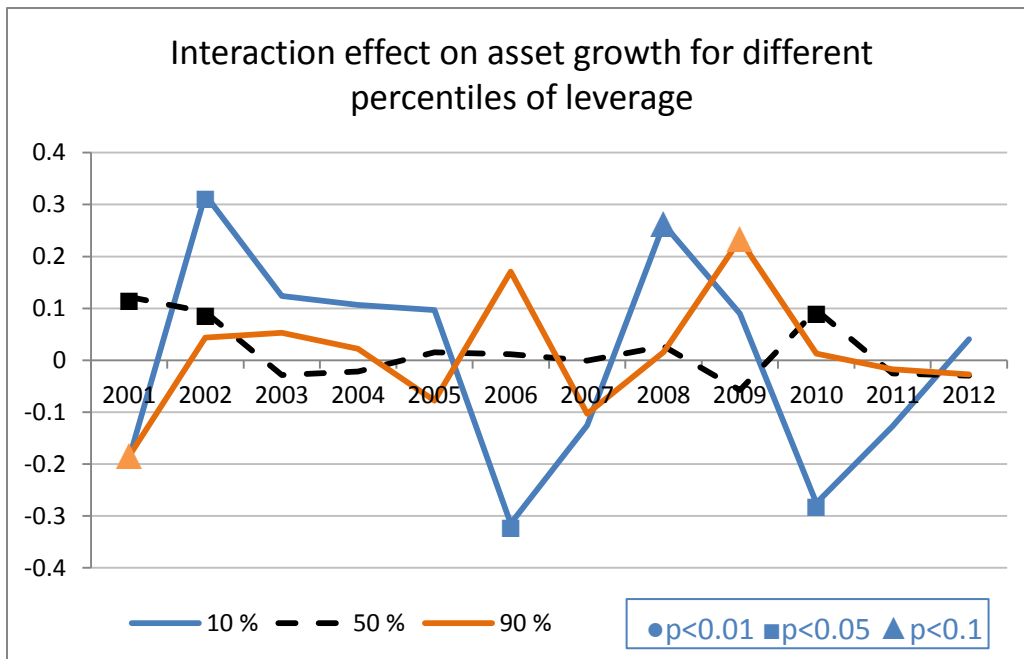
EBITDA

R ²	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Control variables	.383	.373	.421	.445	.431	.465	.459	.464	.415	.425	.449	.423
Δ Incl. debt level	.000	.008	.008	.006	.004	.008	.003	.007	.003	.002	.011	.072
Δ Incl. sales growth	.006	.009	.011	.001	.004	.003	.001	.011	.006	.003	.003	.010
Δ Incl. Interaction term	.000	.000	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Δ Incl. sq sales growth	.022	.003	.001	.012	.019	.013	.005	.001	.022	.005	.007	.009
Δ Incl. sq debt level	.009	.011	.007	.004	.006	.009	.013	.015	.016	.007	.004	.009

A.3 Interaction effects in the segmented sample

We first present the interaction effects in performance models with sample segmented on debt level. The firms in the 90th percentile had the highest levels of debt, and vice versa in the 10th percentile.





Below are the interaction coefficient developments for models where the sample was segmented based on prior growth.

