# Corporate Capital Structure and Product Quality*

Julia Hensel†

October 26, 2011

Master Thesis in Economics
at the Stockholm School of Economics

**Abstract**

Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure suggests that firms commit to providing high quality products by means of a low debt-to-equity ratio. I empirically test this theoretical prediction by examining the effect that product quality has on a firm's leverage. I use US firm level data on product quality ratings from the KLD STATS database as well as financial information regarding debt-to-equity ratios from Compustat between 2003 and 2009. Using a pooled ordinary least squares, an industry fixed effects, as well as a firm fixed effects regression estimation of the partial adjustment model of leverage, this study can confirm that firms that offer products with high quality choose low leverage ratios as predicted by Maksimovic and Titman (1991). Nevertheless, this result is not robust to controlling for firm size and other standard control variables for leverage. A potential explanation is that firms which are small in size provide high product quality, but the choice of leverage ratio of these firms originates rather in firm size. Thus, I conclude that product quality per se does not have an effect on leverage for my sample of firms and reject Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure on the basis of this analysis.

**Keywords:** Capital structure, Product quality, Customers, Implicit contracts, KLD rating

**Tutor:** Erik Lindqvist

*I would like to thank my tutor Erik Lindqvist for valuable comments and support. Wharton Research Data Services (WRDS) was used in preparing this master thesis. This service and the data available thereon constitute valuable intellectual property and trade secrets of WRDS and/or its third-party suppliers.

†40055@student.hhs.se

# Contents

# List of Tables

# 1 Introduction

A firm's bankruptcy is costly for its customers, since implicit contracts between the firm and its customers, such as for future servicing or the availability of spare parts, become invalid. A literature has evolved, which links the effect of a firm's bankruptcy on customers to the capital structure choice of the firm, i.e. debt-to-equity ratios also called leverage (see e.g. Titman, 1984). It is generally assumed that a high debt-to-equity ratio increases a firm's bankruptcy risk, since debt holdings can cause cash flow problems in case of financial difficulties. Theoretical and empirical studies suggest that firms, whose liquidation can impose high costs on their customers and other stakeholders, choose capital structures with low debt-to-equity ratios to reduce stakeholders' concerns about bankruptcy. A different stream of literature suggests that even firms that do not suffer from an immediate threat of bankruptcy choose low debt-to-equity ratios in order to signal commitment to non-financial stakeholders, if these firms can impose high costs on their stakeholders in the event of liquidation (see e.g. Maksimovic & Titman, 1991). More specifically, Maksimovic and Titman (1991)'s theoretical model suggests that firms commit to providing high quality products by means of a low debt-to-equity ratio, even if customers do not suffer from potential liquidation costs. Since product quality is often observed only after the purchase, it is important to understand whether market imperfections can lead a levered firm to reduce product quality in order to increase current cash flows, even if the firm is far from bankruptcy. Taking the airline industry as an example, one implication would be that not only safety and maintenance procedures of airlines should be examined, but also their financial statements to determine an airline's incentive to offer a good quality product, in this case a safe flight (Maksimovic & Titman, 1991). To the best of my knowledge, no study has empirically tested the theoretical prediction of Maksimovic and Titman (1991) that high product quality has a negative effect on a firm's debt-to-equity ratio. A similar study by Bae, Kang, and Wang (2011) was able to confirm the theoretical prediction of Maksimovic and Titman (1991)'s model for the case of employees, showing that firms commit to providing high employee benefits by means of a low debt-to-equity ratio. I add to the existing literature by testing Maksimovic and Titman (1991)'s model for the case of customers, examining the relationship between product quality and leverage.

I empirically test whether high product quality has a negative effect on a firm's leverage, using US firm level data on product quality ratings from the KLD STATS database (short for Statistical Tool for Analysing Trends in Social and environmental performance) as well as financial information regarding debt-to-equity ratios from Compustat between 2003 and 2009. Using a pooled ordinary least squares, an industry fixed effects, as well as a firm fixed effects regression estimation of the partial adjustment model of leverage, this study can confirm that firms that offer products with high quality choose low leverage ratios as predicted by Maksimovic and Titman (1991). Nevertheless, this result is not robust to controlling for firm size and other standard control variables for leverage. A potential explanation is that firms which are small in size provide high product quality, but the choice of the leverage ratio of these firms originates rather in firm size. Thus, I conclude that product quality per se does not have an effect on leverage for my sample of firms and reject Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure on the basis of this analysis.

The remainder of this paper is organised as follows. First, I give an overview of the relevant literature and clarify in what respect my work adds to previous research in section 2. In section 3, I describe the sample selection procedure and explain how the measure of a firm's product quality is constructed. Furthermore, I present summary statistics of the sample firms and show that controlling for firm size, industry and year with the procedure of nearest neighbour matching leaves significant differences between firms with high and with low product quality. Moreover, I introduce a set of control variables, which have been established as determinants of leverage in previous research. In section 4, I describe the partial adjustment model of leverage, identify empirical challenges when estimating the model and specify a pooled ordinary least squares and a fixed effects regression model. I present and interpret the results of these two regression models and show that I have to reject my hypothesis that product quality has a negative effect on a firm's leverage. The paper closes with a conclusion in section 5.

## 2 Previous Literature

The capital structure irrelevance theory, stating that the value of a firm is unaffected by how the firm is financed in the absence of taxes, was developed by Modigliani and Miller (1958). Since then a literature has evolved analysing market imperfections under which capital structure does have an effect on firm value even in the absence of tax shields. The research has primarily focused on stakeholders and their explicit contracts with the firm as explanations for capital structure choice, such as stockholders and banks. A different stream of research acknowledges the importance of a firm's non-financial stakeholders, such as customers, employees, and suppliers, and their implicit contracts with the firm for capital structure choice in addition to the explicit contracts (see e.g. Titman, 1984; Maksimovic & Titman, 1991). Titman (1984) suggests that firms, whose liquidation can impose high costs on their customers and other non-financial stakeholders, choose capital structures with low leverage in order to commit to their implicit contracts. Titman's theoretical model as well as empirical evidence supporting his prediction are examined in subsection 2.1. Maksimovic and Titman (1991) develop a model in which customers may be unwilling to conduct business with a firm that has a high debt-to-equity ratio even if customers suffer no liquidation costs. I examine Maksimovic and Titman's theoretical model and its empirical evidence in subsection 2.2. My study adds to this stream of research by examining the effect of the firm's implicit contracts with customers on its capital structure choice. I empirically test the theoretical prediction of Maksimovic and Titman (1991)'s model that firms commit to providing high quality products by means of a low debt-to-equity ratio. To the best of my knowledge, no study has empirically tested the prediction that product quality has a negative effect on leverage yet.

### 2.1 The Titman (1984) Model

Titman (1984) is the first to link the effect of a firm's liquidation on customers to its capital structure choice. Liquidation describes the process of redistributing assets and property of a company in case of a bankruptcy. It is generally assumed that a high debt-to-equity ratio increases a firm's bankruptcy risk, since debt holdings can cause cash flow problems in case of financial difficulties. While dividend payments to equity holders can be paused during financial difficulties, a firm always has to pay interest expenses related to their debt holdings. Titman develops a theoretical model in which value-maximizing firms in complete and competitive markets, whose liquidation can impose high costs on their customers and business partners, choose capital structures with low leverage, i.e. a low debt-to-equity ratio. By reducing leverage, firms try to limit stakeholders' concerns about the bankruptcy risk of the company. The model predicts that firms with unique products, such as computer and automobile companies, choose low debt-to-equity ratios, since they can impose high costs on customers in the event of liquidation through the loss of future servicing or the availability of spare parts. Therefore, customers are less willing to do business with a firm in financial difficulties that can impose high costs on them when liquidated. Titman's model predicts the price to fall, which firms in financial distress can charge for a good that requires servicing or the like in the future. Firms have to compensate customers with lower prices for the higher liquidation cost. Vice versa, Titman's model predicts that firms, whose liquidation imposes low costs on customers and business partners, such as hotels or retail establishments, choose high debt-to-equity ratios.

In line with Titman (1984)'s theoretical model, several empirical studies confirm that firms which can impose high liquidation costs on non-financial stakeholders have low leverage. More specifically, Titman and Wessels (1988) empirically confirm that firms producing unique products maintain low leverage. Measuring product uniqueness with research and development (R&D) expenses, selling expenses, and quit rates, their study shows that firms manufacturing machines and equipment maintain lower debt-to-equity ratios. Firms from these industries are more likely to produce unique products and therefore impose higher costs on customers when liquidated. In a similar stance, Kale and Shahrur (2007) show that a firm's leverage is negatively related to the R&D intensities of its customer and supplier industries. They argue that firms use low leverage as a commitment device to induce customers or suppliers to undertake relationship-specific investments. Banerjee, Dasgupta, and Kim (2008) come to a similar conclusion. Using firm-level data on bilateral customer-supplier relationships, they show that customer firms of suppliers in manufacturing industries producing durable goods maintain a low debt ratio if suppliers depend on these firms for a major part of their sales. Likewise, suppliers in durable goods industries maintain low leverage if a major proportion of their sales depends on relatively few customers. The reason is that low leverage encourages relationship-specific investments in bilateral relations, since liquidation costs for dependent customers or suppliers are potentially high. Franck and Huyghebaert (2010) confirm these results when showing that potential liquidation costs on non-financial stakeholders are negatively related to the firm's leverage for a sample of business start-ups with high ex-ante failure risk. Furthermore, their study shows that customer and supplier bargaining power is negatively related to the level of debt financing. Another empirical proof for Titman (1984)'s theoretical model is given by Kale, Meneghetti, and Shahrur (2010). Using firm-level data on warranty offerings, Kale et al. (2010) show that a firm's leverage is lower both for firms offering explicit as well as implicit warranties. Thus, low debt levels work as a signalling device for firms to commit to honouring explicit and implicit product warranty contracts with customers. Commitment is necessary since customers with product warranty contracts suffer from high costs in the case of the firm's liquidation, because their product warranties become obsolete.

## 2.2 The Maksimovic and Titman (1991) Model

These empirical studies and the related theoretical model by Titman (1984) mainly investigate liquidation costs imposed on stakeholders as a determinant for capital structure choice. However, only part of the firms in financial difficulties are liquidated (Bris, Welch, & Zhu, 2006). Many are reorganized in which case no liquidation costs arise. Thus, liquidation costs cannot explain all the influence stakeholders have on a firm's capital structure.

In contrast to Titman (1984), Maksimovic and Titman (1991) develop a model in which customers may be unwilling to conduct business with a firm that has a high debt-to-equity ratio even if they suffer no liquidation costs. Financial difficulties can affect the firm's incentives to honour implicit contracts with customers such as to invest in high product quality. Product quality comprises actual quality of the product as well as the reputation for providing product quality, since the quality level of a product is assumed to be observable only after the purchase has been made. The authors argue that a firm in financial distress can decide to cut costs related to the quality of the product. This has similar implications as if the firm would obtain an involuntary loan from customers. Expecting financial difficulties in the future, even firms that do not suffer from an immediate threat of financial distress can choose to decrease product quality in order to increase current cash flows when having debt outstanding. Some rational customers anticipate the incentives of a highly levered firm to cut product quality. Therefore, customers reduce the price they are willing to pay for the product, which has lower quality. A decreased willingness to pay leads to a decrease in future cash flows and thus also a loss in value for the firm. To avoid a loss in value, firms commit to providing high quality products by means of a low debt-to-equity ratio even if customers would not suffer from potential liquidation costs. Thus, the model predicts that product quality has a negative effect on leverage. The model is applicable to other non-financial stakeholders such as employees as well.

The validity of Maksimovic and Titman (1991)'s theoretical model has been tested empirically in several studies. More specifically, Bae et al. (2011) apply the model to the case of employees. They examine the effect of the level of employee benefits on a firm's capital structure. The study shows that firms wanting to maintain a reputation for treating employees fairly need to have low debt-to-equity ratios. A low debt-to-equity level works as a commitment device, since a highly levered firm in financial difficulties has an incentive to cut costs related to employee benefits in order to increase cash flows. Rational employees anticipate the incentive to cut employee benefits and require higher wages, which in turn decreases the value of the firm. Using firm-level employee treatment ratings, Bae et al.'s study shows that firms, which treat their employees fairly, maintain low leverage even when employees suffer no potential liquidation costs. They confirm Maksimovic and Titman (1991)'s prediction that this relationship is more distinct the higher the probability of liquidation, the more firm-specific the assets are, and the higher the importance of this group of stakeholders is for the firm's business. In a similar stance, Verwijmeren and Derwall (2010) show that a firm's interest in employee well-being is negatively related to leverage, using the same firm-level data on employee treatment ratings as Bae et al. (2011). Verwijmeren and Derwall are able to show that firms with better employee relations are more likely to issue equity instead of debt when external financing is needed.

These two empirical studies confirm the validity of the model by Maksimovic and Titman (1991) on the stakeholder theory of capital structure concerning the firm's relations with its employees, stating that firms wanting to credibly commit themselves to providing good employee benefits need low leverage. To the best of my knowledge, no empirical study has tested the model for the perspective of a firm's relations with its customers, stating that firms, which want to credibly commit themselves to providing high product quality, need low leverage. This is the perspective originally chosen by Maksimovic and Titman and therefore relevant to investigate empirically. My study will fill this gap through examining the effect of product quality on a firm's leverage, using US firm level data on product quality ratings from the KLD STATS database as well as financial information regarding debt-to-equity ratios from Compustat between 2003 and

2009. The data used in this study is examined in detail in section 3.

# 3 Data

This study uses data on product quality from the KLD STATS database as well as financial data from Compustat to examine the relationship between product quality and financial leverage. Subsection 3.1 elaborates on the sample selection and matching procedure of the two databases. A central variable in this study is the measure of a firm's reputation for providing a high quality product to its customers. Subsection 3.2 explains how I construct this measure with the help of the KLD STATS database. Summary statistics of the sample firms are presented in subsection 3.3. Using nearest neighbour matching to control for assets, industry, and year, I show that omitted variable bias is present and more control variables are needed. The control variables and their expected effects on leverage are examined in subsection 3.4.

## 3.1 Sample Selection

The KLD STATS database includes year-end binary snapshots of company ratings regarding product quality. The database exists for the time period 1991-2009, but the number of rated companies varies per year.[1] For the purpose of this study, I use KLD ratings between 2003 and 2009, since the sample during this period presents the largest variation across firms with approximately the 3000 largest US companies per year. The initial sample is an unbalanced panel of 20,745 firm-year observations with ratings on product quality, which covers the time range 2003-2009.

Secondly, I download data on firm characteristics from Compustat North America. This database provides fundamental and market information on active and inactive publicly held companies in the US and Canada. Together with Thomson Reuters Datastream it is the largest provider for this type of information. The Compustat database is chosen for this study, since

[1] Before the year 2000, all companies of the S&P 500 Index are rated. These are 500 large-cap common stocks that are selected to make the index representative of the industries in the United States economy. From 2001 on, additionally all companies that are member of the Russell 1000 Index are rated. These are roughly the 1000 largest publicly held US companies in terms of market capitalization. From 2003 on, ratings on those companies within the Russell 2000 Index are added to the KLD STATS database. These are about the next 2000 largest publicly held US companies after those in the Russell 1000 Index. From 2007 on, the largest 3000 US companies by market capitalization are rated.

previous literature suggests its superiority for the US market (see e.g. Ince & Porter, 2006). Sources of information for Compustat North America are for example annual reports and the stock exchanges. For the purpose of this study, I use the complete "Compustat North America Annual Updates - Fundamentals Annual" file, which is available from 1995 until today. Data on firm characteristics from Compustat is available per fiscal year whereas the product ratings from KLD represent calender years. Nevertheless, for 67% of the sample firms the fiscal year is the same as the calendar year. The other firms' fiscal year end is approximately equally distributed across the rest of the year. In this study, I do not exclude firms whose fiscal year is different from the calender year and the results do not change significantly when doing this.

Next, I merge the two datasets on the basis of the CUSIP code, an eight character alphanumeric code, which is used to identify stocks and other financial instruments in North America. The code is assigned to each issue of financial instruments by the CUSIP Service Bureau, which is operated by Standard & Poor's for the American Bankers Association. The code is unique and historic codes are not reused. The CUSIP code can change when there is a "(i) change in company name; (ii) reorganization; (iii) merger; (iv) forward stock split, when payable upon surrender of certificates; (v) reverse stock split; or (vi) emergence from bankruptcy" (NASDAQ OMX, 2010). Since Compustat does not track historic CUSIP codes, those companies that had a change in the CUSIP code could not be matched in the first step. I am able to match 19,033 out of 20,745 firm-year observations in the KLD STATS database to their corresponding firm characteristics from the Compustat database on the basis of the CUSIP code. Those observations that cannot be matched this way are then matched on the basis of a combination of the ticker symbol and the company name. The combination is chosen to prevent miss-matching, since the Ticker symbol is only unique on each stock exchange and historic Ticker symbols can be reused. An additional 203 firm-year observations can be matched this way. The new sample consists of 19,236 firm-year observations.

Following common practice for cross-sectional studies of capital structure determinants (e.g. Bae et al., 2011; Kale & Shahrur, 2007; Berger, Ofek, & Yermack, 1997), I exclude 4,225 financial firms (Standard Industrial Classification (SIC) codes between 6000 and 6999) and 695 utilities (SIC codes between 4900 and 4999). Financial firms and utilities operate in regulated industries. They are believed to have strong differences in capital structure and corporate governance compared to firms in economic sectors that are not regulated. In a similar stance, I exclude the 238 firms that are headquartered in a foreign country. Moreover, since many control variables are scaled by total assets, those 7 observations with missing total assets are excluded. Surprisingly, there are some firms in the database that report a negative equity. Since companies that have negative equity have to be liquidated immediately according to US regulation, I exclude these 445 observations in line with previous research (e.g. Fama & French, 1995). Moreover, 7 observations that have a value for total assets larger than 350 billions of dollars are identified as outliers. Likewise, I exclude 29 observations for which sales exceed 130 billions of dollars. A market-to-book ratio of equity of 300 is used as a cut-off point which excludes 23 outliers. Furthermore, 116 outliers are identified for which R&D expenditures scaled by total sales exceeds 1,000% and 7 outliers for which SGA expenses scaled by total sales exceeds 2,000%. I exclude 4 outliers, since their net income is lower than -20 billions of dollars or larger than 16 billions of dollars. The final sample consists of 13,437 firm-year observations and is an unbalanced panel.

## 3.2 Measure of a Firm's Product Quality

The measure of a firm's reputation for providing a high quality product to its customers is a central variable in this study. This variable is derived from MSCI's KLD STATS database. MSCI provides investment decision support tools which include indices, portfolio risk and performance analytics, as well as governance tools. As part of the governance tools, the company rates around 3,000 publicly-traded US companies on strengths and weaknesses in the categories community, corporate governance, diversity, employee relations, environment, human rights, and product. Within these seven categories, there are more than 80 subcategories for each rated company. Data sources for these ratings are corporate documents, government data, relevant organizations and professionals as well as company interviews. The KLD STATS database includes year-end binary snapshots of these ratings assigning a 1 or 0 for each subcategory depending on whether or not a company has a particular strength or weakness. To the best of my knowledge, KLD STATS is the most detailed and comprehensive source of product quality ratings. The database has been used in many studies to construct proxies such as for employee treatment, corporate social responsibility, or product quality. For example, Verwijmeren and Derwall (2010) and Bae et al. (2011) use KLD STATS to construct a proxy for firms' employee treatment as described in the previous section. A measure of corporate social responsibility is constructed by Hong and Kostovetsky (2011) as well as Galema, Plantinga, and Scholtens (2008) with the help of the database. Johnson and Greening (1999) use KLD STATS to construct a proxy for product quality. In this study the database is used to construct a measure for product quality.

Since Maksimovic and Titman (1991) assume the quality level of a product to be observable for the customer only after the purchase has been made, the Product Quality Index needs to reflect not only the actual product quality of a firm but also the firm's reputation for providing product quality. For the rest of this study, both actual product quality as well as the reputation for product quality are meant when referring to product quality. To construct the index, the ratings in the product category of the KLD STATS database are used. Out of eight different subcategories[2] the following are chosen to be relevant for the index, because they are related to product quality:

**Quality Strength:** Whether or not a company has a "long-term, well-developed, company-wide quality program, or a quality program recognized as exceptional in US industry" (KLD, 2008, p.12).

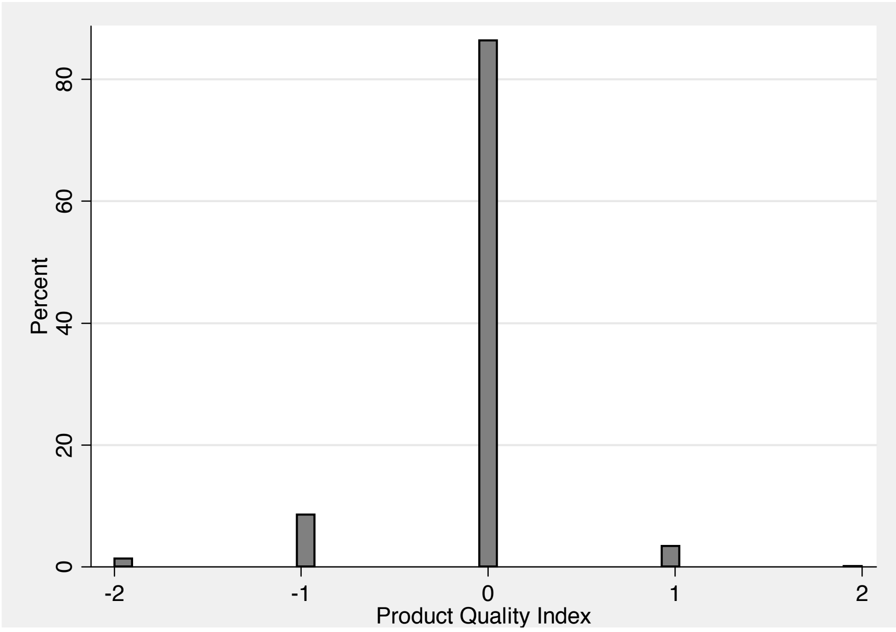
**R&D/Innovation Strength:** Whether or not a company is a "leader in its industry for research and development, particularly by bringing notably innovative products to the market" (ibid.).

**Product Safety Concern:** Whether or not a company has "recently paid substantial fines or civil penalties, or is involved in major recent controversies or regulatory actions, relating to the safety of its products and services" (ibid.).

**Marketing/Contracting Concern:** Whether or not a company has "recently been involved in major marketing or contracting controversies, or has paid substantial fines or civil penalties relating to advertising practices, consumer fraud, or government contracting" (ibid.).

[2]The complete list of ratings in the category product ratings are: Quality Strength, R&D/Innovation Strength, Benefits to Economically Disadvantaged Strength, Other Strength, Product Safety Concern, Marketing/Contracting Concern, Antitrust Concern, Other Concern (KLD, 2008).

**Figure 1** – Distribution of Product Quality Index Across Firms




While the subcategory Quality Strength indicates the current product quality of a firm, the other three subcategories indicate the firm's ability to maintain a reputation for providing a high quality product. MSCI assigns a 0 or 1 to each of the four categories depending on whether a company has a particular strength or concern. Following common practice, the Product Quality Index is constructed by summing up the scores for the strength and subtracting the scores for the concerns in a given year (see e.g. Verwijmeren & Derwall, 2010; Bae et al., 2011). In this study, the Product Quality Index can take on values between -2 and 2, since two strength and two concerns are chosen. Out of 13,437 firm-year observations there are only 484 observations which have a positive Product Quality Index. Figure 1 shows that 0.15% of the sample have a Product Quality Index score of 2, 3.45% have a score of 1, 86.38% a score of 0, 8.6% a score of -1 and 1.41% have a Product Quality Index score of -2.

### 3.3 Summary Statistics

In table 1, summary statistics for all sample firms are provided. Firms with a positive Product Quality Index are compared to firms that have a zero or negative Product Quality Index. A t-test is performed to test whether the difference of means between these two groups is statistically significant. To test whether the difference in medians between the two groups is statistically

**Table 1** – Summary Statistics for All Firms

| | All firms | | Firms with a Product Quality Index > 0 (A) | | Firms with a Product Quality Index ≤ 0 (B) | | Test of Difference (A-B) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Market leverage (%) | 11.669 | 7.215 | 9.926 | 7.128 | 11.735 | 7.219 | (−3.56)*** | (0.05) |
| Book leverage (%) | 16.763 | 13.081 | 15.951 | 13.811 | 16.794 | 13.039 | (−1.28) | (1.13) |
| Logarithm of assets | 6.834 | 6.678 | 7.801 | 7.828 | 6.797 | 6.652 | (12.61)*** | (92.76)*** |
| Logarithm of sales | 6.672 | 6.641 | 7.612 | 7.637 | 6.636 | 6.613 | (11.57)*** | (63.42)*** |
| Market-to-book value of equity | 3.564 | 2.264 | 4.822 | 2.580 | 3.521 | 2.258 | (2.84)** | (6.27)** |
| Fixed assets/total assets | 24.900 | 17.373 | 21.740 | 18.035 | 25.018 | 17.300 | (−4.33)*** | (1.34) |
| Return on assets (%) | 4.108 | 5.548 | 5.109 | 5.918 | 4.065 | 5.539 | (2.05)* | (1.12) |
| Total sales/total assets | 1.065 | 0.892 | 0.985 | 0.847 | 1.068 | 0.895 | (−2.83)** | (7.44)** |
| Sales growth (%) | 11.395 | 8.809 | 7.203 | 5.963 | 11.638 | 8.991 | (−4.73)*** | (26.56)*** |
| Dividend dummy | 0.376 | 0.000 | 0.543 | 1.000 | 0.370 | 0.000 | (7.55)*** | (60.44)*** |
| R&D expenditures/total sales (%) | 13.094 | 0.313 | 10.288 | 3.420 | 13.199 | 0.186 | (−1.90) | (100.74)*** |
| SGA expenses/total sales (%) | 32.371 | 23.578 | 34.002 | 27.661 | 32.309 | 23.383 | (1.18) | (26.45)*** |
| Observations | 13437 | 13437 | 484 | 484 | 12953 | 12953 | | |

This table provides summary statistics for firm characteristics of the sample firms. The sample includes U.S. firms covered by the KLD STATS database as well as Compustat between 2003 and 2009. KLD STATS contains ratings regarding the firms' product quality, which I use to construct a Product Quality Index. Compustat contains financial information for the firms. The appendix provides a detailed description of all variables used. Numbers in parentheses are $t$ statistics and chi-square statistics for the test of difference in means and medians respectively. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 5%, 1% and 0.1% level respectively.

significant, a non-parametric equality of medians test is used, since the normality assumption required by the t-test does not hold for the medians (Wooldridge, 2009). The last two columns of table 1 report t statistics and chi-square statistics for these two tests respectively.

My main measure for financial leverage is market leverage, which indicates the percentage of total financing that is debt financing measured at market value. Market leverage is calculated as long-term debt divided by the sum of total debt and market value of equity. The market value of equity is equal to the closing share price times the number of common shares outstanding. I assume that the market value of debt is equal to its book value. Market leverage is believed to give the most realistic and timely measure of financial leverage, since it takes the up-to-date share price into account. I follow Bae et al. (2011) regarding the definitions and calculations of the variables. A detailed description as well as the data source and calculation of all variables are given in table 6 in the appendix. It becomes evident in table 1 that firms with a positive Product Quality Index have lower mean market leverage than the sample of firms with a zero or negative Index at 9.9% compared to 11.7%. This difference is statistically significant at the 0.1% level and gives support for my hypothesis that firms with high product quality choose low leverage as predicted by Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure. On the other hand, the difference in medians for the two groups at 7.1% compared to 7.2% is not statistically significant.

I use book leverage as an alternative measure for financial leverage, which indicates the percentage of total financing that is debt financing measured at book value. To calculate book leverage, the book instead of market value of equity is used. Since the principle that the sum of book equity and total debt is equal to total assets holds, book leverage is calculated as long-term debt divided by total assets. Book leverage is the more conservative measure of financial leverage, since it takes the historical price for shares into account instead of the market price. Although firms with a positive Product Quality Index have lower mean book leverage than the sample of firms with a zero or negative Index at 15.9% compared to 16.8%, this difference is not statistically significant. This is not the case for the difference in medians either.

Furthermore, firms with a positive Product Quality Index are compared to the sample of firms with a zero or negative Index regarding the control variables used for leverage in the regressions in section 4 as well as selected additional variables. Mean and median logarithm of assets, measuring firm size, are significantly larger for firms with a positive Product Quality Index at 7.801 and 7.828 respectively compared to 6.797 and 6.652. The same holds when measuring firm size with the logarithm of total sales. Furthermore, firms with a positive Product Quality Index have statistically significant higher mean and median market-to-book value of assets, indicating higher growth opportunities. Moreover, these firms have statistically significant lower mean fixed assets scaled by total assets, which is a measure of the tangibility of the firm's assets, and lower mean return on assets, which indicates profitability. Also, mean and median total sales scaled by total assets as well as mean and median sales growth are significantly lower for these firms. On the other hand, the mean and median dividend dummy for firms with a Positive Product Quality Index is significantly higher, which indicates that these firms are less financially constraint. Median R&D expenditures as well as selling, general and administrative (SGA) expenses, both scaled by total sales, are statistically significantly higher for the sample firms with a positive Product Quality Index.

It also becomes evident from table 1 that firms with a positive Product Quality Index are very few compared to firms that have a zero or negative Product Quality Index with 485 compared to 13,010 number of firm-year observations. Also, these firms have a considerably larger firm

**Table 2** – Summary Statistics with Nearest Neighbour Matching

| | Firms with a Product Quality Index > 0 (A) | | Firms with a Product Quality Index ≤ 0 (B) | | Test of Difference (A-B) | |
|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | Mean | Median |
| Market leverage (%) | 9.926 | 7.128 | 12.016 | 7.519 | $(-3.43)^{***}$ | (1.20) |
| Book leverage (%) | 15.951 | 13.811 | 16.753 | 14.217 | $(-1.48)$ | (0.34) |
| Logarithm of assets | 7.801 | 7.828 | 7.720 | 7.753 | (0.75) | (0.26) |
| Logarithm of sales | 7.612 | 7.637 | 7.524 | 7.486 | (0.78) | (1.13) |
| Market-to-book value of equity | 4.822 | 2.580 | 3.060 | 2.147 | $(3.27)^{***}$ | (3.25) |
| Fixed assets/total assets | 21.740 | 18.035 | 21.514 | 14.631 | $(-0.01)$ | $(6.93)^{**}$ |
| Return on assets (%) | 5.109 | 5.918 | 3.920 | 5.439 | $(-0.12)$ | (0.16) |
| Total sales/total assets | 0.985 | 0.847 | 1.020 | 0.891 | $(-0.05)$ | (0.10) |
| Sales growth (%) | 7.203 | 5.963 | 9.458 | 7.419 | $(-2.62)^{**}$ | $(7.98)^{**}$ |
| Dividend dummy | 0.543 | 1.000 | 0.395 | 0.000 | $3.23^{***}$ | $(10.31)^{***}$ |
| R&D expenditures/total sales (%) | 10.288 | 3.420 | 10.749 | 2.239 | (0.70) | $(7.62)^{**}$ |
| SGA expenses/total sales (%) | 34.002 | 27.661 | 29.605 | 22.925 | $(2.92)^{**}$ | $(18.09)^{***}$ |
| Observations | 484 | 484 | 484 | 484 | | |

This table provides summary statistics for firm characteristics of the sample firms. The sample includes U.S. firms covered by MSCI KLD STATS database as well as Compustat between 2003 and 2009. KLD STATS contains ratings regarding the firms' product quality, which I use to construct a Product Quality Index. Compustat contains financial information for the firms. The appendix provides a detailed description of all variables used. For each sample firm that has a positive Product Quality Index, I select a matching firm from the same industry and year with an asset size as similar as possible from the group of firms with a zero or negative Product Quality Index. A firm belongs to the same industry if it has the same first two digits of the SIC code. Numbers in parentheses are $t$ statistics and chi-square statistics for the test of difference in means and medians respectively. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 5%, 1% and 0.1% level respectively.

size in terms of total assets and total sales as described above. Therefore, it is possible that differences in mean and medians between the high- and low-quality group are mainly driven by a difference in size or other aspects and not due to product quality. To find out whether the observed differences are mainly a matter of size, I follow the procedure of nearest-neighbour matching introduced by Abadie, Drukker, Herr, and Imbens (2004) and Abadie and Imbens (2006). This procedure has, for example, been used in the empirical study by Bae et al. (2011) to show the difference between means and medians of firms with different scores on an Employee Treatment Index. For every firm that has a positive Product Quality Index, I select a matching firm from the same industry and year with an asset size as similar as possible from the group of firms with a zero or negative Product Quality Index. A firm belongs to the same industry if it has the same first two digits of the SIC code. According to this definition the sample firms belong to 58 different industries. It is possible for firms to be matched more than once in case they are the nearest neighbour in several cases. The summary statistics with nearest neighbour matching are provided in table 2.

As a result, the mean and median total assets as well as total sales which measures the firm's size are statistically indistinguishable between the two subsamples. Firms with a positive Product Quality Index have lower mean market leverage compared to matched firms with a zero or negative Product Quality Index at 9.9% compared to 12.0%. This difference is statistically significant and gives support for the hypothesis that firms with high product quality choose low leverage. On the other hand, the difference in medians at 7.1% compared to 8.2% is not statistically significant. Again, firms with a positive Product Quality Index have lower mean book leverage at 16.0% compared to 16.8%, but this difference is statistically indistinguishable. So is the difference in medians of book leverage. The procedure of nearest neighbour matching allows to single out the relationship between financial leverage and product quality controlling for asset size, industry, and year. Nevertheless, significant differences still exist between the high- and low-quality group regarding the mean market-to-book value of equity, median fixed assets scaled by total assets, mean and median sales growth, and dividend dummy as well as median R&D expenditures divided by total sales and mean and median SGA expenses scaled by total sales. This leads to the conclusion that the observed differences are not only caused by differences in size. On the contrary, it is important to control for other variables as well to eliminate the omitted variable bias, which is present in table 2. Therefore, I develop an ordinary least squares and two-way fixed effects regression model in section 4. Subsection 3.4 describes the control variables used and their expected effect on leverage.

## 3.4 Control Variables

In previous literature on capital structure, the following determinants of leverage have been established as standard variables: market-to-book value of equity, log of assets, log of sales, fixed assets scaled by total assets, return on assets, total sales divided by total assets, and the dividend dummy (e.g. Bae et al., 2011; Kale & Shahrur, 2007; Verwijmeren & Derwall, 2010; Lemmon, Roberts, & Zender, 2008; Rajan & Zingales, 1995). These explanatory variables are expected to be related to leverage in different ways. Table 6 in the appendix explains in detail how these variables are constructed.

The market-to-book value of equity is a proxy for a firm's growth opportunities. It is expected to have a negative effect on leverage, since the risk of financial distress rises with higher growth opportunities, which in turn reduces optimal target leverage (see e.g. Bae et al., 2011). Moreover, log of assets and log of sales measure firm size and are expected to be positively related to leverage.[3] Large firms are usually more diversified and thus have a lower bankruptcy risk, which increases their ability to obtain a bank loan (see e.g. Frank & Goyal, 2009). Next, fixed assets scaled by total assets indicate tangibility of the firm's assets. This ratio is expected to have a positive influence on leverage, because firms can use tangible assets as collateral when taking on a loan (see e.g. Verwijmeren & Derwall, 2010). Further, return on assets is a measure for profitability and is expected to have a negative relation to leverage. Fama and French (2002) show that profitable firms use less external financing such as debt. Furthermore, total sales divided by total assets, also called the asset turnover ratio, indicates how much assets are needed to generate sales. The higher the asset turnover ratio, the less capital intensive is a firm's business. This means that the financing need of the company is lower and along with this the firm's need to take on debt (Bae et al., 2011). Thus, a negative relationship between total sales divided by total assets and leverage is expected. Besides, the dividend dummy measures whether a firm pays dividends or not. Paying dividends is generally associated with being less financially constrained. As suggested by the pecking order theory, these firms are less dependent on debt (Fama & French, 2002; Frank & Goyal, 2003). Thus, a negative relation between the dividend dummy and leverage is expected.

In addition to these standard control variables, more recent literature has also used R&D expenditures scaled by total sales and selling, general, and administrative expenses divided by total sales as determinants of capital structure (Bae et al., 2011; Kale & Shahrur, 2007; Verwijmeren & Derwall, 2010). R&D expenditures scaled by total sales are expected to have a negative relation to leverage (Bae et al., 2011; Frank & Goyal, 2009). A high R&D expenditures/total sales ratio can be regarded as an indicator for more product specialization which reduces the firm's ability to take on debt, since low diversification increases bankruptcy risk. Also a high R&D expenditures/total sales ratio can be regarded as an indicator for more intangible assets, which cannot easily be used as collateral for taking on a loan. Similarly, selling, general, and administrative (SGA) expenses divided by total sales is predicted to be negatively related to

[3] I assume a logarithmic rather than a linear relationship between assets or sales and leverage and have therefore chosen the logarithmic form.

leverage. It can be regarded as a proxy for product specialization which decreases the firm's ability to take on debt (see e.g. Frank & Goyal, 2009; Bae et al., 2011).

In section 4, I show that high product quality has a negative effect on leverage. Nevertheless, this result is not robust to controlling for standard leverage determinants introduced in this section.

# 4 Empirical Findings

In the previous section I find support for the hypothesis that firms offering products with high quality choose low leverage ratios. Furthermore, I identify the need for a more sophisticated model to examine the relationship between product quality and leverage. Subsection 4.1 describes the partial adjustment model on the basis of which I analyse the data. In subsection 4.2, I identify empirical challenges present when estimating the model. Pooled ordinary least squares, a two-way industry, as well as firm fixed effects model are used to analyse the data. Their regression specifications are developed in the same subsection. The empirical results and interpretation of the pooled OLS model are given in subsection 4.3. In subsection 4.4, I present and discuss the empirical results of the industry and firm fixed effects model.

## 4.1 The Partial Adjustment Model of Leverage

To determine the effect of product quality on a firm's capital structure choice, the partial adjustment model is used. It has been extensively used and empirically proven in the previous literature (see e.g. Fama & French, 2002; Flannery & Rangan, 2006; Lemmon et al., 2008; Antoniou, Guney, & Paudyal, 2008; Chang & Dasgupta, 2009; Bae et al., 2011). The partial adjustment model describes the change in leverage as a function of last period's leverage, target leverage, and speed of adjustment. The model builds on the assumption that there is a difference between a firm's target and actual leverage in each time period due to adjustment costs. Firms weigh these adjustment costs towards the costs of operating with suboptimal capital structure and partially adjust towards the target leverage. The speed of adjustment indicates the proportion of the gap between actual and target capital structure that the average firm closes each year. The partial adjustment model can be expressed as follows:

$$\ell_{i,t} - \ell_{i,t-1} = \lambda(\ell^{*}_{i,t} - \ell_{i,t-1}) + \epsilon_{i,t} \tag{1}$$

where $\ell_{i,t}$ represents actual leverage and $\ell^{*}_{i,t}$ target leverage for firm $i$ at time $t$. $\lambda$ denotes the speed of adjustment which can take values between 0 and 1 and is simplified to be the same for each firm. $\epsilon_{i,t}$ denotes the error term which is potentially heteroskedastic. Target leverage is assumed to be expressed as follows:

$$\ell^{*}_{i,t} = \beta_0 + \beta_1 p + \sum_{k=2}^{K} \beta_k X_{k,i,t} + \mu_i + \eta_t \tag{2}$$

where $\beta_0$ is a constant and $p$ is the Product Quality Index with its coefficient $\beta_1$. $X_{k,i,t}$ is the pre-determined vector of explanatory variables consisting of k determinants for target leverage and $\beta_k$ is its coefficient. $\mu_i$ denotes the time-invariant effects which are unobservable. These can be firm-specific, such as management performance or corporate culture, or industry-specific, such as market imperfections. $\eta_t$ represents time-specific effects such as the inflation rate and demand shocks which can change over time but are the same for all firms. Combining equation (1) and (2) gives the following equation:

$$\ell_{i,t} = \lambda\beta_0 + \lambda\beta_1 p + \lambda \sum_{k=2}^{K} \beta_k X_{k,i,t} + (1-\lambda)\ell_{i,t-1} + \lambda\mu_i + \lambda\eta_t + \epsilon_{i,t} \tag{3}$$

where both $\mu$ and $\eta$ are potentially correlated with $X$. Equation (3) is estimated using a pooled ordinary least squares (OLS) model as well as an industry and firm fixed effects (FE) model. The models' regression specifications are examined in the following subsection.

### 4.2 Empirical Specifications

Estimating equation (3) with the empirical data obtained poses several empirical challenges, which threaten the internal validity of my regression studies. First of all, potentially omitting a variable that is both a determinant of leverage and correlated with at least one of the included explanatory variables can cause omitted variable bias. In this case an ordinary least squares model would be biased and inconsistent while a fixed effects model controls for this variation using individual effects as a component of the model.

Second, it is possible that the used datasets contain measurement error. There can be data entry errors in both databases. It is also possible that the ratings of product quality in the KLD STATS database are based on ambiguous information or subjective judgement. In that case the rating does not accurately reflect a company's product quality. Also, the measure of product quality might not be dispersed enough to reflect the variation of product quality between firms. As shown in figure 1, 86% of the sample firms have a Product Quality Index of 0. Only very few firms have a positive Product Quality Index. A measure that more accurately reflects the variation in product quality between firms can give different results. If there is measurement error in one of the dependent variables then only the intercept is biased. In that case, OLS estimators are unbiased but have a larger variance. If there is measurement error in an explanatory variable and the measurement error is uncorrelated with the unobserved explanatory variables, then OLS will be inconsistent and biased (Wooldridge, 2009). This is also called attenuation bias in the literature. Attenuation bias is magnified in the fixed effects model, because the fixed effects model controls for the variation due to unobserved individual effects, but not for the variation due to attenuation bias. Thus, attenuation bias in a fixed-effects model will be larger than the bias in OLS. It becomes evident that there are advantages and disadvantages with using OLS and FE models. To be able to draw conclusions from the regression results, it is crucial that both methods are used.

Moreover, it is possible that the time horizon of the model is misspecified. For example, firms might not be able to adjust leverage as quickly as they can adjust product quality or the other way around. This cannot be tested but only argued for with economic reasoning. In a similar model, Bae et al. (2011) assume that leverage and employee treatment have the same time horizon. On the basis of this, I assume the same for leverage and product quality.

Furthermore, I can have matched the datasets incorrectly or done other mistakes. To provide support for the correctness of my dataset, I choose to replicate Bae et al. (2011)'s study. They use the KLD STATS database to construct an Employee Treatment Index for a sample of firms between years 2003 and 2007 and match this data with data from Compustat. The authors show that firms that have a reputation for providing high employee benefits maintain low leverage in support of Maksimovic and Titman (1991)'s stakeholder theory of capital structure model. I am able to confirm this result and obtain a similar coefficient for the Employee Treatment Index in a pooled OLS as well as fixed effects model, having the same data at hand.

Keeping these empirical challenges in mind, I estimate equation (3) using two different panel data estimation methods. First, a pooled ordinary least squares model is used which reduces equation (3) to

$$\ell_{i,t} = \lambda\beta_0 + \mu + \lambda\beta_1 p + \lambda\sum_{k=2}^{K}\beta_k X_{k,i,t} + (1-\lambda)\ell_{i,t-1} + \lambda\eta_t + \epsilon_{i,t} \tag{4}$$

since the time-specific effects $\mu_i$ are assumed to be fixed and common across individuals so that $\mu_i$=$\mu$ for all i firms. Year dummies are used to account for these time-specific effects. The results for the pooled OLS model are reported in subsection 4.3.

Second, a two-way fixed effects estimation is run which includes the time-specific effects $\eta_t$ as well as the individual effects $\mu_i$. Both industry fixed effects and firm fixed effects are used to estimate the fixed-effects model, which is the full equation (3):

$$\ell_{i,t} = \lambda\beta_0 + \lambda\beta_1 p + \lambda\sum_{k=2}^{K}\beta_k X_{k,i,t} + (1-\lambda)\ell_{i,t-1} + \lambda\mu_i + \lambda\eta_t + \epsilon_{i,t} \tag{5}$$

where year dummies are used to account for the time-specific effects $\mu_i$. Industry-specific or firm-specific effects $\eta_t$ cannot be observed or measured, but the fixed effects model differs out these unobserved fixed effects. A Hausman specification test rejects the assumption that the individual effects $\mu_i$ are uncorrelated with the explanatory variables $X_{k,i,t}$. This implies that a random effects model would not be consistent while the fixed effects model is consistent.[4] The results for the fixed effects model are reported in subsection 4.4.

The Breusch-Pagan / Cook-Weisberg test for heteroskedasticity is performed on the sample. The null hypothesis that the squared residuals have constant variance is rejected with 99.9% significance (chi-squared of 3,701.82). This indicates that the variation of the squared residuals can be explained by variation in the independent variables, which is also called heteroskedasticity. Heteroskedasticity poses a problem, because it biases the variance of the estimated parame-

[4]Hausman chi-squared statistic of -8,735.28.

ters. Therefore, common practice to use robust standard errors is followed in all regressions (Wooldridge, 2009). Furthermore, standard errors are clustered at the industry level. There are 58 clusters, which is the number of industries in the sample as defined by the first two digits of the SIC code.[5] Clustering standard errors is necessary, because standard errors of observations belonging to the same industry from different firms and years are likely to be correlated. To take this into account common practice to use clustered robust standard errors is followed, which inflates the standard errors (Wooldridge, 2009).

### 4.3 Pooled Ordinary Least Squares Model

Table 3 shows the results of the pooled ordinary least squares regressions that examine the relationship between product quality and leverage. In regressions (1)-(3) and (5)-(6), market leverage is the dependent variable, while it is book leverage in regressions (4) and (7). Regressions (1)-(4) exclude the lagged leverage ratio in the regression, while it is included in regressions 5-7. Although my sample of US firms covered by MSCI's KLD STATS database as well as Compustat spans from 2003 to 2009, I run regressions for the time period 2004 - 2009 to be able to include the lagged market leverage. This reduces the sample to 11,663 firm-year observations. To make the various regressions more comparable only those 8,885 observations that have no missing values are included. All regressions include year dummies, which are significant, but their estimates are not reported for the sake of brevity.

In regression (1), my only independent variable is the Product Quality Index defined in section 3. The coefficient estimate of -1.702 is significant at the 5% level. As the Product Quality Index increases by one point, a firm's leverage decreases by approximately 1.7 percentage points. With a mean leverage ratio of 11.7%, this is not only statistically, but also economically significant. The adjusted $R^2$ of 0.033 indicates that 3.3% of the variation in market leverage is explained by the Product Quality Index. The negative and statistically significant coefficient for the Product Quality Index gives support for the hypothesis, that firms with high product quality choose low leverage. However, there may be other variables that have an influence on leverage too and are correlated with the Product Quality Index. In that case the coefficient

[5] It is not obvious whether standard errors should be clustered at the industry or firm level. Clustering standard errors at the industry level yields larger standard errors than clustering at the firm level. Thus, the former is chosen.

**Table 3** – Regression Results Pooled OLS Model

| | Excluding lagged leverage ratio in the regression | | | | Including lagged leverage ratio in the regression | | |
|---|---|---|---|---|---|---|---|
| | Market leverage (%) | | | Book leverage (%) | Market leverage (%) | | Book leverage (%) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Product Quality Index | −1.702* | 0.697 | −0.0273 | −0.479 | −0.0167 | 0.118 | −0.0510 |
| | (−2.47) | (0.79) | (−0.04) | (−0.56) | (−0.11) | (0.66) | (−0.22) |
| Lagged market leverage (%) | | | | | 0.910*** | 0.851*** | |
| | | | | | (55.99) | (58.44) | |
| Lagged book leverage (%) | | | | | | | 0.829*** |
| | | | | | | | (60.55) |
| Market-to-book value of equity | | | −0.0162 | 0.343*** | | −0.0179 | 0.119*** |
| | | | (−0.40) | (4.78) | | (−1.21) | (3.64) |
| Logarithm of assets | | 2.945*** | 6.495** | 7.366*** | | 1.981*** | 1.933*** |
| | | (11.61) | (3.41) | (3.79) | | (3.66) | (3.87) |
| Logarithm of sales | | | −4.023* | −4.024* | | −1.604** | −1.372** |
| | | | (−2.07) | (−2.00) | | (−2.82) | (−2.71) |
| Fixed assets/total assets | | | 0.132*** | 0.166*** | | 0.0225* | 0.0307** |
| | | | (3.51) | (3.92) | | (2.64) | (3.42) |
| Return on assets (%) | | | −0.297*** | −0.303*** | | −0.0903*** | −0.118*** |
| | | | (−6.29) | (−7.42) | | (−6.42) | (−7.97) |
| Total sales/total assets | | | 0.793 | −0.0653 | | 0.389 | 0.101 |
| | | | (0.84) | (−0.07) | | (1.21) | (0.37) |
| Dividend dummy | | | −1.465* | −1.422 | | −0.0361 | 0.266 |
| | | | (−2.24) | (−1.91) | | (−0.18) | (1.22) |
| R&D expenditures/total sales (%) | | | −0.0778*** | −0.0889** | | −0.0349*** | −0.0548*** |
| | | | (−3.54) | (−2.97) | | (−4.74) | (−4.72) |
| SGA expenses/total sales (%) | | | −0.0270* | −0.0220 | | 0.000870 | 0.00963 |
| | | | (−2.11) | (−1.28) | | (0.27) | (1.40) |
| Constant | 12.09*** | −8.764*** | −7.794*** | −9.320** | 2.688*** | −2.097*** | −0.446 |
| | (9.44) | (−4.91) | (−3.84) | (−3.32) | (8.98) | (−3.90) | (−0.56) |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | No | No | No | No | No | No | No |
| Industry fixed effects | No | No | No | No | No | No | No |
| Observations | 8885 | 8885 | 8885 | 8885 | 8864 | 8864 | 8873 |
| Adjusted $R^2$ | 0.033 | 0.122 | 0.293 | 0.264 | 0.763 | 0.775 | 0.792 |

This table presents the results of the pooled ordinary least squares regressions in which I regress market leverage and book leverage on the Product Quality Index and a set of leverage determinants. The appendix provides a detailed description of the variables used. All regressions use the sample of US firms covered by MSCI's KLD STATS database as well as Compustat between 2004 and 2009. Year dummies are included in all regressions, but I do not report their coefficients. Numbers in parentheses are $t$ statistics based on robust standard errors clustered at the firm level. *, ** and *** denote significance at the 5%, 1% and 0.1% level respectively.

estimate in regression (1) would be biased.

Adding logarithm of assets to regression (1) has the largest effect on the coefficient of the Product Quality Index as shown in regression (2). The positive sign of the coefficient of logarithm of assets is expected according to Frank and Goyal (2009). The coefficient estimate of the Product Quality Index changes from -1.702 to 0.697 and becomes insignificant. Thus, there is no longer proof for the relationship that firms offering high product quality choose capital structures with low leverage. This implies that omitting the variable logarithm of assets in regression (1) leads to a large negative bias. According to Wooldridge (2009), a negative bias combined with a positive coefficient of logarithm of assets would be present when there is a negative correlation between the Product Quality Index and logarithm of assets. Table 8 in the appendix shows the correlation matrix of the variables and confirms this speculation. Product

Quality Index and logarithm of assets have indeed a negative correlation of -0.2243. A potential explanation is that firms, which are able to offer high product quality, are small as measured by total assets, since they are for example specialized, but product quality per se does not influence leverage. The correlation between Product Quality Index and logarithm of sales, an alternative measure for firm size, is almost as high at -0.2143. Indeed, when adding logarithm of sales to the model, the coefficient of the Product Quality Index changes from -1.702 to -0.189, which is shown in table 7 in the appendix. Furthermore, table 7 shows that the coefficient of the Product Quality Index remains significant and at a similar magnitude when adding all other covariates individually to regression (1).

To estimate the unbiased effect of the Product Quality Index on leverage, I include all control variables discussed in subsection 3.4 in regression (3). All covariates have the expected sign, except for total sales and total sales scaled by total assets. The adjusted $R^2$ of 0.293 suggests that 29.3% of the variation in market leverage is explained by the model. Compared to the results for regression (1), the coefficient estimate of the Product Quality Index decreases to -0.0273 and is statistically insignificant. Regression (3) gives further evidence that the coefficient estimate in regression (1) was biased downwards due to omitted variable bias. This fails to provide support for the hypothesis that firms offering high product quality choose low leverage ratios.

As a robustness check of the results, regression (4) estimates the model with all its covariates using book leverage as an alternative measure for financial leverage. An adjusted $R^2$ of 26.4% suggests that book leverage has slightly lower explanatory power than market leverage. Compared to regression (1) a similar decrease in the coefficient estimate of the Product Quality Index can be observed. All covariates except for market-to-book value of equity and logarithm of assets have the expected signs.

Next, I estimate the OLS model including the lagged leverage ratio in the regression. Regression (5) has the Product Quality Index as well as the lagged market leverage as independent variables. Comparing the adjusted $R^2$ between regression (1) and regression (5) suggests that, while the Product Quality Index explains 3.3% of the variation in market leverage, the lagged market leverage explains 73%. Adding the highly significant lagged market leverage ratio to the regression decreases the coefficient of the Product Quality Index from -1.702 to -0.0167 and removes its statistical significance. As in regression (3), adding the covariates to the regression changes the sign of the coefficient of the Product Quality Index, which is reported as 0.118 in regression (6). The adjusted $R^2$ of 0.775 shows that 77.5% of the variation in market leverage is explained by the model. Adding the control variables does not increase the explanatory power of the model as much as in model (3) where the lagged leverage ratio is excluded.

As a robustness check, regression (7) estimates the full model again using book leverage instead of market leverage as the dependent variable and lagged book leverage instead of lagged market leverage as an independent variable. The coefficient of the Product Quality Index remains insignificant and close to zero, but has a negative sign this time. The adjusted $R^2$ is slightly higher at 79.2%.

The OLS analysis shows that firms offering products with high quality choose low leverage ratios. However, this result is not robust to controlling for standard determinants of leverage. Thus, product quality per se does not have an effect on a firm's leverage according to the pooled OLS model. On the other hand, the pooled OLS model might not give unbiased and consistent estimates due to potentially omitting a variable that is both a determinant of leverage and correlated with at least one of the included explanatory variables. A fixed effects model controls for this variation using individual effects as a component of the model. Furthermore, my sample of panel data includes both time-series as well as cross-sectional variation in leverage and other variables, which the pooled OLS model does not account for. The variation in leverage reported in table 3 can originate in time series variation of product quality or in cross-sectional variation of product quality. Similarly, the variation in leverage can originate in the variation of product quality within an industry or in variation within firms. Therefore, a fixed effects model is estimated in subsection 4.4.

### 4.4 Fixed Effects Model

Table 4 shows the results of the industry fixed effects regressions that examine the relationship between product quality and leverage, while controlling for variation within industries. The regressions are set up in the same way as in table 3. In regression (1), the only independent variable is the Product Quality Index. The negative and highly significant coefficient estimate of -1.177 suggests that an increase of the Product Quality Index by 1 point, decreases leverage

**Table 4** – Regression Results Industry Fixed Effects Model

| | Excluding lagged leverage ratio in the regression | | | | Including lagged leverage ratio in the regression | | |
|---|---|---|---|---|---|---|---|
| | Market leverage (%) | | | Book leverage (%) | Market leverage (%) | | Book leverage (%) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Product Quality Index | −1.177** | 0.419 | 0.229 | 0.292 | −0.0153 | 0.184 | 0.0811 |
| | (−2.87) | (0.75) | (0.44) | (0.46) | (−0.11) | (1.18) | (0.40) |
| Lagged market leverage (%) | | | | | 0.864*** | 0.818*** | |
| | | | | | (55.99) | (56.32) | |
| Lagged book leverage (%) | | | | | | | 0.805*** |
| | | | | | | | (65.64) |
| Market-to-book value of equity | | | −0.00528 | 0.335*** | | −0.0136 | 0.127*** |
| | | | (−0.14) | (5.06) | | (−0.95) | (3.76) |
| Logarithm of assets | | 2.084*** | 5.213*** | 6.019*** | | 1.905*** | 1.815*** |
| | | (11.17) | (4.96) | (5.43) | | (4.07) | (3.84) |
| Logarithm of sales | | | −3.114** | −3.059* | | −1.533** | −1.249** |
| | | | (−2.79) | (−2.60) | | (−3.20) | (−2.76) |
| Fixed assets/total assets | | | 0.125*** | 0.154*** | | 0.0244*** | 0.0298*** |
| | | | (4.71) | (4.99) | | (3.66) | (4.52) |
| Return on assets (%) | | | −0.256*** | −0.258*** | | −0.0884*** | −0.113*** |
| | | | (−6.63) | (−8.38) | | (−6.35) | (−8.02) |
| Total sales/total assets | | | −0.386 | −1.188 | | 0.0789 | −0.248 |
| | | | (−0.63) | (−1.60) | | (0.30) | (−1.03) |
| Dividend dummy | | | −2.419** | −2.664** | | −0.231 | 0.0476 |
| | | | (−3.44) | (−3.21) | | (−0.95) | (0.19) |
| R&D expenditures/total sales (%) | | | −0.0532** | −0.0659** | | −0.0289*** | −0.0483*** |
| | | | (−3.14) | (−2.74) | | (−3.81) | (−3.67) |
| SGA expenses/total sales (%) | | | −0.0268* | −0.0219 | | −0.000957 | 0.00824 |
| | | | (−2.21) | (−1.39) | | (−0.25) | (1.12) |
| Constant | 11.81*** | −3.874** | −9.251*** | −9.678*** | 3.267*** | −2.716*** | −0.327 |
| | (49.56) | (−2.93) | (−5.10) | (−3.71) | (8.98) | (−4.01) | (−0.36) |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | No | No | No | No | No | No | No |
| Industry fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 8885 | 8885 | 8885 | 8885 | 8864 | 8864 | 8873 |
| Adjusted $R^2$ | 0.251 | 0.291 | 0.391 | 0.353 | 0.770 | 0.781 | 0.796 |

This table presents the results of the industry fixed effects regressions in which I regress market leverage and book leverage on the Product Quality Index and a set of leverage determinants. A firm belongs to the same industry if it has the same first two digits of the SIC code. The appendix provides a detailed description of the variables used. All regressions use the sample of US firms covered by MSCI's KLD STATS database as well as Compustat between 2004 and 2009. Year dummies are included in all regressions, but I do not report their coefficients. Numbers in parentheses are $t$ statistics based on robust standard errors clustered at the firm level. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 5%, 1% and 0.1% level respectively.

by -1.177 percentage points. Given a mean leverage of 11.7%, this is not only statistically, but also economically significant. Comparing the adjusted $R^2$ in regression (1) to the corresponding regression in table 3 suggests that while 3.3% of the variation in leverage is due to the Product Quality Index, an additional 21.8% of the variation in leverage are explained by industry fixed effects. This means that industries, in which firms offer products with high quality, generally have lower leverage. It gives support for my hypothesis that firms, which offer high product quality, choose low leverage.

The high change in the coefficient estimate for the Product Quality Index, when adding logarithm of assets to the model, from -1.177 in regression (1) to an insignificant 0.419 in regression (2) indicates that there is omitted variable bias present in regression (1). As shown before, Product Quality Index and logarithm of assets have a large negative correlation. Adding the control variables to the model in regression (3) changes the coefficient estimate for the Product Quality Index to 0.229 and turns it insignificant. The adjusted $R^2$ in regression (3) increases to 39.1% and the coefficients of the covariates have the expected sign, except for the variable logarithm of sales. As a robustness test, this regression is repeated with book leverage instead of market leverage as the dependent variable in regression (4). The coefficient for Product Quality Index is again positive and insignificant and has the same magnitude. The adjusted $R^2$ decreases slightly to 35.3%.

Comparing regression (1) and (5) in table 4 the only difference is the included lagged leverage ratio in the regression. The coefficient of Product Quality Index decreases to a value close to zero and is insignificant, but remains negative. Including the highly significant lagged market leverage in the regression increases the adjusted $R^2$ from 25.1% in regression (1) to 77% in regression (5), which is slightly higher compared to regression (5) in the pooled OLS model in table 3. Including the control variables in regression (6) changes the sign of the coefficient for the Product Quality Index, which remains insignificant and close to zero. Repeating the regression with book leverage as the dependent variable in regression (7) does not change this conclusion.

The industry fixed effects model shows that firms offering products with high quality choose low leverage ratios. However, this result is not robust to including standard determinants of leverage. Thus, product quality per se does not have an effect on a firm's leverage according to the industry fixed effects model.

Table 5 shows the results of the firm fixed effects regressions that examine the relationship between product quality and leverage, while controlling for variation within firms instead of controlling for variation within industries. All variation between firms is discarded in the firm fixed effects, which controls for the variation within firms only. This implies that it does not matter whether some firms have i.e. very high leverage ratios or very high product quality, since only the variation within each firm is examined. The regressions are set up in the same way as in table 3 and 4. Regression (1) with Product Quality Index as the only independent variable displays a positive and insignificant coefficient estimate. Comparing this result with the negative and significant coefficient estimate in regression 1 in the pooled OLS model in table 3 and the industry fixed effects model in table 4 suggests that within firm variation is very large. Since it was omitted until now, the previous negative and significant coefficient estimates were biased.

**Table 5** – Regression Results Firm Fixed Effects Model

| | Excluding lagged leverage ratio in the regression | | | | Including lagged leverage ratio in the regression | | |
|---|---|---|---|---|---|---|---|
| | Market leverage (%) | | | Book leverage (%) | Market leverage (%) | | Book leverage (%) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Product Quality Index | 0.210 | 0.223 | 0.663 | 0.583 | 0.585 | 0.597 | 0.476 |
| | (0.42) | (0.45) | (1.33) | (0.76) | (1.51) | (1.66) | (0.89) |
| Lagged market leverage (%) | | | | | 0.352*** | 0.323*** | |
| | | | | | (14.49) | (11.70) | |
| Lagged book leverage (%) | | | | | | | 0.342*** |
| | | | | | | | (18.97) |
| Market-to-book value of equity | | | 0.00475 | 0.196* | | −0.00310 | 0.170* |
| | | | (0.31) | (2.63) | | (−0.23) | (2.53) |
| Logarithm of assets | | 4.229*** | 7.349*** | 7.430*** | | 6.555*** | 6.355*** |
| | | (5.82) | (6.91) | (4.28) | | (6.88) | (4.16) |
| Logarithm of sales | | | −2.960* | −3.438* | | −2.576* | −3.322* |
| | | | (−2.47) | (−2.13) | | (−2.51) | (−2.45) |
| Fixed assets/total assets | | | 0.103** | 0.0671 | | 0.101** | 0.0746 |
| | | | (2.86) | (1.57) | | (3.05) | (1.86) |
| Return on assets (%) | | | −0.149*** | −0.137*** | | −0.125*** | −0.128*** |
| | | | (−5.77) | (−6.56) | | (−5.99) | (−6.75) |
| Total sales/total assets | | | −1.473* | −1.604 | | −1.711* | −1.936* |
| | | | (−2.13) | (−1.64) | | (−2.63) | (−2.20) |
| Dividend dummy | | | −1.530** | −1.085 | | −0.451 | −0.131 |
| | | | (−2.93) | (−1.76) | | (−0.77) | (−0.20) |
| R&D expenditures/total sales (%) | | | 0.00184 | 0.0524 | | 0.0146 | 0.0467 |
| | | | (0.15) | (1.76) | | (0.94) | (1.73) |
| SGA expenses/total sales (%) | | | −0.0347** | −0.0745* | | −0.0392* | −0.0655* |
| | | | (−2.68) | (−2.28) | | (−2.64) | (−2.37) |
| Constant | 13.36*** | −16.18** | −17.53* | −9.544 | 6.369*** | −19.26** | −9.519* |
| | (40.16) | (−3.20) | (−2.47) | (−1.55) | (14.05) | (−3.42) | (−2.10) |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry fixed effects | No | No | No | No | No | No | No |
| Observations | 8885 | 8885 | 8885 | 8885 | 8864 | 8864 | 8873 |
| Adjusted $R^2$ | 0.125 | 0.152 | 0.219 | 0.103 | 0.239 | 0.311 | 0.226 |

This table presents the results of the firm fixed effects regressions in which I regress market leverage and book leverage on the Product Quality Index and a set of leverage determinants. The appendix provides a detailed description of the variables used. All regressions use the sample of US firms covered by MSCI's KLD STATS database as well as Compustat between 2004 and 2009. Year dummies are included in all regressions, but I do not report their coefficients. Numbers in parentheses are $t$ statistics based on robust standard errors clustered at the firm level. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 5%, 1% and 0.1% level respectively.

The adjusted $R^2$ of 12.5% is naturally much lower than in the corresponding regression of the industry fixed effects model, since there are 2,335 firms compared to 58 industries in the sample. Adding the logarithm of assets and the other covariates in regression (2) and (3) increases the coefficient estimate for the Product Quality Index even more, while it remains insignificant. Exchanging the independent variable for book leverage in regression (4) does not change these results considerably. Including the lagged leverage ratio in the regressions improves the goodness of fit of the model less than in the pooled OLS and industry fixed effects model in table 3 and 4 respectively, as seen by the adjusted $R^2$. The coefficient remains positive and insignificant in regressions (5)-(7), which includes the lagged leverage ratio, while most of the covariates have the expected sign.

The analysis has shown that when controlling for within-firm variation, the hypothesis that firms offering products with high quality choose low leverage ratios cannot be confirmed. This result does not change when controlling for standard leverage determinants, using book leverage as an alternative measure for financial leverage, as well as including the lagged leverage ratio in the regression.

# 5 Conclusion

This thesis investigates whether firms commit to providing customers with high quality products by means of a low debt-to-equity ratio, using US firm level data on product quality ratings from the KLD STATS database as well as financial information regarding debt-to-equity ratios from Compustat between 2003 and 2009. I hypothesise that product quality has a negative effect on a firm's leverage as predicted by Maksimovic and Titman (1991)'s theoretical model. Using a pooled ordinary least squares, an industry fixed effects, as well as a firm fixed effects regression estimation of the partial adjustment model of leverage, this study can confirm that firms that offer products with high quality choose low leverage ratios as predicted by Maksimovic and Titman (1991). Nevertheless, this result is not robust to controlling for firm size and other standard control variables for leverage. A potential explanation is that firms, which are small in size, are associated with high product quality, but the choice of leverage ratio of these firms originates in firm size. Thus, I conclude that product quality per se does not have an effect on leverage for my sample of firms and reject Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure on the basis of this analysis.

While I cannot confirm Maksimovic and Titman (1991)'s model on the stakeholder theory of capital structure for the case of customers, Bae et al. (2011) confirm the theory for the case of employees. They show that firms that credibly want to commit themselves to high employee benefits choose low leverage ratios. One potential explanation is that leverage works well as a signalling device towards employees, but not towards customers. Therefore, firms use other channels to signal high product quality towards customers than their debt-to-equity ratio.

I acknowledge certain empirical limitations of this study which constrain the conclusion. Most importantly the measure of product quality constructed on the basis of the KLD STATS database is possibly not dispersed enough to accurately reflect the differences in product quality between firms. For future research, I suggest the use of a more detailed measure of product quality, although I do not have a practical recommendation of how this can be obtained.

Furthermore, for future research I suggest to differentiate between industries in which firms can impose high costs on customers in the event of liquidation, such as the automobile industry where the availability of spare part and future servicing is crucial, and industries where this is not the case. Although Maksimovic and Titman (1991)'s theoretical model holds for all industries, even for industries in which customers do not suffer from potential liquidation costs, this might not be the case empirically.

# 6 References

Abadie, A., Drukker, D., Herr, J., & Imbens, G. (2004). Implementing matching estimators for average treatment effects in stata. *Stata Journal*, *4*, 290–311.

Abadie, A., & Imbens, G. (2006). Large sample properties of matching estimators for average treatment effects. *Econometrica*, *74*(1), 235–267.

Antoniou, A., Guney, Y., & Paudyal, K. (2008). The determinants of capital structure: Capital market-oriented versus bank-oriented institutions. *Journal of Financial and Quantitative Analysis*, *43*(01), 59–92.

Bae, K.-H., Kang, J.-K., & Wang, J. (2011). Employee treatment and firm leverage: A test of the stakeholder theory of capital structure. *Journal of Financial Economics*, *100*(1), 130 - 153.

Banerjee, S., Dasgupta, S., & Kim, Y. (2008). Buyer-supplier relationships and the stakeholder theory of capital structure. *The Journal of Finance*, *63*(5), 2507 - 2552.

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The Journal of Finance*, *52*(4), pp. 1411-1438.

Bris, A., Welch, I., & Zhu, N. (2006). The costs of bankruptcy: Chapter 7 liquidation versus chapter 11 reorganization. *The Journal of Finance*, *61*(3), 1253–1303.

Chang, X., & Dasgupta, S. (2009). Target behavior and financing: How conclusive is the evidence? *The Journal of Finance*, *64*(4), 1767–1796.

Fama, E., & French, K. (1995). Size and book-to-market factors in earnings and returns. *The Journal of Finance*, *50*(1), 131–155.

Fama, E., & French, K. (2002). Testing trade-off and pecking order predictions about dividends and debt. *Review of Financial Studies*, *15*(1), 1.

Flannery, M., & Rangan, K. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics*, *79*(3), 469–506.

Franck, T., & Huyghebaert, N. (2010). Determinants of capital structure in business start-ups: The role of nonfinancial stakeholder relationship costs. *Journal of Financial Research*, *33*(4), 487–517.

Frank, M., & Goyal, V. (2003). Testing the pecking order theory of capital structure. *Journal* *of Financial Economics*, *67*(2), 217–248.

Frank, M., & Goyal, V. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, *38*(1), 1–37.

Galema, R., Plantinga, A., & Scholtens, B. (2008). The stocks at stake: Return and risk in socially responsible investment. *Journal of Banking & Finance*, *32*(12), 2646–2654.

Hong, H., & Kostovetsky, L. (2011). Red and blue investing: Values and finance. *Journal of Financial Economics*, *In Press, Accepted Manuscript*.

Ince, O., & Porter, R. (2006). Individual equity return data from Thomson Datastream: Handle with care! *Journal of Financial Research*, *29*(4), 463–479.

Johnson, R. A., & Greening, D. W. (1999). The effects of corporate governance and institutional ownership types of corporate social performance. *Academy of Management Journal*, *42*(5), 564 - 576.

Kale, J. R., Meneghetti, C., & Shahrur, H. (2010, January). *Explicit and implicit contracts with non-financial stakeholders and corporate capital structure: The case of product warranties.* Available from http://ssrn.com/abstract=1539217

Kale, J. R., & Shahrur, H. (2007). Corporate capital structure and the characteristics of suppliers and customers. *Journal of Financial Economics*, *83*(2), 321 - 365.

KLD. (2008). *Getting Started With KLD STATS And Ratings Definitions.*

Lemmon, M., Roberts, M., & Zender, J. (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *The Journal of Finance*, *63*(4), 1575–1608.

Maksimovic, V., & Titman, S. (1991). Financial policy and reputation for product quality. *Review of Financial Studies*, *4*(1), 175.

Modigliani, F., & Miller, M. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, *48*(3), 261-297.

NASDAQ OMX. (2010). *Frequently asked questions.* Available from https://listingcenter.nasdaqomx.com/Show_Doc.aspx?File=FAQsMarketIntegrity.html

Rajan, R., & Zingales. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, *50*(5), 1421–1460.

Titman, S. (1984). The effect of capital structure on a firm's liquidation decision. *Journal of Financial Economics*, *13*(1), 137 - 151.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *Journal of Finance*, *43*(1), 1 - 19.

Verwijmeren, P., & Derwall, J. (2010). Employee well-being, firm leverage, and bankruptcy risk. *Journal of Banking & Finance*, *34*(5), 956 - 964.

Wooldridge, J. (2009). *Introductory econometrics: A modern approach.* South-Western Pub.

# Appendix

**Table 6** – Description of Variables

| **Variable** | **Description** | **Data Source and Calculation** |
|---|---|---|
| Book leverage (%) | Long-term debt/total assets | Compustat: (dltt/at) · 100 |
| Dividend dummy | Dummy is equal to one if common dividends are paid out in a particular year, it is zero otherwise | Compustat: Dummy variable based on dvc |
| EBIT (millions of dollars) | Earnings before interest and taxes | Compustat: oiadp |
| Fixed assets/total assets (%) | Fixed assets/total assets | Compustat: (ppent/at)·100 |
| Logarithm of sales | Logarithm of total sales | Compustat: log(sale) |
| Market-to-book value of equity | (Closing price * common shares outstanding) / (total shareholder's equity + deferred taxes + investment tax credit - preferred stocks) | Compustat: (prcc_f · csho) / (seq + txdb + itcb - Preferred Stocks), where Preferred Stocks = pstkrv (if missing equal to pstkl, if still missing equal to topstk) |
| Market leverage (%) | Long-term debt/(total debt + market value of equity) | Compustat: (dltt / (at - ceq + (prcc_f · csho))) · 100 |
| Product quality index | Scores for product quality strength + R&D/innovation strength - product safety concern - marketing/contracting concern | KLD STATS: prostrA + prostrB - proconA - proconB |
| Return on assets (%) | Net Income/total assets$_{(t-1)}$ | Compustat: (ni/l1.at) · 100 |
| R&D expenditures/total sales (%) | R&D expenditures/total sales | Compustat: (xrd/sale) · 100, if missing set a 0 |
| R&D intensity | Research and development expenditures/ number of employees | Compustat: xrd/emp |
| Sales growth (%) | Geometric mean of sales growth during year t-3 to t | Compustat: ((sale/l3.sale)$^{1/3}$-1) · 100 |
| SGA expenses/total sales (%) | Selling, general and administrative expenses/total sales | Compustat: (xsga/sale) · 100 |
| Total assets (millions of dollars) | Total assets | Compustat: at |
| Total sales (millions of dollars) | Total sales | Compustat: sale |

**Table 7** – Relation between Product Quality Index and Covariates

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Product Quality Index | −1.702* | −1.732* | 0.697 | −0.189 | −1.941*** | −1.819* | −1.819* | −1.619* | −1.530* | −1.539* | −0.0273 |
| | (−2.47) | (−2.51) | (0.79) | (−0.28) | (−3.50) | (−2.65) | (−2.35) | (−2.36) | (−2.44) | (−2.40) | (−0.04) |
| Market-to-book value of equity | | −0.157* | | | | | | | | | −0.0162 |
| | | (−2.15) | | | | | | | | | (−0.40) |
| Logarithm of assets | | | 2.945*** | | | | | | | | 6.495** |
| | | | (11.61) | | | | | | | | (3.41) |
| Logarithm of sales | | | | 1.760*** | | | | | | | −4.023* |
| | | | | (5.73) | | | | | | | (−2.07) |
| Fixed assets/total assets | | | | | 0.195*** | | | | | | 0.132*** |
| | | | | | (5.98) | | | | | | (3.51) |
| Return on assets (%) | | | | | | −0.224*** | | | | | −0.297*** |
| | | | | | | (−3.78) | | | | | (−6.29) |
| Total sales/total assets | | | | | | | −2.853** | | | | 0.793 |
| | | | | | | | (−2.74) | | | | (0.84) |
| Dividend dummy | | | | | | | | 0.773 | | | −1.465* |
| | | | | | | | | (0.91) | | | (−2.24) |
| R&D expenditures/total sales (%) | | | | | | | | | −0.0762** | | −0.0778*** |
| | | | | | | | | | (−3.24) | | (−3.54) |
| SGA expenses/total sales (%) | | | | | | | | | | −0.0386*** | −0.0270* |
| | | | | | | | | | | (−3.64) | (−2.11) |
| Constant | 12.09*** | 12.63*** | −8.764*** | −0.149 | 7.089*** | 11.20*** | 15.22*** | 11.77*** | 12.55*** | 13.20*** | −7.794*** |
| | (9.44) | (9.70) | (−4.91) | (−0.05) | (5.36) | (8.08) | (6.78) | (7.76) | (10.08) | (11.04) | (−3.84) |
| Observations | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 | 8885 |
| Adjusted $R^2$ | 0.033 | 0.037 | 0.122 | 0.069 | 0.131 | 0.075 | 0.058 | 0.033 | 0.050 | 0.052 | 0.293 |

This table presents the results of the pooled ordinary least squares regressions in which I regress market leverage on the Product Quality Index and individual leverage determinants. The appendix provides a detailed description of the variables used. All regressions use the sample of US firms covered by MSCI's KLD STATS database as well as Compustat between 2004 and 2009. Year dummies are included in all regressions, but I do not report their coefficients. Numbers in parentheses are $t$ statistics based on robust standard errors clustered at the firm level. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 5%, 1% and 0.1% level respectively.

**Table 8** – PAIRWISE CORRELATION MATRIX

| | Market leverage (%) | Product Quality Index | Market-to-book value of equity | Logarithm of assets | Logarithm of sales | Fixed assets/total assets | Return on assets (%) | Total sales/total assets | Dividend dummy | SGA expenses/total sales (%) | R&D expenditures/total sales (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Market leverage (%) | 1.0000 | | | | | | | | | | |
| Product Quality Index | -0.0639$^{***}$ | 1.0000 | | | | | | | | | |
| Market-to-book value of equity | -0.0909$^{***}$ | 0.0017 | 1.0000 | | | | | | | | |
| Logarithm of assets | 0.2803$^{***}$ | -0.2243$^{***}$ | -0.0105 | 1.0000 | | | | | | | |
| Logarithm of sales | 0.1843$^{***}$ | -0.2143$^{***}$ | -0.0016 | 0.9081$^{***}$ | 1.0000 | | | | | | |
| Fixed assets/total assets | 0.3039$^{***}$ | 0.0086 | -0.0410$^{***}$ | 0.2053$^{***}$ | 0.1565$^{***}$ | 1.0000 | | | | | |
| Return on assets (%) | -0.2439$^{***}$ | -0.0169 | 0.0803$^{***}$ | 0.1077$^{***}$ | 0.1926$^{***}$ | -0.0026 | 1.0000 | | | | |
| Total sales/total assets | -0.1532$^{***}$ | -0.0005 | 0.0057 | -0.0868$^{***}$ | 0.2876$^{***}$ | -0.0534$^{***}$ | 0.1361$^{***}$ | 1.0000 | | | |
| Dividend dummy | 0.0290$^{**}$ | -0.0664$^{***}$ | 0.0100 | 0.3518$^{***}$ | 0.4162$^{***}$ | 0.1728$^{***}$ | 0.1523$^{***}$ | 0.1455$^{***}$ | 1.0000 | | |
| SGA expenses/total sales (%) | -0.1498$^{***}$ | 0.0325$^{***}$ | 0.0941$^{***}$ | -0.2069$^{***}$ | -0.3251$^{***}$ | -0.2075$^{***}$ | -0.3023$^{***}$ | -0.1674$^{***}$ | -0.1583$^{***}$ | 1.0000 | |
| R&D expenditures/total sales (%) | -0.1380$^{***}$ | 0.0337$^{***}$ | 0.0814$^{***}$ | -0.1404$^{***}$ | -0.2586$^{***}$ | -0.1780$^{***}$ | -0.3244$^{***}$ | -0.1860$^{***}$ | -0.1628$^{***}$ | 0.7754$^{***}$ | 1.0000 |

This table presents the results of the correlation matrix between all dependent and independent variables used in this study. Year and industry dummies are excluded. The appendix provides a detailed description of the variables used. I use the sample of US firms covered by MSCI's KLD STATS database as well as Compustat between 2004 and 2009. $^{*}$, $^{**}$, and $^{***}$ denote significance at the 5%, 1%, and 0.1% level respectively.