NATIONAL RESEARCH UNIVERSITY
HIGHER SCHOOL OF ECONOMICS

Maria Kokoreva, Anastasia Stepanova,
Kirill Povkh

COULD HIGH-TECH COMPANIES LEARN FROM OTHERS WHILE CHOOSING CAPITAL STRUCTURE?

BASIC RESEARCH PROGRAM

WORKING PAPERS

SERIES: FINANCIAL ECONOMICS
WP BRP 62/FE/2017

Maria Kokoreva[1], *Anastasia Stepanova*[2],

Kirill Povkh[3]

COULD HIGH-TECH COMPANIES LEARN FROM OTHERS WHILE CHOOSING CAPITAL STRUCTURE?

This paper analyzes why high-tech firms are less likely to have debt in their capital structure. The share of zero-leverage firms increased in the US in the Software & Services, Hardware Equipment and the Pharmaceutical & Biotechnical industries which are treated as high-tech firms in our research. We divide the sample of US-based firms from the RUSSELL 3000 index for the period from 2004 to 2015 into two groups, one of them includes only high-tech firms, another contains all other firms from the sample. Traditional determinants of corporate structure such as size, age, asset tangibility, profitability and market-to-book ratio cannot fully explain why high-tech firms choose a zero-debt policy. We found that high-tech firms are more financially constrained than non-high-tech firms. The managerial entrenchment hypothesis could not predict zero-leverage for high-tech firms, but it can partially predict the debt conservatism of non-high-tech firms. The evidence shows that the excess cash hypothesis explains why unconstrained high-tech firms have zero-leverage but does not explain it for non-high-tech firms. Finally, we did not find a significant influence of the financial flexibility hypothesis for the decision of unconstrained high-tech firms to be unlevered, while for their non-high-tech counterparts this hypothesis fits.

JEL Classification: Z

Keywords: capital structure, zero-leverage, zero debt, high-tech firm

[1] National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; E-mail: mkokoreva@hse.ru

[2] National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; E-mail: anstepanova@hse.ru

[3] National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; E-mail: kspovkh@edu.hse.ru

Introduction

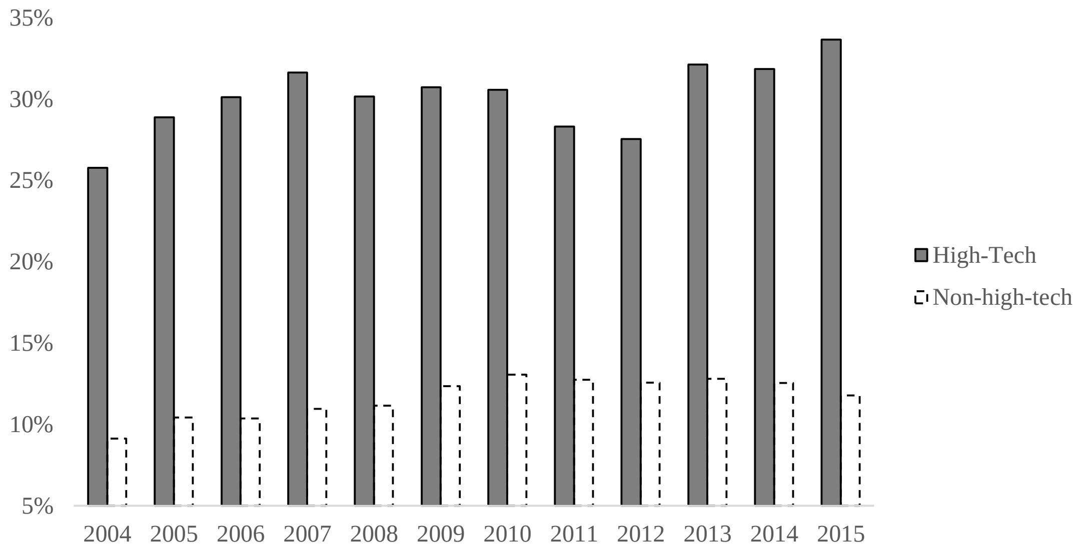
Capital structure choice has been an important issue in corporate finance since the 1960s. Modigliani & Miller (1963) provided the foundation for modern capital structure theories in corporate finance and showed that a firm's value does not depend on its capital structure under a set of strict assumptions including the absence the transaction costs and information asymmetry. However, later researchers show that the corporate structure of the firm affects its performance. Since the 1980s, the two most popular corporate structure theories, the pecking order theory (Myers & Majluf, 1984) and the trade-off theory (Kraus & Litzenberger, 1972), advocate the use of debt because of either the lower cost of asymmetric information or tax benefits. Capital structure choice is affected by many others factors, therefore there is a plenty room for discussion about the optimal debt level for a firm. Scholars do not, however, include zero-debt in the range of possible optimal levels of debt.

During the last three decades the proportion of companies raising no debt for financing capital increased from about 8% in 1988 to 30% in 2013 (Bessler et al., 2013) as illustrated in Figure 1. Earlier research notes that although zero-debt firms are not limited to certain industries, the information technology and healthcare represent the biggest share of them.

There is clear evidence that the world economy is again experiencing dramatic structural change. Less than 10 year ago, before the financial crisis in 2008, the top 10 largest companies around the world were primarily banks, and oil and gas companies. Now we can see Apple, Alphabet, Microsoft are the top 3 companies by capitalization. The technology industry has already become the most capitalized in the US.

Technology-based firms are the most prosperous companies; Silicon Valley has crowded out Wall Street as the place where most capitalized firms are concentrated. The success of technology firms has led researchers to explore their organizational structure more intently. As corporate structure is considered to be one of the most important issues in corporate finance, the exploration of factors affecting it in high-tech firms also led to more attention as well.

1.A – number of zero-leverage firms



1.B – Market leverage

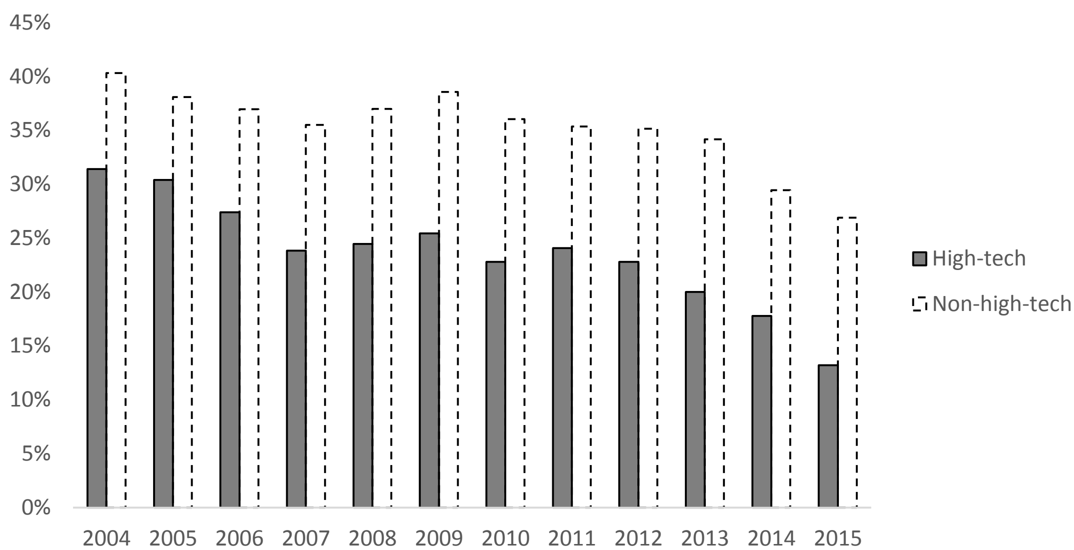


Figure 1. Number of high tech firms and market leverage

Figure 1.A shows changing in number of zero-leverage firms from 2004 to 2015. Solid line represents high-tech firms (include firms from RUSSEL 3000 index relating to “Software & Services”, "Technology Hardware & Equipment" and "Pharmaceuticals, Biotechnology & Life Sciences" according to Capital IQ classification), dash lines dipicts non-high-tech firms (firms from RUSSEL 300, with exception of firms, highlighted as high-tech, financial organizations and utilities.

Figure 1.B shows changing in market leverage over period. Market leverage was defined as long-term debt devided by long-term debt plus market capitalization.

Source: authors’ calculations

One of the most contentious problems in studying high-tech firms is to correctly define what a high-tech firm is. Some authors identify a list of jobs that are more likely to be science- and engineering-intensive as well as the industries "whose shares of employment in those occupations were three times the national average" (Chapple et al., 2004). However, the most popular method to distinguish between high-tech and non-high-tech firms is to analyze the R&D expenditure. In our study, we take the CIQ classification as a base to determine high-tech firms; firms from the Software and Services, the Hardware and Equipment, and the Pharmaceuticals and Biotechnical sectors.

Despite the fact that the majority of contemporaneous studies on the zero-leverage puzzle focus primarily on US-based firms, there is still a large gap in the literature examining high-tech sector in the US. Papers on the capital structure of high-tech firms (Coleman & Rob, 2012; Aghion et al, 2014) have not yet revealed the reasons for firms avoiding debt. The US represents a suitable environment for studying zero-leverage policies since the proportion of zero-leverage firms is higher in developed countries than in emerging countries (Devos et al., 2012) and a large number of high-tech firms are concentrated in 4 centers (Silicon Valley, San Diego, Seattle and Washington) making the US economy the best laboratory for studying the features of high-tech companies.

Table 1. Distribution of zero-leverage firms by sectors

Sector	% of ZL
Pharmaceuticals, Biotechnology & Life Sciences	37%
Software & Services	36%
Technology Hardware & Equipment	28%
Retailing	26%
Semiconductors & Semiconductor Equipment	25%
Health Care Equipment & Services	22%
Automobiles & Components	21%
Consumer Durables & Apparel	21%
Commercial & Professional Services	17%
Consumer Services	16%
Transportation	14%
Capital Goods	11%
Telecommunication Services	8%
Food Beverage & Tobacco	8%
Energy	7%
Household & Personal Products	7%
Media	7%
Materials	6%
Food & Staples Retailing	6%

Source: authors' calculations

Pharmaceuticals and biotechnology, software and hardware are sectors represent the highest fraction of zero-leveraged firms (see Table 1). Firms from these sectors build their business based on technology, therefore as we dealing with the RUSSEL 3000 index which includes only large and mid-cap firms, their technological basis should be at a high level in order to compete in the market. The concentration of these firms in high-tech industries is consistent with real-life experience as firms with highly specialized products, and a high fraction of intangible assets will enforce higher costs on their staff, the users of their products, suppliers and potential debt-holders in the event of bankruptcy.

Classical capital structure theories fail to explain the increased propensity of firms to follow zero-leverage policies. In spite of numerous attempts to explain this phenomenon, there is still a large gap between the theoretical basis and empirical evidence from different sectors. This paper investigates different motives high-tech and non-high-tech firms have to stay unlevered. We check the different motives of both high-tech and non-high-tech firms in order to capture distinctions between these two groups of firms and identify whether the results of studies for non-high-tech firms can be applied to high-tech ones.

We contribute to the literature with a comparative analysis of a zero-debt policy in high-tech and non-high-tech firms. In previous investigations, the authors tested either various hypotheses for zero-leveraging on a sample of US-based firms (Dang et al., 2013) and firms from developed markets (Bessler et al., 2013) or a divided sample, based on a selection parameter, such as the dividend paying status (Strebulaev & Yang, 2013). Unlike these studies, this paper considers today's most capitalized industries in the US, i.e. Software and Services, Hardware Equipment, and Pharmaceuticals and Biotechnology, which include many successful, fast-growing firms.

The first step is to determine whether or not traditional predictors of corporate structure can explain the high level of debt conservatism across high-tech firms. Next, we present the sample and conduct a univariate analysis in order to find significant statistical differences of key variables between high-tech and non-high-tech firms. Using the findings from initial empirical analysis, we apply a regression analysis supporting the 3 main findings and shed light on the motives for a zero-debt policy.

Literature review

Traditional corporate structure theories

Although during the last several decades attempts have been made to expand the theoretical basis for the choice of optimal corporate structure, the zero-leverage puzzle lacks a theoretical basis. Standard capital structure theories fail to explain why many firms follow a zero-debt policy.

According to the pecking order theory (Myers & Majluf, 1984) insiders of a firm possess internal information about the firm, which is not always published for external users. Due to this information asymmetry, potential external purchasers of the firm's stock are more likely to underprice it. Thus, firms prefer to rely on the internal financing first, then on the debt financing and equity financing as a last resort.

The static trade-off theory (Kraus & Litzenberger, 1972) examines the marginal costs (the cost of financial distress) and benefits (tax shields) associated with an increase of the debt-to-equity ratio. Under this theory, firms with high leverage a have higher risk of default and they try to minimize this risk. Logically the cost of financial distress is more significant for smaller or younger firms, which have a limit access to the debt financing. Firms with a low level of debt miss the potential benefits related to tax shields (Graham, 2000). Tax shields appear because of the difference between the tax rate for dividends payments, and tax rates for interest payments which are usually lower. Unlike this static framework, the dynamic trade-off theory (Fisher et al., 1989) considers the existence of a long-term optimal capital structure choice; while in the short-term firms tend to deviate from it.

One of the first scholars who studied the conservative capital structure policy of many firms was Graham (2006), who found some factors offset the debt tax shield, which leads to the "underlevered puzzle". More recently, Milton & Wruck (20011), investigate the low leverage puzzle and found that financial conservatism is a widespread phenomenon, not limited to certain industries and countries. They point out that debt conservatism is more common for industries prone to bankruptcy.

However, in recent investigations (Devos et al., 2012; Bessler et al., 2013) an upward trend in the percentage of zero-levered firms during the last two decades has been identified.

The financial constraints hypothesis

Probably the most popular theory why many firms stay unlevered is the financial constraints hypothesis. Research on the examining the zero-debt puzzle often determine whether firms are financially constrained. Some researchers split their sample into groups formed based on the level of financial constraints (Korajczyk & Levy, 2002) and test their hypothesis separately on these groups.

While the importance of this factor is accepted by most scholars, there is no clear answer which proxy should be used to measure the level of financial constraint. For instance, Hadlock & Pierce (2010) characterize a financially constrained firm as a young small firm with limited access to debt financing or with a poor reputation, while Diamond (1989) notice that constrained firms are less likely to have a credit history. Such firms could lack tangible assets, which are commonly used as collateral in order to lower the cost of debt (Benmelech & Bergman, 2009). It has been also explored whether such firms often rely on lease financing rather than on external financing in order to buy an asset (Eisfeldt & Rampini, 2009). These firms usually switch to the debt financing when the financial constraints relax and the cost of debt decreases.

Korajczyk & Levy (2002) use a combination of high retention rate and existing investment opportunities. As far as dividend payouts and share repurchases compete with capital investments for funds, firms with investment opportunities and a high cost of external finance have to reinvest most of their net income. Therefore, according to this point of view, financially constrained firms are less likely to pay dividends or repurchase shares prior to the observation date. This idea is similar to methodology used by Fazzari et al. (1988), who use the level of dividend payouts in order to define the level of financial constraints of those firms.

Relating to the capital structure, there is much evidence that financially constrained firms are more likely to be debt free than unconstrained firms (Devos et al, 2012; Bessler at al., 2013; Dang, 2013). While it seems to be easy to provide an explanation why financially constrained firms stay unlevered, it is much more difficult to find out the incentives for unconstrained firms which maintain zero-leverage deliberately (Bessler et al., 2013).

The managerial entrenchment hypothesis

One possible explanation of zero-leverage is the managerial entrenchment hypothesis. This explanation has a theoretical basis; one of the studies where this issue was examined was Jensen & Meckling (1976), where the concept of agency costs and "separation and control" issues were defined, which was the breakthrough in corporate finance. Shleifer and Vishny (1989) conducted a study, providing clear evidence of managerial entrenchment and documented that it negatively influences firm performance. One of the main implications of their theory is that managers choose only investment projects maximizing their welfare and try to avoid risk by dropping out potentially profitable but more risky projects.

Relating to the corporate structure choice, the supporters of this hypothesis finds a positive relationship between the level of the managerial entrenchment and the debt ratio. Some authors argue that entrenched managers maintain zero-leverage to protect their human capital (Fama, 1980). While others claim that a conservative debt policy allows management to reap the corporate benefits of decreasing interest payments (Stulz, 1990).

In an empirical study Strebulaev & Yang (2013) test the managerial entrenchment theory on a sample of US-based firms and get supportive results. They find evidence that one reason why firms stay unlevered is weak governance mechanisms. From their point of view, governance characteristics such as CEO ownership, board turnover and board size significantly decrease the influence on firms' capital structure policy.

One of the main features of managerial entrenchment is a high percentage of shares owned either by the CEO or by insiders. There is clear evidence from business practice supporting the idea of a positive effect of insider ownership. Thus, it is clear from previous investigations (Cuii & Mak, 2001; Devos et al., 2013) that the relationship between insider ownership and the effectiveness of the firm is not linear. In terms of our research it means, that it is difficult to predict the results of testing this hypothesis.

The financial flexibility hypothesis

Another explanation why firms maintain zero-leverage is the financial flexibility hypothesis. The financial flexibility of the firm is defined as a firm's ability to respond to negative market conditions in a value-maximizing manner. It means that when the firm is temporary unlevered, it accumulates cash to save its debt capacity for future investment projects (DeAngelo & DeAngelo, 2007; Gamba & Triantis, 2008). Consequently, unlike financially constrained firms, such firms strategically maintain zero-leverage in order to be more flexible in the future and mitigate possible negative effects from the market.

Bessler et al. (2013) describe financial flexibility as a firm's ability to react to sharp changes in economic conditions and investment opportunities, which is relatively close to how it was defined elsewhere in the literature. To test the hypothesis the authors analyze changes in property, plant, equipment and capital expenditures among zero-debt and leveraged firms. Zero-leveraged firms which decided to borrow money increased capital expenditures in following years, which supports the financial flexibility hypothesis. In such cases, firms remain zero-leveraged for quite a short period, otherwise the financial constraints hypothesis is more relevant (Dang, 2013).

Dang (2013) on the empirical analysis of UK-based zero-leverage firms, found that firms with high growth opportunities and cash holdings eschew debt for financial flexibility. The logic here is that high-growth firms strategically maintain high level of cash reserves and follow a conservative debt policy in order to preserve debt capacity for market downturns.

Equity decisions

Another branch of researchers documents the relationship between the capital structure policy and the attractiveness of the firm for current and potential investors. Byoun & Xu (2012) claim that many firms maintain zero-leverage deliberately in order to attract new investors. Zero-debt seems to be appealing for stockholders, as such firms do not need to spend cash on debt repayments and are more likely to have a higher dividend payout ratio (Strebulaev & Young, 2013). Zaher (2011) compares the performance of large cap zero-debt firms with their unlevered peers and found that debt-free firms generate higher returns. Intriguingly, firms with lower leverage are more likely to issue new equity when their appraisal is high, while firms with high leverage tend to raise funds when their appraisal is low (Baker & Wurgler, 2012).

Strebulaev & Young (2013) report that approximately one third of zero-debt firms pay dividends, which tends to be higher than the proportion of comparable unlevered firms. Byoun & Xu (2013) reveal different incentives to pay higher dividends between large and small zero-leverage firms. For small firms high dividend payouts give reputational benefits in equity capital markets, while for large firms high dividends payouts allows them raise equity capital on favorable terms.

The risk aversion of top management

Using financial variables, to explain firms' capital structure does not leave much room for discussion; non-financial data seems to be more innovative. In general, the most important non-financial data are associated with corporate governance characteristics, which strongly affect the effectiveness of the firm and its market value. Some variables, relating to corporate governance have been already mentioned as factors affecting the managerial entrenchment. In terms of leverage, one of the possible ways governing features of the firm may force it to follow a conservative capital structure policy is the perception of risk to the board.

The literature focusing on board diversity (e.g. Peni, 2012) provides persuasive evidence that a higher share of woman on boards leads them to be more conservative. The intuition behind this argument is that women are considered to be more risk-averse that men, as they tend to avoid losses and are less resistant to the extremely high risks (Byrnes et al., 1999; Jianakoplos & Bernasek, 1998; Schubert, 2006).

There are also many arguments on corporate governance supporting the importance of CEO characteristics such as professional and educational background (Hamori & Koyuncu, 2014; Dittmar & Duchin, 2014).

Hypotheses

Our hypotheses are divided into two parts. First, we investigate whether traditional determinants can explain the differences in the probability of being debt free in high-tech and other industries. Second, we investigate which motives for being debt free are reliably important for high-tech firms compared to non-high-tech firms. Thus, one of the main contributions of the study is that the hypotheses are separately tested on the subsamples of high-tech firms and on the other firms which allows us to show which motives for being zero-leveraged for high-tech firms could be replicated by non-high-tech firms and which motives are significant only for high-tech firms.

H1: Traditional capital structure determinants are not able to fully explain why high-tech firms maintain zero-debt.

Although there are different frameworks evaluating the optimal capital structure of firms, some indicators are likely to have higher predictive power (Rajan & Zingales, 1995). The five indicators, which we focus on in our study are size, age, profitability, asset tangibility and market-to-book ratio. We expect that traditional determinants of capital structure are relevant for high-tech firms as well, still, this set of factors cannot capture the difference in capital structure choice of high-tech firms and non-high-tech firms.

Size. The most common way to estimate the size of a firm is to consider its total assets. Hadlock & Pierce (2010) show that the size of a firm negatively correlates with the probability that the firm follows a zero-debt policy. Similarly, Fama & French (2002) documented that total assets and the financial leverage of a firm are positively related, as a firm with a large amount in total assets is more likely to obtain favorable conditions for debt. We expect that in terms of assets, high-tech firms are smaller than their counterparts from traditional industries.

Age. The firm age variable was constructed by subtracting the year of incorporation from the considered year. Typically, age is assumed as an indicator of financial constraints. We decided to include this variable in the traditional set as it has been commonly used in prior research (Bessler et al., 2013; Devos et al., 2013). Similar to size, age is positively correlated with the leverage of a firm, as mature firms have had more time to build a reputation on capital markets and have more access to debt. It is also expected that high-tech firms are considerably younger than non-high-tech firms.

Tangibility. The tangibility variable was derived by dividing tangible assets by total assets. It is clear from prior research (Coles et al., 2006; Mackie-Mason, 1990; Molina, 2005) that tangible assets allow firms to decrease the cost of debt-financing, as they could serve as collateral for bank loans. In the case of default, debt-holders will more likely convert tangible assets to cash, therefore tangibility is supposed to have positive relationship with leverage. In fact, the difference of the level of asset tangibility between high-tech and non-high-tech firms in one of the most important reasons why we decided to consider high-tech firms separately, as we anticipate that high-tech firms have less tangible assets that non-high-tech firms.

Profitability. To measure profitability earnings before interest and taxes (EBIT) was divided by total sales per year. EBIT was chosen instead of net income as it a much more stable indicator, this logic is consistent with the research of Bessler et al. (2013) and Devos et al. (2013). According to pecking order theory (Myers et al., 2013) more profitable firms are less likely to initiate debt financing as they have sufficient internal financing. However, the high profitability of a firm can also be treated as a positive sign for banks, therefore it is not clear about the expectation of the sign of this coefficient in the model. There is no confidence whether high-tech firms are more or less profitable than non-high-tech firms, as evidence shows that high-tech industry tends to be more lucrative than traditional sectors but technology-based firms are often more volatile and unstable, which can reduce its mean value on the whole sector.

Market-to-book ratio. This ratio is calculated by dividing current market capitalization plus the market value of debt by the total assets of a firm. It demonstrates the level of investor confidence in a firm’s business and their expectations relating to a firm’s growth opportunities. A high market-to-book ratio means that investors are confident in the future prospects of the firm, which in turn increase confidence of potential debtholders. Consequently, it is expected that higher market-to-book ratios are associated with leveraged firms (Devos et al., 2012). What is more, due to the high growth rates of high-tech sector in the US, market-to-book ratio is expected to be higher for high-tech firms.

By testing our first hypothesis we expect to find that there is a higher probability that high-tech firms are unlevered and the set of traditional factors cannot fully explain the difference in the number of zero-leverage firms between high-tech and non-high-tech companies. Thus, our further research focuses on attempts to capture the peculiarities of high-tech firms motives to follow a zero-debt strategy.

H2: High-tech firms are more financially constrained than non-high-tech firms.

The financial constraints hypothesis is broadly used in the literature and could explain why firms from developed countries are debt-free. Financial constraint proxies we used traditional corporate structure variables and add the available cash and cash equivalents (Devos et al., 2013). According to the financial constraint determinants, which are treated as traditional capital structure variables in our research, high-tech firms are expected to be more constrained. Moreover, there is much evidence signaling that high-tech firms tend to be riskier due to the intangible nature of their products which leads to a high level of uncertainty among potential debt-holders. (Coleman & Robb, 2012). As mentioned above, the fact that high-tech firms possess a large amount of cash potentially reduces their constraints, the testing this hypothesis could give controversial results. We expect the financial constraint hypothesis to be significant for high-tech firms while less so for firms from other industries.

H3: Managerial entrenchment influences the decision of high-tech firms to become zero-leveraged less than for non-high tech firms.

Managerial entrenchment can be expressed by corporate governance characteristics, which show the level of internal and external monitoring. We use two variables which have been employed in the literature, as important mechanisms of management monitoring: board size (Yermack, 1996) and the share of outside directors on the board (Wiesbach, 1988). Boone at el. (2007) find that smaller and less independent boards give CEOs more freedom, power and influence. We also include the percentage of shares owned by insiders, but we consider insider ownership could lead to both managerial entrenchment and an alignment of owners and management (Morck et al., 1998).

Lastly, Shleifer & Vishny (1986) provide evidence that investors owning a large part of the firm have strong incentives to monitor the management of the firm, which decreases managerial entrenchment. Thus, we include the percentage of shares owned by blockholders, defined as investors, who own at least 5% of a firm's common stock.

In contrast to the financial constraint hypothesis we expect that managerial entrenchment for high-tech firms where corporate governance is not so settled and quite often the owners are represented by the entrepreneurs is not highly relevant. A lower significance of this motive for high-tech firms could partially explain the difference in capital structure choice of high-tech companies.

H4: Financial flexibility influences the decisions of high-tech firms to become zero-leveraged less than for the non-high tech firms.

This hypothesis is tested for unconstrained firms, as financial flexibility is related to deliberate decisions to maintain zero-leverage. Market-to-book ratio, expressing a firm's growth opportunities, and cash balances will be used as proxies for firm flexibility. Changes in property, plant and equipment in the following year are included in the model, as we expect that zero-leverage firms which remain unlevered because of financial flexibility will be likely to make investments which will lead to an increase of property, plant and equipment (Harfold et al., 2012). As for the managerial entrenchment hypothesis we also expect that financial flexibility is more relevant for non-high tech firms. This could be partially explained by the intangibility of the assets of high-tech firms compared to those non-high-tech firms.

H5: The existence of excess cash is more likely for unlevered high-tech firms.

For those high-tech zero-leveraged firms which are not constrained financially, one possible factor affecting their decision to eschew debt is an excess of cash investment opportunities. Firms with relatively weak governance characteristics tend to spend excess cash on capital investments rather than on both dividends payments or share repurchases (Harford et al., 2008), which allow them to avoid initiating debt. A number of well-known high-tech firms such as Apple, Google and Microsoft have huge cash balances,[4] while it is not obvious that high-tech firms in general have this feature.

First, excess cash itself and the ratio of excess cash to capital expenditures could be a good proxy of the zero-leverage puzzle. Does the excess of cash is a distinguishing characteristic of all

[4] https://9to5mac.com/2016/05/24/aapl-cash- reserves-moodys/

unconstrained high-tech firms or just attributable to the largest and most prosperous ones? Logically, the availability of large cash reserves allows a firm to cover all planned investment projects without external financing. Therefore, we expect that for non-financially constrained firms excess cash serves as the main reason why such firms stay unlevered.

We compare the average surplus of excess cash over capital expenditure on the subsample of financially constrained high-tech firms and of all other financially constrained firms from our sample.

Data and methodology

Sample

We collected annual financial data from the Bloomberg database and non-financial data from the Capital IQ database over the period 2004-15. All variables are denominated in US dollars. The full sample consists of non-financial large and mid-cap firms from the RUSSEL 3000 index and excluded utilities from sample, due to differences in their business model. There are 2 189 firms in 2004 and 2 242 firms in 2015 in the initial sample. We divided the sample into two subsamples according to the CIQ industry classification. The first subsample represents high-tech firms and combine firms from Software & Services, Technology Hardware & Equipment, Pharmaceuticals, Biotechnology & Life Sciences industries. The second subsample contains other firms from the index.

We omitted observations with missing values for total assets, long-term debt and market capitalization. All variables that were used are winsorized at the 2,5% and 97,5% level. After cleaning and manipulation, we have a final panel dataset, which includes 17 199 firm-year observations.

An overview and the calculations of all the variables are provided in Table 1A in the Appendix.

Methodology

At the first stage of the research, our task is to check if the standard corporate structure determinants predict the high share of zero-debt firms in the high-tech sector.

We, therefore, first run annual logistic regressions using the full sample except high-tech firms to estimate the propensity to have zero-leverage 2004-15. The dependent binary variable is 1 for a zero-leverage policy (and 0 otherwise). Explanatory variables are market-to-book ratio, size, tangibility and profitability, which are considered to be traditional capital structure variables (Rajan & Zingales, 1995). Then, using the estimated coefficients, we compute the probability for each high-tech firm to be debt free. The expected percentage of zero-debt firms is obtained by averaging individual probabilities across all non-high-tech firms in a year. Finally, we subtract the expected percentage from the actual and obtain the difference, which cannot be explained by traditional capital structure coefficients.

At the second stage of the research, we conduct both univariate and multivariate regression analysis. Purpose of the univariate analysis is to investigate whether the difference between the characteristics of high-tech and non-high-tech firms is significant. We also investigate the differences between zero-leveraged and unlevered firms. In the multivariate analysis, we run logistic regressions to examine firm-specific factors determining the firm's propensity to maintain zero-debt. The model is:

$$\Pr(ZL=1|x) = \frac{1}{1+e^{-(\alpha+X\beta)}}, \tag{1}$$

where *ZL* is a binary variable which is 1 if the firm is zero-leveraged in year *z*, otherwise it is 0. *X* is a vector including all variables which are expected to determine a zero-leverage decision. β is a vector of estimated coefficients, α is a constant. As discussed in the previous section we include in the model (*X*) both the traditional variables, which are treated as control variables (size, age, market to book ratio, profitability, and tangibility) and the following firm specific variables: payouts to investors, capital expenditure, insider ownership, the percent of independent directors on the board, R&D expenditures, cash holdings, changes in property, plant and equipment, net debt tax shield.

We do not use a probit model in place of logit because the number of observations (more than 1 000 for each model) allows us to assume a normal distribution of the standard error.

Next, we divide each of our two subsamples into financially constrained and unconstrained firms based on the amount of payouts to investors, and then for unconstrained firms testing our hypothesis again.

Empirical analysis and results

In this section we first represent the descriptive statistics of our sample and run the univariate analysis, comparing the means of firm-specific variables for high-tech and non-high-tech firms. Then, we investigate whether the coefficients estimated on the sample of non-high-tech firms are able to predict zero-leverage for high-tech firms. Next, a multivariate regression analysis is conducted on both high-tech and non-high-tech subsamples in order to support or reject the hypotheses. Finally, additional tests will be conducted.

Initial empirical analysis

The descriptive statistics are provided in Table 2. It demonstrates the means of key variables used in further analysis. The mean values were separately calculated for both zero-leverage (ZL) and levered firms, as well as for high-tech ZL firms, non-high-tech ZL firms and the respective levered firms. A univariate analysis proved the significance of all the differences and the results are represented in Table A3 in the Appendix.

Table 4 shows the average market leverage of high-tech firms is lower than that of non-high-tech firms. It is consistent with our idea that high-tech firms generally borrow less.

The descriptive statistics provide evidence supporting the financial constraints hypothesis for both high-tech and non-high-tech firms. First, our findings are consistent with previous investigations, stating that ZL firms are usually smaller (Bessler et al., 2013; Devos et al., 2013). High-tech firms are the same size as non-high-tech firms. Secondly, ZL firms have a lower share of tangible assets in their assets structure, and high-tech firms have lower tangibility ratio than other firms. This finding demonstrates that high-tech firms are more financially constrained than firms from traditional industries, therefore it may be a major reason forcing them to eschew debt. However, there is little evidence to support the idea that ZL firms are more likely to be younger, but as Table 4 shows, high-tech firms are younger than non-high-tech firms, which is consistent with common sense.

Another important finding is that ZL firms are less profitable than levered firms, which is seems to be a controversial result, It supports the financial constraint hypothesis, as firms with low gross margin are less likely to have access to debt capital markets, however, this contradicts the pecking order theory (Myers et al., 2013), since a low profit margin leads to internal financing, which according to the theory forces firms to initiate new debt. High-tech ZL firms are less profitable than other firms in the sample.

Next, our results support the financial flexibility hypothesis. First, both high-tech and non-high-tech ZL firms have higher market to book ratio than unlevered firms. All ZL firms from the sample have higher cash balances as well, which is consistent with Dang et al. (2013), who found that ZL firms deliberately stay unlevered to be financially flexible in the future.

The results show that the costs for high-tech firms are three times higher for R&D and capital expenditures than for levered firms. These results underline the technological factor of firms belonging to this subsample.

One of the most important ratios in Table 2 is cash divided by total assets, as it sheds some light on the distinction between the two subsamples. It is clear from the data that zero-leverage firms have a higher cash-to-capital expenditures ratio than unlevered firms which serves as the foundation for the excess cash hypothesis. However, the results obtained do not demonstrate a significant difference between high-tech and non-high-tech firms.

The relationship between payment to equity holders and the presence of debt was supported by the data. The whole sample represents both a higher dividend payout ratio and more share repurchases among levered firms compared to ZL firms. Both buy-backs and dividend payments require a large amount of cash, which firms are rarely have, thus it forces firms to increase their leverage to get enough cash.

Table 2. Mean values of variables

Table represents mean values of variables using in the study.

Variable	Full sample		High-tech		Non-high-tech	
	ZL	Non-ZL	ZL	Non-ZL	ZL	Non-ZL
Market leverage	0.000	0.182	0.000	0.081	0.000	0.215
Age	19.012	18.873	14.000	11.595	23.980	21.772
Market-to-book	2.230	1.616	2.470	2.031	2.050	1.466
Size (Log)	6.070	6.927	6.080	6.322	6.060	7.152
Tangibility	0.200	0.256	0.170	0.183	0.220	0.283
Profitability	0.070	0.122	0.040	0.071	0.090	0.138
R&D	0.094	0.045	0.110	0.087	0.080	0.033
CapEx	0.046	0.049	0.042	0.037	0.049	0.051
Cash holdings	0.550	0.296	0.870	0.600	0.300	0.220
Cash / CapEx	79.829	18.554	77.850	40.344	81.342	13.050
Share repurchases	51.020	186.820	66.210	194.091	39.400	184.980
Dividend payout ratio	0.189	0.258	0.179	0.182	0.196	0.282
Payouts to investors	1.277	9.387	0.798	0.830	1.592	1.675
Net debt tax shield	0.040	0.040	1.525	0.040	0.040	0.040
Delta PP&E	30.510	103.760	10.180	39.730	12.260	110.840
N of directors on board	7.690	8.754	7.640	8.114	7.740	9.004
Blockholder ownership	36.739	33.095	36.240	34.261	37.110	32.682
% of independent directors	75.897	78.024	76.370	77.354	75.510	78.258
% of insider ownership	8.194	6.278	8.310	7.494	8.099	5.819

Source: authors' calculations

However, there is little evidence that ZL firms have significantly different corporate governance characteristics. For example, ZL firms have on average 7,69 persons on their boards, which is just 1 person less that for unlevered firms. There is also no differences between high-tech and traditional firms in this respect.

In order to find out the most correlated variables, a correlation matrix was built and is provided in Table 3A in the Appendix. Variables with high correlations were not included in a model simultaneously. For example, a strong positive correlation was found between the size of a firm and its revenue, which is indicates that it is better to use only one of these variables in our model. We also found a strong correlation between capital expenditures and the size of a firm, which means we avoid using this coefficient. Instead of using the nominal value we calculated the relative variable by dividing capital expenditures by the total assets of the firm. This coefficient is even better for us, as it is much more important how many firms are ready to invest in long-term assets relative to their size, in other words this coefficient depicts a firm's propensity to invest. Some other factors, specifically corporate governance characteristics are also correlated, therefore in order to test the managerial entrenchment hypothesis several model specifications are run.

Propensity model and high-tech difference

Table 3 shows the number of zero-leverage high-tech firms has increased, while the mean values of traditional corporate structure variables have not changed over the period (Table 4), which indicates that these variables do not predict zero-leverage correctly for high-tech firms. In the following sections, additional tests will be conducted.

It is essential to check on the first stage of the study weather high-tech firms tend to be unlevered due to same reasons as non-high-tech firms. In order to do that we use approach quite similar to Fama & French (2001) and Denis & Osobov (2008).

The results from the first stage of the study are provided in Table 5. At the beginning of the sample period the difference between the actual and the predicted percentage is small, while it increased to more than 14% in 2014 and then slightly decreased to about 11% at the end of the sample period. This finding is consistent with the hypothesis that traditional corporate structure determinants are less likely to predict the probability of high-tech firm staying unlevered as well as they can predict it for non-high-tech firms.

Table 3. Distribution of unlevered firms.
This table summarizes the data in the paper. The second column lists the number of public, non-financial firms relating to Software & Services, "Technology Hardware & Equipment" and "Pharmaceuticals, Biotechnology & Life Sciences" according to Capital IQ classification. The sample period is from 2004 to 2015, a firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. Full sample include all non-financial firms from RUSSEL 3000 except utilities.

Year	Full sample			High-tech			Others		
	All	ZL	%	All	ZL	%	All	N	%
2004	1 288	169	13.12%	287	74	25.78%	1 040	95	9.13%
2005	1 359	204	15.01%	315	91	28.89%	1 083	113	10.43%
2006	1 402	213	15.19%	322	97	30.12%	1 118	116	10.38%
2007	1 455	232	15.95%	332	105	31.63%	1 158	127	10.97%
2008	1 524	242	15.88%	358	108	30.17%	1 201	134	11.16%
2009	1 596	272	17.04%	384	118	30,73%	1 247	154	12.35%
2010	1 642	289	17.60%	399	122	30,58%	1 278	167	13.07%
2011	1 746	297	17.01%	445	126	28,31%	1 342	171	12.74%
2012	1 857	314	16.91%	501	138	27,54%	1 399	176	12.58%
2013	1 972	365	18.51%	554	178	32,13%	1 461	187	12.80%
2014	2 045	376	18.39%	587	187	31,86%	1 506	189	12.55%
2015	2 089	385	18.43%	609	205	33,66%	1 528	180	11.78%

Source: authors' calculations

Table 4. Mean values of traditional capital structure determinants of high-tech firms.
Table represents mean values of traditional capital structure determinants of high-tech firms at the beginning of the examining period (2004) and at the end (2015).

Variable	2004	2015
Profitability	0.0369962	0.0596827
Tangibility	0.1653919	0.1676554
Size	6.467622	6.772838
Market to book	2.273838	2.244689
Age	18.74747	17.60209

Source: authors' calculations

Given that traditional capital structure determinants failed to explain the increased percentage of zero-leveraged high-tech firms over the sample period, there should be other significant factors.

We provide further evidence supporting the difference between high-tech and non-high-tech firms by running a logit regression with five traditional determinants of capital structure and a high-tech dummy. Panel B of Table 5 shows that the high-tech dummy is significant at the 1% level, reflecting the high probability of high-tech firms being unlevered. To highlight the differences in the probability of high-tech and non-high-tech firms of being unlevered we test the hypothesis separately on high-tech and non-high-tech firms.

Table 5. Propensity model and logit regressing with high-tech dummy
Table represents evidence supporting differences between high-tech and non-high-tech firms

Panel A. Differences between actual and predicted share of zero-leverage high-tech firms. Predicted % on zero-leverage firms are obtained by using estimated coefficients from annual logit regressions on the whole sample of the firms with traditional corporate structure determinants.

Year	Actual %	Predicted %	Actual - Predicted %
2004	29.487	22.85	6.637
2005	34.734	26.37	8.364
2006	34.247	25.39	8.857
2007	35.184	24.67	10.514
2008	35.539	23.05	12.489
2009	39.179	25.39	13.789
2010	41.215	26.89	14.325
2011	38.151	27.02	11.131
2012	37.587	23.84	13.747
2013	39.095	26.69	12.405
2014	36.645	24.65	11.995
2015	35.44	24.632	10.808

Panel B. Logit regression with high-tech dummy	(1)
Varibales	
Size	-0.967***
	(0.0621)
Profitability	0.488*
	(0.261)
Tangibility	-1.625***
	(0.422)
Market to book ratio	0.0734*
	(0.0391)
Age	-0.00947**
	(0.00448)
High-tech dummy	2.335***
	(0.228)
Constant	2.668***
	(0.443)
Observations	14.183
Wald chi	455.99

Source: authors' calculations

Our evidence is also consistent with the literature relating to the relationship between traditional capital structure determinants and the zero-leverage decision. The size and age of the coefficients have a negative sign at the 1% and 5% significance level respectively. Next, the level of asset tangibility negatively affects the probability of firms having zero-leverage at the 1% significance level, which is also supports the results from the literature.

Regression analysis

This section of the study provides the results of the regression analysis. First, we run logistic regressions on the full sample and on the two subsamples separately.

Table 6. Regression analysis
Table represents the logistic regression analysis. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Variables	Whole sample	High-tech	Non-high-tech
Size	-1.609***	-0.953***	-2.081***
	(0.139)	(0.185)	(0.310)
Profitability	0.473	1.522	-0.950
	(0.742)	(1.112)	(1.107)
Tangibility	-1.925**	0.996	-2.315*
	(0.774)	(1.277)	(1.286)
Age	-0.0216***	-0.0368**	-0.00726
	(0.00720)	(0.0169)	(0.0104)
Net debt tax shield	2.269	-14.44	11,010
	(6.397)	(9.716)	(9.789)
Financial const. dummy	0.544**	0.750*	0.238
	(0.232)	(0.399)	(0.308)
Insider ownership	0.00609	0.0278	-0.0212
	(0.0158)	(0.0237)	(0.0234)
% of independent directors	-0.0252**	-0.00422	-0.0445***
	(0.0103)	(0.0163)	(0.0156)
Constant	8.604***	4.649**	11.48***
	(1.337)	(1.896)	(2.654)
Observations	6.392	1.469	4.923
Wald chi2	188.57	55.59	55.64

Source: authors' calculations

Table 6 shows that the estimated coefficients for predicting the zero-leverage of high-tech firms differ from the coefficients for non-high-tech firms.

These results primarily support the financial constraints hypothesis of the whole sample. First, the size of the firm negatively influences the probability of the firm being unlevered, as we found significant coefficients in all six models. This factor is less important for high-tech firms rather than for traditional firms. A possible explanation is that traditionally the size of a firm has been a sign of it creditworthiness, while for high-tech firms size does not play such an important role as the share of intangible assets is higher.

We do not find evidence supporting the managerial entrenchment hypothesis for high-tech firms. Both insider ownership and the percent of independent directors on board are not significant for the high-tech subsample. However, board independence negatively affects the probability of a non-high-tech firm being unlevered, which is consistent with the managerial entrenchment hypothesis. Thus, such results are supportive of our hypothesis that managerial entrenchment does not affect the zero-leverage decision of high-tech firms.

Table 7. Regression analysis on the sample of unconstrained firms
Table represents the results from logit regression. First specification (1) tests financial flexibility hypothesis, second specification (2) tests the excess cash hypothesis. Uncontrained firms are defined as those, which value of total payout to investors is more that its mean value. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

	All		High-tech		Non-high-tech	
Variables	(1)	(2)	(1)	(2)	(1)	(2)
Size	-1.668***	-2.066***	-1.155***	-1.456***	-1.853***	-2.409***
	-0.205	-0.243	-0.248	-0.358	-0.285	-0.44
Tangibility	-2.043*	-3.109***	-2.096	0.617	0.0989	-3.033**
	-1.103	-1.11	-1.999	-2.263	-1.399	-1.492
Age	-0.0232***	-0.0208**	-0.0287	-0.0366	-0.00788	-0.00623
	-0.00881	-0.00863	-0.0182	-0.0244	-0.00963	-0.0106
Market to book	0.707***		0.684***		0.616***	
	-0.12		-0.167		-0.162	
Cash holdings	-0.00836		-2.722		3.946***	
	-0.0516		-1.878		-1.526	
Delta PP&E	-0.00018		-9.99E-05		-0.00021	
	-0.00027		-0.0004		-0.00039	
Excess cash /capex		-0.0517**		-0.124***		-0.00579
		-0.0239		-0.0443		-0.0289
Constant	7.004***	9.525***	7.229***	7.734***	5.257**	11.43***
	-1.503	-1.815	-2.309	-2.783	-2.094	-2.805
Observations	3.832	5.335	560	632	3.272	4.703
Wald chi2	109.04	82.95	38.99	23.41	71.34	31.07

Source: authors' calculations

Next, we included a dummy variable in the model which indicates whether a firm is constrained or not, the description is provided in Table A1 in the Appendix. This coefficient is positive for the whole sample and for high-tech firms at the 5% and 0% significant levels respectively, while we did not found any significance for it in the zero-leverage decision of non-high-tech firms. Due to such results, we split the subsample into constrained and unconstrained high-tech firms in order to test the two other hypotheses. We also test this model on the whole sample and on the subsample of non-high-tech firms in order to capture possible differences of the high-tech firms.

Our results relating to the financial flexibility hypothesis are controversial; cash holdings and market-to-book ratio positively affect the decision of non-high-tech firms to have zero-leverage. Therefore, we can conclude, that non-high-tech firms with high growth opportunities strategically maintain a high level of cash in order to save their borrowing capacity. However, we did not find significant changes in property, plant and equipment in following year, which is likely to mean that firms spend their funds on either buy-backs or mergers and acquisitions. This hypothesis is not applicable to high-tech firms as these coefficients are not significant.

Our evidence supports the excess cash hypothesis as the excess cash-to-capital expenditure ratio negatively affects the probability of an unconstrained high-tech firm being unlevered at the 1% significance level. The excess cash hypothesis is not able to explain why unconstrained non-high-tech firms are unlevered.

Conclusions

This research focuses on a comparison of the capital structure determinants of high-tech and non-high-tech firms.

First, we provided evidence showing the increasing propensity for high-tech firms to be unlevered over the considered period, while there is no such trend among non-high-tech firms. Secondly, the descriptive statistics show that high-tech firms are younger, smaller, have less tangible assets and a better growth prospective than non-high-tech firms. High-tech firms have more cash in both absolute terms and relative to capital expenditures than non-high-tech firms. We also found that the most significant indicators of financial constraints for both high-tech and non-high-tech firms are firm size and firm age. We also demonstrate that high-tech firms paying high cash dividends to investors or making significant share repurchases are more likely to be debt-free, while this logic is not reliable for non-high-tech firms.

There is room for further investigation of this phenomenon.

We further show that the managerial entrenchment hypothesis is not applicable for high-tech firms and partially applicable for non-high-tech firms. This suggests there are stronger governmence mechanisms in high-tech firms.

Finally, it was shown that excess cash is a major reason why unconstrained high-tech firms stay unlevered, while unconstrained non-high-tech firms follow a zero-debt capital structure policy for financial flexibility purposes.

As it seems impossible to test all the potential explanations for zero-leverage, this study takes into account special features of the high-tech industry. Determinants which may have potentially good explanatory power for predicting zero-leverage for firms from traditional industries, will possibly not be included in the model, if they could not predict zero-leverage for high-tech firms.

References

1. Aghion, P., Bond, S., Klemm, A., & Marinescu, I., 2004. Technology and financial structure: are innovative firms different? Journal of the European Economic Association, 2(2-3), 277-288.
2. Baker, M., & Wurgler, J., 2002. Market timing and capital structure. Journal of Finance 57(1), 1–32.
3. Benmelech, E., Bergman, N.K., 2009. Collateral pricing. J. Financ. Econ. 91, 339–360.
4. Bessler, W., Drobetz, W., Haller, R., & Meier, I., 2013. The international zero-leverage phenomenon. Journal of Corporate Finance, 23, 196-221.
5. Boone, A.L., Field, L.C., Karpoff, J.M., Raheja, C.G., 2007. The determinants of corporate board size and composition: an empirical analysis. J. Financ. Econ. 85, 66–101.
6. Byoun, S., & Xu, Z., 2013. Why do some firms go debt free?. Asia-Pacific Journal of Financial Studies, 42(1), 1-38.
7. Byrnes, J. P., Miller, D. C., & Schafer, W. D., 1999. Gender differences in risk taking: A meta-analysis. Psychological Bulletin, 125(3), 367–383.
8. Chapple, K., Markusen, A., Schrock, G., Yamamoto, D., & Yu, P., 2004. Gauging metropolitan "high-tech" and "i-tech" activity. Economic Development Quarterly, 18(1), 10-29.
9. Coleman, S., & Robb, A., 2012. Capital structure theory and new technology firms: is there a match?. Management Research Review, 35(2), 106-120.
10. Coles, J.L., Daniel, N.D., Naveen, L., 2006. Managerial incentives and risk-taking. J. Financ. Econ. 79, 431–468.
11. Cui, H., & Mak, Y. T.. 2002. The relationship between managerial ownership and firm performance in high R&D firms. Journal of Corporate Finance, 8(4), 313-336.
12. Denis, D.J., Osobov, I., 2008. Why do firms pay dividends? International evidence on the determinants of dividend policy. J. Financ. Econ. 89, 62–82.
13. Dang, V.A., 2013. An empirical analysis of zero-leverage: New evidence from the U.K. International Review of Financial Analysis 30, 189-202
14. DeAngelo, H., DeAngelo, L., 2007. Capital structure, payout policy, and financial flexibility. University of Southern California, Working Paper.
15. Devos, E., Dhillon, U., Jagannathan, M., & Krishnamurthy, S., 2012. Why are firms unlevered? Journal of corporate finance, 18(3), 664-682.

16. Diamond, D.W., 1989. Reputation acquisition in debt markets. J. Polit. Econ. 97, 828–862.
17. Dittmar, A., & Duchin, R., 2016. Looking in the Rearview Mirror: The Effect of Managers' Professional Experience on Corporate Financial Policy. Review of Financial Studies, 29(3), 565-602.
18. Eisfeldt, A. L., & Rampini, A. A., 2009. Leasing, ability to repossess, and debt capacity. Review of Financial Studies, 22(4), 1621-1657.
19. Fama, E.F., 1980. Agency problems and the theory of the firm. J. Polit. Econ. 88, 288–307.
20. Fama, E.F., French, K.R., 2001. Disappearing dividends: changing firm characteristics or lower propensity to pay? J. Financ. Econ. 60, 3–43.
21. Fazzari, S.M., Hubbard, R.G., Petersen, B.C., 1988. Financing constraints and corporate investment. Brookings Pap. Econ. Act. 1988, 141–195.
22. Harford, J., Mansi, S. A., & Maxwell, W. F., 2012. Corporate governance and firm cash holdings in the US. In Corporate Governance Springer Berlin Heidelberg,107-138.
23. Gamba, A., & Triantis, A., 2008. The value of financial flexibility. The Journal of Finance, 63(5), 2263-2296.
24. Graham, J., 2000. How big are the tax benefits of debt? J. Finance 55, 1901–1941.
25. Graham, J., 2003.Taxes and corporate finance: a review. Review of Financial Studies 16, 1074–1128.
26. Hadlock, C.J., Pierce, J.R., 2010. New evidence on measuring financial constraints: moving beyond the KZ index. Rev. Financ. Stud. 23, 1909–1940.
27. Hamori, M., & Koyuncu, B., 2015. Experience matters? The impact of prior CEO experience on firm performance. Human Resource Management, 54(1), 23-44.
28. Jensen, M., & Meckling, W., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360.
29. Jianakoplos, N., & Bernasek, A., 1998. Are women more risk averse? Economic Inquiry, 36(4), 620–630.
30. Kraus, A., Litzenberger, R.H., 1973. A state-preference model of optimal financial leverage. J. Finance 28, 911–922.
31. Korajczyk, R. A., & Levy, A., 2003. Capital structure choice: macroeconomic conditions and financial constraints. Journal of financial economics, 68(1), 75-109.
32. MacKie-Mason, J.K., 1990. Do taxes affect corporate financing decisions? J. Finance 45, 1471–1493.

33. Modigliani, F., & Miller, M. H., 1963. Taxes and the cost of capital: A correction. American Economic Review, 53(3), 433–443.
34. Molina, C.A., 2005. Are firms underleveraged? An examination of the effect of leverage on default probabilities. J. Finance 60, 1427–1459.
35. Morck, R., Shleifer, A., Vishny, R.W., 1988. Management ownership and market valuation: an empirical analysis. J. Financ. Econ. 20, 293–315.
36. Myers, S.C., Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. J. Financ. Econ. 13, 187–221.
37. Peni, E., 2014. CEO and Chairperson characteristics and firm performance. Journal of Management & Governance, 18(1), 185-205.
38. Rajan, R. G., & Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. Journal of Finance, 50(5), 1421–1461.
39. Shleifer, A., Vishny, R.W., 1986. Large shareholders and corporate control. J. Polit. Econ. 94, 461–488.
40. Strebulaev, I. A., & Yang, B., 2013. The mystery of zero-leverage firms. Journal of Financial Economics, 109, 1–23.
41. Stulz, R., 1990. Managerial discretion and optimal financing policies. Journal of financial Economics, 26(1), 3-27.
42. Schubert, R., 2006. Analyzing and managing risks—on the importance of gender difference in risk attitudes. Managerial Finance, 32(9), 706–715.
43. Weisbach, M.S., 1988. Outside directors and CEO turnover. J. Financ. Econ. 20, 431–460.
44. Yermack, D.L., 1996. Higher market valuation of companies with a small board of directors. J. Financ. Econ. 40, 185–211.
45. Zaher, T. S.,2011. Does It Pay to Invest in Debt Free Firms During Recessions?

Appendix

Table A1 Description of variables

Variable	Description
Market leverage	Long-term debt divided by long-term debt plus market value of equity
Age	Number of years since the date on incorporation
Market-to-book	Current market capitalization plus long-term debt divided by total assets
Size (Log)	Natural logarithm of total assets
Tangibility	Tangible assets divided by total assets
Profitability	Earnings before tax and interest divided by revenue
R&D	Research and development expenditures divided by total assets
CapEx	Capital expenditures divided by total assets
Cash holdings	Cash and cash equivalents
Cash / CapEx	Cash and cash equivalents divided by capital expenditures
Share repurchases	Total amount of share repurchases for the year
Dividend payout ratio	Proportion on net income paying out to investors
Payouts to investors	Dividend payouts plus share repurchases dividend by net income
Net debt tax shield	Depreciation divided by total assets
Delta PP&E	Changing in PP&E in t+1 period compared to t period
N of directors on board	Number of directors on board
Blockholder ownership	% of shares owned by investors with 5 and more % of firm's common stock
% of independent directors	% of shares owned by independent directors
% of insider ownership	% of shares owned by insiders and affiliated persons
Financial constants dummy	Equal 1 if firm pays dividend or make share repurchase more that on average

Source: authors' calculations

Table A2. Descriptive statistics.
This table shows the mean, the standard deviation (Std. Dev.), the number of firm-year observations (N), the minimum (Min) and maximum (Max)

Variable	Full sample					Non-high-tech		High-tech	
	Mean	S. D.	Min	Max	N	Mean	N	Mean	N
Market leverage	0.18	0.20	0	0.84	17 269	0.22	12 975	0.08	4 294
Age	19	25	0	199	22 480	22	16 321	12	6 159
Market-to-book	1.62	1.51	0.13	8.37	18 613	1.47	13 679	2.03	4 934
Size	6.93	1.97	1.77	11.45	21 498	7.15	15 667	6.32	5 831
Tangibility	0.26	0.24	0	0.89	21 466	0.28	15 644	0.18	5 822
Profitability	0.10	0.24	0.73	0.44	21 342	-0.15	15 560	-0.64	5 782
Revenue	4 531	19 140	0	79 664	21 983	5 231	15 962	2 675	6 021
R&D	112.86	425	0	3 381	18 125	82.10	12 837	187.53	5288
Capital expenditure	280.99	778.10	0	5 379	21 688	341.59	15 780	119.12	5 908
Excess cash /Revenue	0.10	2.07	0	0.14	18 237	0.09	13 558	0.17	18 237
Share repurchases	394.65	1 504	0	45 001	11 368	348.44	8 980	568.42	2 388
Dividend payout ratio	25.84	47.42	0	315.67	15 752	28.24	11 991	18.19	3 761
WACC	9.39	2.88	1.79	17.46	21 110	9.26	15 432	9.73	5 678
N of directors on board	8.75	2.43	2.00	15	4 433	9.00	3 188	8.11	1 245
Blockholder ownership	33.09	19.90	0	85.49	18 669	32.68	13 795	34.26	4 874
% of independent directors	78.02	13.02	33.33	92.86	12 623	78.26	9 352	77.35	3 271
% of insider ownership	6.28	9.99	0	54.50	9 559	5.82	6 942	7.49	2 617

Source: authors' calculations

Table A3.
Univariate analysis

Variables	High-tech N	High-tech Mean	Non-high-tech N	Non-high-tech Mean	Mean Difference
Market leverage	12881	35.282	4216	21.596	13.686***
Age	11388	28.19	3730	17.583	10.607***
Market-to-book	12927	1.436	4272	2.03	-0.593***
Size (Log)	12927	7.448	4272	6.674	0.774***
Tangibility	12921	0.29	4272	0.173	0.117***
Profitability	12815	0.138	4216	0.072	0.066***
R&D	10590	72.248	3882	143.395	-71.147***
CapEx	12915	-332.349	4268	-131.448	200.901***
Cash holdings	12846	545.461	4250	963.599	-418.138**
Cash / CapEx	12773	-23.025	4222	-52.566	29.541***
Share repurchases	12927	229.476	4272	297.033	-67.557***
Dividend payout ratio	10444	45.821	2930	22.253	23.568***
Payouts to investors	10409	0.71	2882	1.122	-0.411*
Net debt tax shield	12916	0.04	4266	0.039	0.001**
Delta PP&E	9454	105.341	3204	39.933	65.407***
N of directors on board	3023	9.139	1160	8.259	0.880***
Blockholder ownership	10978	32.076	3790	34.322	-2.247***
% of independent directors	8744	78.801	2929	77.913	0.887***
% of insider ownership	6579	5.392	2410	6.595	-1.203***

Source: authors' calculations

Authors:

1. Maria Kokoreva, National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; PhD in Finance;
   E-mail: mkokoreva@hse.ru, tel +7 (903) 622-26-71
2. Anastasia Stepanova, National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; PhD in Finance, Monetary Circulation and Credit; E-mail: anstepanova@hse.ru, tel +7 (916) 446-32-10
3. Kirill Povkh National Research University Higher School of Economics (Moscow, Russia). Corporate Finance Center; E-mail: kspovkh@edu.hse.ru tel +7 (926) 368-91-24