# The New Strategy of High-Tech Companies – Hidden Sources of Growth

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## Abstract

The recent increase in the share of zero-leverage firms is most pronounced in the Software and Services, Hardware Equipment, and Pharmaceutical and Biotechnical industries. The reasons for these industries' conservative debt policies are not fully disclosed. How companies in technological sectors manage to perform well attracting no debt and losing debt tax shield benefits is a mystery. This study aims to determine why high-tech firms are less likely to have debt in their capital structure. On a sample of US-based firms from the RUSSELL 3000 index for the past 12 years, we show the factors leading to a zero-debt structure. After dividing the sample into high-tech and non-high-tech subsamples, we demonstrate the gap between zero-debt motives for technological and traditional sectors. We show that the common determinants of the corporate structure cannot fully explain why high-tech firms choose a zero-debt policy. Testing the possible motives of debt financing avoidance, we find that high-tech firms are more financially constrained than non-high-tech firms. We further show that unconstrained high-tech firms may avoid debt to maintain their financial flexibility. On top of that, managerial entrenchment also adds to the zero-leverage choice of high-tech companies. This study's results are helpful for top-management teams and investors since they shed light on the specific style of financing choice for technological firms.

**Keywords:** capital structure; leverage; financial flexibility; financial constraint; zero-leverage; zero debt; high-tech firm; managerial entrenchment

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## Introduction

During the last three decades, the proportion of companies raising no debt increased from about 8% in 1988 to 30% in 2013 (Bessler et al., 2013). More than 34% of companies between 1996 and 2015 were zero-leverage at a certain point in time (Lotfaliei, Lundberg, 2019). The trend for conservative debt policies could be found on both developed and emerging markets (Cui, 2020; Ghoul et al., 2018; Yasmin, Rashid, 2019). Earlier research notes that although zero-debt firms are not limited to specific industries, information technology and healthcare represent their most significant share, as illustrated in Figure 1.

During the same period, the market faced structural changes with the constant growth of high-tech firms. The success of technology firms has led researchers to explore their organizational structure and decision-making more intently. As capital structure is considered one of the most critical corporate decisions, exploring factors affecting high-tech firms' debt-to-equity ratio requires more attention.

Following the sectoral view, we find that pharmaceuticals, biotechnology, software, and hardware represent the highest fraction of zero-leverage firms as of 2016 (see Table 1). The concentration of zero-leverage firms in high-tech industries is consistent with real-life experience. High-tech firms with highly specialized products and a high fraction of intangible assets enforce higher costs on their staff, the users of their products, suppliers, and potential debtholders in the event of bankruptcy.

Although attempts have been made over the last several decades to expand the theoretical basis for optimal corporate structure choice, the zero-leverage puzzle still lacks a theoretical basis. Classical capital structure theories fail to explain the increased propensity of firms to follow zero-leverage policies (Graham, 2003). However, there are many ideas behind the choice of zero-leverage policy, including financial constraints (Devos et al., 2012), financial flexibility (DeAngelo et al., 2011), agency problems (Butt, 2020), and signaling (Miglo, 2020). Despite numerous attempts to explain this phenomenon, there is still a large gap between theoretical and empirical evidence from different sectors.

Given the specifics of high-tech firms and the high concentration of zero-debt firms in high-tech sectors, we look for the difference between the zero-leverage motives for high-tech and non-high-tech firms in this paper. Papers on the capital structure of high-tech firms have not yet reached a consensus on the reasons for firms avoiding debt (Coleman, Robb, 2012; Aghion et al., 2014). So, we contribute to the literature by demonstrating the different motives for zero debt at high-tech and non-high-tech firms and comprehensively analyzing high-tech firms' capital structure choices.

One more unique feature of the high-tech sector that has not been discussed above is its geographical concentration. In the United States, the high-tech firms are concentrated in four centers (Silicon Valley, San Diego, Seattle, and Washington, D.C.), making the US economy the best laboratory for studying the features of high-tech companies. Dealing with firms from one country also allows us to focus on firm-level and industry-level factors of zero-leverage so that the results are not biased by country-level cultural differences (El Ghoul et al., 2018).

Our key results are the following. We first argue that classical determinants of capital structure cannot explain the high share of high-tech firms with zero leverage. We show that zero-leverage policies are often the result of financial constraints rather than the deliberate choice of high-tech firms. However, high-tech firms also choose a conservative debt policy for financial flexibility which means that with the growing share of high-tech firms, we expect to see lower interest in the corporate debt market. Finally, we show that high-tech firms with higher shares of insider ownership may choose a zero-leverage policy because of managerial entrenchment.

We contribute to the literature with a thorough comparative analysis of zero-debt policy at high-tech firms. Previous studies either provide the results of various determinants testing for a zero-leverage sample of US-based firms (Dang, 2013) and firms from developed markets (Bessler et al., 2013), or a divided sample based on a selection parameter, such as dividend-paying status (Strebulaev, Yang, 2013). Unlike these studies, this paper considers high-tech firms separately and in contrast to firms from traditional sectors to promote a more in-depth understanding of the capital structure choice of the most capitalized industries in the US. Moreover, we investigate several possible motives for choosing zero-leverage (financial constraints, financial flexibility, managerial entrenchment), allowing us to obtain a broader picture of high-tech firms' financing policies.

The share of companies with conservative leverage or zero debt policies is also increasing on emerging capital markets (Machokoto et al., 2021; Ghoul et al., 2018). An analysis of firms from 21 emerging markets (Asia, South and Central America, East Europe, Africa) showed the predominance of financial flex-

ibility as the major reason to choose a zero-leverage policy, which is followed by the motive of financial constraints (Iliasov, Kokoreva, 2018). That is not surprising keeping in mind the specifics of emerging markets that leads to higher barriers for capital access: asymmetry of information, high levels of state ownership, and the presence of pyramidal ownership structures (Bekaert, Harvey, 2003; Buchanan et al., 2011; Sprenger, Lazareva, 2021). Although the research shows the relevance of financial constraints and financial flexibility for emerging market firms, there are no insights into the choice of capital structure by high-tech firms. Moreover, the research on high tech companies in emerging markets is challenging at the moment given the small amount of available data.

Still, we have at least two reasons why the results of our paper could be of interest for high-tech industries on emergency markets. First, the results of zero-leverage policy on emerging markets revealed that the major determinants of zero debt policy are those connected with the unpredicted future results of the firm (Iliasov, Kokoreva, 2018), which is especially relevant for high-tech firms. Secondly, it was shown that the significance of macroeconomic parameters is lower than internal corporate factors. Thus, based on research in developed capital markets, we can anticipate how relevant these results would be for emerging capital markets and develop strategies for optimal capital structure choices by technology companies.

Table 1. **Distribution of zero-leverage firms by sectors in the US**

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

*Source:* Capital IQ and authors' calculations.

## Literature Review and Development of Hypotheses

While many attempts have been made to broaden the theoretical basis for optimal corporate structure selection, the zero-leverage puzzle has no theoretical rationale. Standard capital structure theories (trade-off theory, pecking order theory) fail to explain why many firms follow a zero-debt policy (Myers, Majluf, 1984; Fisher, 1933).

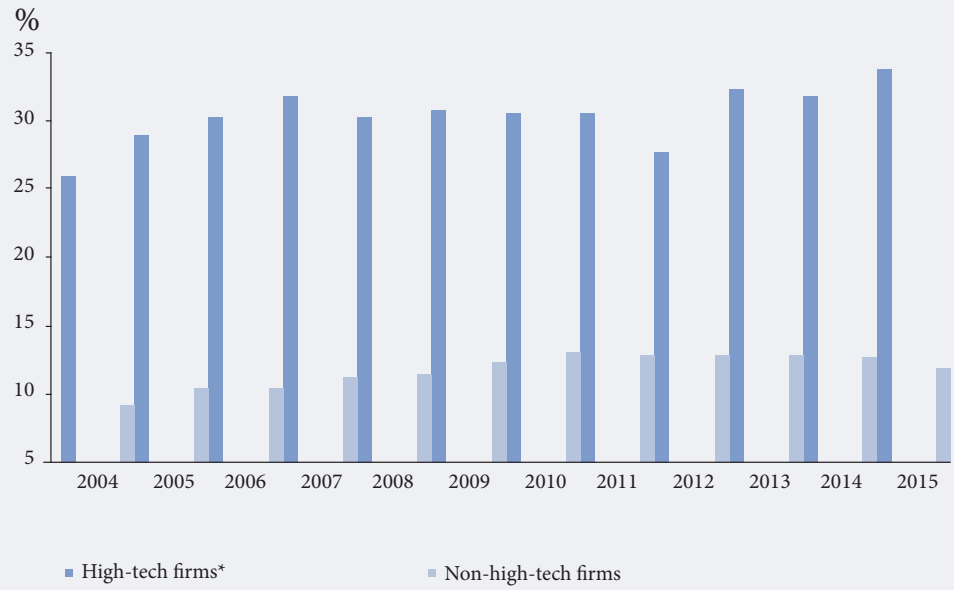
Graham (2003) found some factors that offset the debt tax shield, which leads to an 'underlevered puzzle' and a conservative capital structure policy. Later, Minton and Wruck (2001) investigated the low leverage puzzle and found that financial conservatism is widespread, not limited to specific industries and countries.

As this growth in the share of companies without debt goes hand in hand with the growth of companies in the high-tech sectors (Bessler et al., 2013), the latter firms deserve special attention. High-tech firms differ in several ways from traditional sectors. First, high-tech firms are more R&D intensive, which leads to more significant uncertainty of outcomes and greater risks. Here the asymmetric information problem is added since the insiders have more information on the probability of the firm's success. As soon as the high-tech firms' products are, in general, more specific, outside investors face difficulties with cash flow forecasting.

Moreover, evidence shows that high-tech firms are smaller (Talberg et al., 2008) and, in general, younger, which goes in line with the greater prevalence of riskier firms participating in recent IPOs (Bessler et al., 2013). As a result, high-tech firms meet the demand for higher risk premiums on external financing (Hart, Moore, 1994, Rampini, Viswanathan, 2010). Thus, we focus our research on the zero-leverage choice of high-tech firms.

We contribute by identifying the difference in capital structure choice of high-tech and non-high-tech firms based on the determinants and applicable theories levels. We focus on common capital structure determinants (size, tangibility, profitability, growth opportunities) and three possible theoretical explanations of zero-leverage policy: financial constraints, financial flexibility, and managerial entrenchment.

Figure 1. **The percentage of zero-leverage firms from 2004 to 2015**




* Including firms from RUSSEL 3000 index relating to Software and Services, Technology, Hardware and Equipment, Pharmaceuticals, Biotechnology, and Life Sciences.

*Source:* authors.

### *Common capital structure determinants as drivers of zero-leverage choice*

Previous research defined a set of indicators likely to have a higher predictive power of debt-to-equity level choice (Rajan, Zingales, 1995; Hang et al., 2018). The four indicators we focus on in our study are size, profitability, asset tangibility, and growth opportunities. We call them common determinants in our study.

Hadlock and Pierce (2010) show that the *size* of a firm negatively correlates with the probability that the firm follows a zero-debt policy. Similarly, a firm with higher total assets has a better reputation and is more likely to obtain favorable conditions for debt (Saona et al., 2020). We expect that high-tech firms are smaller than their counterparts from traditional industries in terms of assets.

Tangible assets allow firms to decrease the cost of debt financing, as they could serve as collateral for bank loans (Molina, 2005). In the case of default, debt-holders will more likely convert tangible assets to cash. Therefore, *tangibility* is supposed to have a positive relationship with leverage. Despite the increase in the debt supply, no evidence was found for the impact of tangibility on the demand side, suggesting a declining propensity for zero leverage (Morais et al., 2020). We anticipate that high-tech firms have fewer tangible assets than non-high-tech firms, leading to a higher probability of zero-leverage.

According to the pecking order theory, more profitable firms are less likely to initiate debt financing as they have sufficient internal financing. On the other hand, the high profitability of a firm serves as a positive sign for banks to attract more debt (Morais et al., 2020). Therefore, it is not clear how *profitability* affects the propensity to choose a zero-leverage policy. There is no confidence about whether high-tech firms are more or less profitable than non-high-tech firms. However, technology-based firms are often more volatile, reducing the mean value for the whole sector.

The market-to-book ratio demonstrates investor expectations relating to a firm's *growth opportunities*. A high market-to-book ratio means that investors are confident in the firm's prospects. A company's growth opportunities are directly related to the financial resources the company needs. From the perspective of pecking order theory, for companies with high growth opportunities, investment needs exceed retained earnings, which means that external sources must be raised, resulting in a high debt burden. However, in the environment of high information asymmetries (which is especially true for high-tech firms), investors with a lack of knowledge regarding the firm's value and future growth opportunities ask

for higher premiums (Myers, Majluf, 1984), resulting in lower debt ratios.

Moreover, adherents of the trade-off theory conclude that companies with high growth opportunities will have lower debt burdens due to the high potential costs of financial distress. Thus, capital structure theories provide different explanations for the growth opportunities' role in conservative debt policy. Still, empirical evidence shows that debt ratios are negatively related to a market-to-book ratio (Frank, Goyal, 2009). We expect that the high-tech firms demonstrate higher market-to-book ratios and, consequently, a greater propensity of zero-leverages.

To summarize, at least three of the four common determinants of capital structure, namely size, tangibility, and growth opportunities, can positively affect the propensity toward zero-leverage policies for high-tech firms. Firm size and asset tangibility are naturally lower for high-tech firms, which on average increases uncertainty and reduces financial leverage, and thus increases the propensity for zero-leverage policies. Growth opportunities can increase leverage in a perfect market. However, high information asymmetry in an emerging market leads to a significant increase in the cost of debt due to a serious increase in risk, which together leads to the popularity of zero-debt policies.

In other words, we expect that the common determinants of capital structure are relevant for high-tech and non-high-tech firms. Moreover, we expect to find a higher probability that high-tech firms are unlevered. Thus, our first hypothesis is as follows:

*H1. There is a persistent difference in the likelihood of choosing a zero-leverage policy between high-tech and non-high-tech firms that is not fully driven by common determinants of capital structure.*

However, we assume common 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 capturing the peculiarities of high-tech firms' motives to follow a zero-debt strategy.

### *The financial constraints hypothesis*

The financial constraints hypothesis is broadly used in the literature to explain why firms are debt-free. The financial constraints hypothesis refers to a forced motive to stay unlevered as constrained firms face costly external financing.

While most scholars accept the importance of this factor, there is no clear answer on which proxy should be used to measure the level of financial constraint. Diamond (1989) noticed that constrained firms are less likely to have a credit history; they often lack tangible assets commonly used as collateral. Eisfeldt and Rampini (2009) explored whether such firms often rely on lease financing rather than external financing to buy an asset. These firms usually switch to debt financing when the financial constraints relax and the cost of debt decreases.

As dividend payouts and share repurchases compete with capital investments for funds, firms with investment opportunities and a high external finance cost must reinvest most of their net income. Therefore, financially constrained firms are less likely to pay dividends or repurchase shares before the observation date. Korajczyk and Levy (2002) use a combination of a high retention rate and existing investment opportunities.

Another measure, the KZ Index, introduced by Kaplan and Zingales (1997), uses five variables to estimate financial constraints: cash flow, market-to-book, leverage, dividends, and cash holdings. The index was updated by Hadlock and Pierce (2010), who characterized a financially constrained firm as a small young firm with limited access to debt financing or with a poor reputation. As with the KZ Index, the research applies the coefficients developed for the size-age (SA) index in the subsequent research (Farre-Mensa, Ljungqvist, 2016).

As high-tech companies are generally younger, smaller, and have fewer tangible assets in their asset structures, we expect financial constraints to be a relevant driver of the sustainable choice of zero-leverage (Talberg et al., 2008). There is much evidence indicating that high-tech firms tend to be riskier due to their products' intangible nature, which leads to a high level of uncertainty among potential debtholders (Coleman, Robb, 2012). Moreover, high-tech firms are involved in innovations that lead to more volatile cash flows due to the high uncertainty of investment outcomes. As a result, high-tech firms tend to face a higher cost of debt and risk premium required by shareholders. Financial constraints for innovative firms mean potential problems with credit access, especially in times of crisis (Hall et al., 2016).

We, therefore, present our second hypothesis.

*H2: High-tech firms are more financially constrained than non-high-tech firms, often resulting in a zero-debt policy*

We expect that high-tech firms are more financially constrained, which is one reason high-tech demonstrate a large proportion of zero-debt firms. We

thus assume that the choice of constrained and unconstrained firms differs and should be approached separately.

### *The financial flexibility hypothesis*

There is much evidence that financially constrained firms are more debt-free than unconstrained firms (Devos et al., 2012; Dang, 2013; Cunha, Pollet, 2020). While it seems easy to explain why financially constrained firms stay unlevered, it is much more challenging to find the incentives for unconstrained firms that deliberately maintain zero-leverage (Bessler et al., 2013).

Another explanation of why firms maintain zero leverage is the financial flexibility hypothesis. The firm's financial flexibility is defined as a firm's ability to respond to unfavorable market conditions in a value-maximizing manner. In contrast to financial constraints, the financial flexibility motive is a deliberate choice of firms to stay unlevered. When the firm is temporarily unlevered, it accumulates cash to save its debt capacity for future investment projects (Gamba, Triantis, 2008, Favara et al., 2021). Consequently, unlike financially constrained firms, such firms strategically maintain zero leverage to be more flexible in the future and preserve debt capacity for market downturns (Dang, 2013).

Bessler et al. (2013) describe financial flexibility as a firm's ability to react to sharp changes in economic conditions and investment opportunities. It is more critical for high-tech firms than firms in traditional industries. Thus, the motive is particularly pronounced for firms with future growth opportunities.

While the financial flexibility motive is understudied for the zero-leverage policy, in contrast to (Lundberg, Lotfaliei, 2020), we suppose that financial flexibility plays a vital role for high-tech firms. High-tech industries are high-growth industries where firms must be flexible in their investment policies. At the same time, financial flexibility should be an essential motive only for companies without significant financial constraints. That leads us to the third hypothesis.

*H3: The financial flexibility motive for zero-leverage is stronger for high-tech firms than for non-high-tech firms*

### *The managerial entrenchment hypothesis*

Another possible explanation for zero-leverage is the managerial entrenchment hypothesis (Strebulaev, Yang, 2013).

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

One of the main features of managerial entrenchment is a high percentage of shares owned by the CEO or insiders. Strebulaev and Yang (2013) test the managerial entrenchment theory on a sample of US-based firms and obtained supportive results. They find evidence that firms stay unlevered by weak governance mechanisms. They show that family firms and firms with higher CEO ownership and longer CEO tenure are more likely to have zero debt, especially if boards are smaller and less independent.

Our fourth hypothesis is as follows.

*H4: Managerial entrenchment in high-tech firms increases the probability of a zero-leverage policy*

Following Strebulaev and Yang (2013), we believe managerial entrenchment significantly impacts staying unlevered. Moreover, we suppose that high-tech companies are less diversified on average than traditional industries. Thus, in line with arguments by (Ji et al., 2019), we believe that managerial entrenchment has a more significant effect on corporate decisions.

## Data and Methodology

### *Sample*

We collected annual financial data from the Bloomberg database and non-financial data from the Capital IQ database for 2004-2015. The entire sample consists of large and mid-cap firms from the RUSSEL 3000 index, excluding utilities and financial companies due to differences in their business models. There were 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 combines firms from Software and Services, Technology Hardware and Equipment, Pharmaceuticals, Biotechnology, and Life Sciences industries. The second subsample contains other firms from the index. All variables are winsorized at the 2.5% and 97.5% levels. 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 2.

### *Methodology*

In the first stage of the research, we conducted a univariate analysis. The purpose of the univariate analysis is to investigate whether the difference between the critical characteristics of high-tech and non-high-tech firms is significant.

In the second stage, we first run annual probit regressions to estimate the propensity to have zero-leverage. 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 (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 is not explained by common capital structure determinants.

As D'Mello and Gruskin (2021) demonstrated, the set of factors influencing the decision to eliminate debt differs from the determinants of reducing leverage. Thus, we assume that there is a difference in the determinants of choosing between zero and non-zero policies and the level of the debt-to-equity ratio. Therefore, in the multivariate analysis, we run probit regressions to examine firm-specific factors determining the firm's propensity to maintain zero debt and tobit regressions to account for the censored nature of the leverage (Nivorozhkin, 2015).

To test the financial constraint hypothesis, we run several steps. We start by comparing the characteristics of high-tech and non-high-tech firms commonly used in the literature to forecast the possibility of financial constraints. We expect to see that high-tech firms are younger, smaller, and have fewer tangible assets but higher growth opportunities.

Following (Hadlock, Pierce, 2010), we apply the size-age (SA) index to divide the sample into constrained and unconstrained firms. We chose this measure of the financial constraints based on the transparent characteristics, which are not easy to manipulate by management, and based on the information available for all companies. The SA index based on the loadings on size, size squared, and age is calculated as follows:

$$SA = -0.737 * SIZE + 0.043 * SIZE^2 - 0.040 * AGE \quad (1)$$

where SIZE is the logarithm of the total assets, and AGE is the number of years the firm is listed or years after the IPO took place.

We divide the sample into quartiles based on the index levels and determined that the quartile with the highest index level is the constrained subsample. The quartile with the lowest level of the index is considered unconstrained. We drop the second and third quartiles from this part of the analysis to avoid misleading results.

To test the flexibility hypothesis, we follow the methodology of Arslan-Ayaydin et al. (2014) and Lee et al. (2011). We approximate financial flexibility with retained earnings and cash holdings. We construct a dummy variable equal to one if the company has cash holdings or retained earnings above the sample medians by industries. Thus, all other companies with both cash and retained earnings below medians demonstrate a low level of financial flexibility. Using probit and tobit regressions, we estimate the influence of financial flexibility on the probability of zero-leverage choice and leverage of unconstrained firms.

Finally, we approximate managerial entrenchment with corporate governance characteristics demonstrating CEO power and monitoring (board size (Yermack, 1996) and the share of outside directors on the board (Weisbach, 1988)). Boone et al. (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. We follow (Strebulaev, Yang, 2013) to approximate

Table 2. **Description of variables**

| Variable | Description |
|---|---|
| Market leverage | Long-term debt divided by long-term debt plus the market value of equity |
| Age | Number of years since the date of incorporation |
| Market-to-book | Current market capitalization plus long-term debt divided by total assets |
| Size | 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 divided by total assets |
| Dividend payout ratio | The proportion of net income paid out to investors |
| N of directors on board | Number of directors on board |
| % of independent directors | % of shares owned by independent directors |
| % of insider ownership | % of shares owned by insiders and affiliated persons |

*Source:* authors.

managerial entrenchment through ownership and governance indicators.

## Results in Descriptive Statistics

The descriptive statistics are provided in Table 3. A univariate analysis proved the significance of all the differences; the results are represented in Table 4.

The descriptive statistics support the financial constraints hypothesis for high-tech and non-high-tech firms. First, we find that ZL firms are usually smaller (Devos et al., 2012). Secondly, ZL firms have a lower share of tangible assets, and high-tech firms have a lower tangibility ratio than other firms. This finding demonstrates that high-tech firms are more financially constrained than traditional industries. Therefore, it may be a major reason forcing them to eschew debt. Secondly, there is clear evidence that ZL firms are younger, with high-tech firms being younger than non-high-tech firms.

Another important finding is that ZL firms are less profitable than levered firms. It supports the financial constraint hypothesis, as firms with low gross margins are less likely to access debt capital markets. However, this contradicts the pecking order theory since a low-profit margin leads to internal financing, which 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, high-tech and non-high-tech ZL firms have a higher market-to-book ratio than levered firms. The descriptive statistics show that high-tech firms demonstrate a high market-to-book ratio (2.7 for ZL and 1.9 for non-Z.L.), showing higher growth opportunities and a high need for financial flexibility.

All non-ZL firms from the sample have higher cash balances, which is not consistent with Dang (2013), who found that ZL firms deliberately stay unlevered to be financially flexible in the future but corresponds to the financial constraints' hypothesis.

We could also observe greater insider ownership at ZL firms; thus, we could expect managerial entrenchment to be a significant factor in choosing an unlevered financing policy.

The results show that the R&D expenditures are much higher for high-tech firms, whereas the highest capital expenditures could be seen at non-ZL, non-high-tech firms. These results underline the technological factor of firms belonging to different subsamples.

## Empirical Results

It is essential to check whether high-tech firms tend to be unlevered for the same reasons as non-high-tech firms. Table 5 shows that the number of zero-leverage high-tech firms has increased. In contrast, the mean values of common capital structure determinants have not changed dramatically over the period (Table 6), which indicates that these variables do not predict zero-leverage correctly for high-tech firms. We use an approach similar to Fama and French (2001) and Denis and Osobov (2008). We run the probit regressions to evaluate firms' probability of ZL based on common factors. Then we estimate the predicted proportion of ZL firms for high-tech firms based on the results obtained and compare that with the actual figures. The results from the first stage of the study are provided in Table 7.

The actual share of zero-leverage firms varies from 32% to 36.06% over the period, while the predicted values lie between 22.39% and 26.44%. The predicted ratios are consistently and significantly lower than the actual ones. This finding is consistent with the hypothesis that common corporate structure determinants are less likely to predict the probability of high-tech firms remaining unlevered, and can also predict this decision for non-high-tech firms. Given that common 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 probit regression with four common determinants of capital structure and a high-tech dummy. Panel B of Table 7 shows that the high-tech dummy is significant, reflecting the high probability of high-tech firms being unlevered. This result corresponds to Hypothesis 1.

### *Financial Constraints*

We tested the financial constraint hypothesis (Hypothesis 2) by dividing the sample into constrained and unconstrained firms. The descriptive statistics of subsamples (the first and fourth quartiles) are represented in Table 8. The unconstrained firms are much older, larger, more profitable, and more tangible assets. The growth opportunities are higher for the constrained firms that appear to be younger, less profitable at the moment, and obtain a lower volume of tangible assets. The ratio of high-tech firms in the constrained subsample is more than a third (37%), whereas the unconstrained subsample has

Table 3. **Mean values of variables**

| Variable | High-tech | | Non-high-tech | |
|---|---|---|---|---|
| | *ZL* | *Non-ZL* | *ZL* | *Non-ZL* |
| Market leverage | 0.01 | 0.12 | 0.03 | 0.25 |
| Age | 14.64 | 20.35 | 23.99 | 29.53 |
| Market-to-book | 2.71 | 1.91 | 2.16 | 1.38 |
| Size | 6.08 | 7.02 | 6.05 | 7.71 |
| Tangibility | 0.17 | 0.17 | 0.22 | 0.30 |
| Profitability | 0.04 | 0.09 | 0.10 | 0.15 |
| RandD | 82.65 | 177.45 | 35.29 | 79.28 |
| CapEx | –74.18 | –162.88 | –50.04 | –382.14 |
| Cash holdings | 329.22 | 1314.15 | 144.39 | 616.59 |
| Dividend payout ratio | 22.24 | 22.49 | 54.66 | 44.53 |
| N of directors on board | 7.62 | 8.52 | 7.73 | 9.37 |
| % of independent directors | 76.17 | 78.50 | 75.38 | 79.21 |
| % of insider ownership | 8.78 | 6.19 | 8.51 | 5.18 |

*Note*: A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year.

*Source:* authors.

only around 11% of the high-tech representatives. Panel B of Table 8 shows approximately 77% of constrained firms in high-tech and 41.5% in non-high-tech sectors. Thus, we see that high-tech firms tend to be more financially constrained.

Table 9 presents the results of financial constraint hypothesis testing. The results support the financial constraints hypothesis as constrained firms are more likely to eschew debt. When we divide this group into high-tech and non-high-tech firms, we find that financial constraints for the high-tech firms only is significant. From the descriptive statistics, we expected financial constraints to be valid for the non-high-tech firms, although less significant. The results we obtained are even more striking since we see that for non-high-tech firms, financial constraints are not significant in predicting zero-leverage choices.

Thus, we state that financial constraints are essential for high-tech firms, so it is pretty often the case that for high-tech firms, zero-leverage is not an option but the result of an impossibility to obtain debt.

Table 4. **Univariate analysis**

| Variable | Non-high-tech | | High-tech | | Mean Difference |
|---|---|---|---|---|---|
| | *N* | *Mean* | *N* | *Mean* | |
| Market leverage | 12881 | 21.60 | 4216 | 0.08 | 21.52*** |
| Age | 11388 | 28.19 | 3730 | 17.58 | 10.61*** |
| Market-to-book | 12927 | 1.44 | 4272 | 2.03 | –0.59*** |
| Size | 12927 | 7.45 | 4272 | 6.67 | 0.77*** |
| Tangibility | 12921 | 0.29 | 4272 | 0.17 | 0.12*** |
| Profitability | 12815 | 0.14 | 4216 | 0.07 | 0.07*** |
| RandD | 10590 | 72.25 | 3882 | 143.40 | –71.15*** |
| CapEx | 12915 | –332.35 | 4268 | –131.45 | 200.9*** |
| Cash holdings | 12846 | 545.46 | 4250 | 963.60 | –418.14** |
| Dividend payout ratio | 10444 | 45.82 | 2930 | 22.25 | 23.57*** |
| N of directors on board | 3023 | 9.14 | 1160 | 8.26 | 0.88*** |
| % of independent directors | 8744 | 78.80 | 2929 | 77.91 | 0.89*** |
| % of insider ownership | 6579 | 5.39 | 2410 | 6.60 | –1.20*** |

*Note*: A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively.

*Source:* authors.

### *Financial Flexibility*

Table 10 presents the results of testing Hypothesis 3. This hypothesis is tested on a subsample of unconstrained firms. First, we show that financial flexibility does not affect the probability of zero-leverage for unconstrained firms but affects the chosen debt level (Columns 1-2).

Second, we demonstrated the effect of financial flexibility on the probability of zero-leverage high-tech and non-high-tech firms. Financial flexibility is still insignificant for traditional industries, while financial flexibility significantly reduces the probability of zero debt (Columns 3-4). This fully confirms Hypothesis 3. For the choice of debt level, this dependence holds, i.e., financial flexibility has a more significant effect on the level of debt for tech companies (Columns 5-6).

### *Managerial Entrenchment*

Table 11 presents the results of testing the managerial entrenchment hypothesis. First, we show that the choice of zero-leverage is encouraged by insider ownership (the indicator is only significant at the 15% level). At the same time, a large board and its independence reduce the likelihood of a zero-leverage policy choice. The choice of leverage is also influenced by insider ownership and independent directors. However, board size no longer plays a role.

Second, we identify a difference between high-tech and non-high-tech firms. In high-tech firms, insiders significantly increase the probability of choosing a zero-debt policy, consistent with the results (Strebulaev, Yang, 2013). For traditional sector firms, the influence of insiders is insignificant. At the same time, independent directors play a significant moderating role for traditional firms, while only board size plays a significant role in high-tech firms.

Table 5. **Distribution of unlevered firms in time**

| Year | High-tech | | | Others | | |
|---|---|---|---|---|---|---|
| | *All* | *ZL* | *%* | *All* | *N* | *%* |
| 2004 | 287 | 74 | 25.78% | 1 040 | 95 | 9.13% |
| 2005 | 315 | 91 | 28.89% | 1 083 | 113 | 10.43% |
| 2006 | 322 | 97 | 30.12% | 1 118 | 116 | 10.38% |
| 2007 | 332 | 105 | 31.63% | 1 158 | 127 | 10.97% |
| 2008 | 358 | 108 | 30.17% | 1 201 | 134 | 11.16% |
| 2009 | 384 | 118 | 30.73% | 1 247 | 154 | 12.35% |
| 2010 | 399 | 122 | 30.58% | 1 278 | 167 | 13.07% |
| 2011 | 445 | 126 | 28.31% | 1 342 | 171 | 12.74% |
| 2012 | 501 | 138 | 27.54% | 1 399 | 176 | 12.58% |
| 2013 | 554 | 178 | 32.13% | 1 461 | 187 | 12.80% |
| 2014 | 587 | 187 | 31.86% | 1 506 | 189 | 12.55% |
| 2015 | 609 | 205 | 33.66% | 1 528 | 180 | 11.78% |

*Note*: A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. This table demonstrates the frequency of zero-leverage firms in time for the whole sample, high-tech and non-high-tech companies.

*Source:* authors.

Table 6. **Mean values of common capital structure determinants of high-tech firms**

| Variable | 2004 | 2015 |
|---|---|---|
| Profitability | 0.04 | 0.06 |
| Tangibility | 0.17 | 0.17 |
| Size | 6.47 | 6.77 |
| Market to book | 2.27 | 2.24 |

*Note*: The table represents the mean values of common capital structure determinants of high-tech firms at the beginning of the examining period (2004) and the end (2015).

*Source:* authors.

Table 7. **Propensity model and probit model with high-tech dummy**

***Table 7a. Panel A.***

| Year | Actual | Predicted | Actual - Predicted |
|---|---|---|---|
| 2004 | 32.00 | 22.64 | 9.36*** |
| 2005 | 36.44 | 24.94 | 11.51*** |
| 2006 | 35.77 | 25.60 | 10.17*** |
| 2007 | 35.45 | 26.13 | 9.32*** |
| 2008 | 33.33 | 23.16 | 10.18*** |
| 2009 | 35.48 | 25.41 | 10.07*** |
| 2010 | 36.06 | 26.19 | 9.87*** |
| 2011 | 33.06 | 26.44 | 6.62*** |
| 2012 | 32.13 | 25.32 | 6.81*** |
| 2013 | 34.75 | 26.37 | 8.38*** |
| 2014 | 34.36 | 23.89 | 10.48*** |
| 2015 | 34.03 | 22.39 | 11.64*** |

*Note.* Predicted % on zero-leverage firms are obtained using estimated coefficients from annual probit regressions on the whole sample of the firms with the following determinants: size, profitability, growth opportunities, and tangibility. A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively.

***Table 7b. Panel B.***

| Variables | z |
|---|---|
| profitability | 0.29** (0.13) |
| tangibility | –0.98*** (0.21) |
| size | –0.53*** (0.03) |
| MB ratio | 0.10*** (0.02) |
| Ht_dummy | 1.33*** (0.12) |
| Constant | 1.29*** (0.22) |
| Observations | 16 925 |
| Number of companies | 2017 |

Panel B. Panel B. Probit regression with high-tech dummy. A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively.

*Source*: authors.

The limitation of testing the hypothesis on managerial entrenchment is that we tested it only for the latest period, since 2013. Before 2013, the disclosure level is not sufficient to verify the hypothesis.

## Discussion

Our results indicate that high-tech firms tend to be more conservative in their capital structure choice. This conservative policy cannot be fully explained by the common capital structure determinants. Industry-specific factors influence financing policy. First, the nature of high-tech firms with uncertain cashflows adding to financially constraints can partially explain the zero-leverage policy. Financially constrained high-tech firms are forced to turn down debt financing. This is especially relevant for firms in the early stages of their life cycles (Lundberg, Lotfaliei, 2020). As the firm moves along the life cycle and information asymmetry between a firm and creditors diminishes, the role of the financial constraints deteriorates as well. At the same time, interestingly, financially constrained firms with high-medium productivity are prone to investments in innovation instead of investments in internationalization (Roelfsema, Zhang, 2018).

However, we show that unconstrained high-tech companies are also prone to zero debt. The second point we should mention on sector-specific issues is that the business models in technological sectors may require higher financial flexibility, since the research and development demonstrating high time uncertainty is a part of the business process. In this study we show the sector-specific relevance of finan-

Table 8. **Comparative statistics of constrained and unconstrained subsamples**

***Table 8a. Panel A.***

| Parameters | Status | | | | | |
|---|---|---|---|---|---|---|
| | Unconstrained | | | Constrained | | |
| **Stat** | **mean** | **p50** | **N** | **mean** | **p50** | **N** |
| **Age** | 61.78 | 56.00 | 4043 | 6.78 | 6.00 | 4058 |
| **Profitability** | 0.16 | 0.15 | 4035 | 0.04 | 0.10 | 3941 |
| **Tangibility** | 0.29 | 0.21 | 4042 | 0.22 | 0.13 | 4056 |
| **Size** | 7.95 | 7.95 | 4043 | 6.08 | 5.72 | 4058 |
| **MB ratio** | 1.33 | 1.03 | 4043 | 1.99 | 1.39 | 4058 |
| **ht** | 0.11 | 0.00 | 4043 | 0.37 | 0.00 | 4058 |

***Table 8b. Panel B.***

| ht | Variable | mean | p50 | N |
|---|---|---|---|---|
| 0 | constrained | 0.42 | 0 | 6147 |
| 1 | constrained | 0.77 | 1 | 1954 |
| Total | | 0.50 | 1 | 8101 |

*Note*. The sample division into constrained and unconstrained is based on the SA index. We divide the sample into quartiles based on the index levels and assign the quartile with the highest index level as the constrained subsample. The quartile with the lower level of the index is assigned as unconstrained. Panel B of the table presents the distribution of constrained firms between high-tech and non-high-tech firms.

*Source:* authors.

Table 9. **Financial constraint hypothesis testing results**

| Variables | Whole sample | High-tech | Non-high-tech |
|---|---|---|---|
| | *z* | *z* | *z* |
| Size | –0.56*** (0.05) | –0.33*** (0.07) | –0.70*** (0.07) |
| Profitability | 0.17 (0.18) | –0.12 (0.23) | 0.45 (0.28) |
| Tangibility | –0.64** (0.30) | 0.28 (0.49) | –1.10*** (0.40) |
| MBratio | 0.05* (0.03) | 0.10** (0.04) | 0.01 (0.04) |
| Ht-dummy | 1.30*** (0.16) | – | – |
| SA_constrained | 0.32* (0.17) | 0.65** (0.32) | 0.21 (0.20) |
| Constant | 1.11*** (0.380) | 0.56 (0.62) | 2.07*** (0.53) |
| Observations | 7933 | 1879 | 6054 |
| Number of companies | 1504 | 430 | 1074 |

*Note*: KA firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively. The sample division into constrained and unconstrained is based on the SA index. We divide the sample into quartiles based on the index levels and assign the quartile with the highest index level as the constrained subsample. The quartile with the lower level of the index is assigned as unconstrained.

*Source*: authors.

cial flexibility and managerial entrenchment. Could we claim that we have found the reliable motives behind the lack of debt in the capital structure of these companies? And can the internal sources and equity financing be a strategically wise industry-specific decision for high-tech firms' development? Here we go to the third sector-specific issue: in a highly uncertain macroeconomic environment strengthened with the volatility in the sector, high-tech firms try to mitigate any incremental risks, even if the financing decision they make looks financially unfavorable in the short term.

Moreover, conservative debt policy could be a result of shifting the focus of capital structure choice from choosing value-maximizing debt ratio to providing a reliable access to funding (DeAngelo, 2022). As funding is essential to implement necessary research and development and further investments and thus, to the strategic development and finally firm's value, making a focus on funding could help us with more insights on zero-debt policies. Investment opportunities are highly uncertain in terms of time and volume in the high-tech sector. COVID-19, which has contributed to the dramatic growth of technology and has driven technological innovation to a new level, is an indisputable example (OECD, 2021).

DeAngelo states that management's insufficient knowledge for optimizing capital structure should lead to a new understanding of comprehensive debt-to-equity choice (DeAngelo, 2022). Given the role of intellectual capital in the business models of technology companies, we can presume that the proportion of managers considering capital structure choice in the new, broader paradigm is greater in high-tech firms (Fritsch, Wyrwich, 2019).

Therefore, keeping a firm's option to borrow and its ability to accumulate (excess cash) and raise internal funds when new investment opportunities appear could be a key to understanding successful zero-leverage high-tech firms. The ability to run a successful technology business without external debt or with a close-to-zero-debt is also demonstrated by companies in the S&P500 index, such as Intuitive Surgical, Inc. (the robotic-assisted surgery industry), Amdocs Limited (CRM services), and SEI Investments (a fintech company).

## Conclusions

This paper investigates why there are so many zero-leverage firms in high-tech industries and the mo-

Table 10. **Financial flexibility testing**

| Variables | whole sample | whole sample | high-tech | non-high-tech | high-tech | non-high-tech |
|---|---|---|---|---|---|---|
| | *z* | *ltd* | *z* | *z* | *ltd* | *ltd* |
| Size | –0.660*** (0.11) | 0.03*** (0.00) | –0.43** (0.21) | –0.71*** (0.19) | 0.02 (0.01) | 0.03*** (0.00) |
| Profitability | 0.55 (0.55) | –0.04** (0.02) | –0.03 (1.13) | 0.81 (0.62) | 0.09* (0.05) | –0.07*** (0.02) |
| Tangibility | –1.36** (0.61) | 0.06*** (0.02) | 2.673 (1.68) | –1.73** (0.71) | –0.08 (0.08) | 0.07*** (0.02) |
| MBratio | 0.19*** (0.07) | –0.03*** (0.00) | 0.47*** (0.16) | 0.13 (0.08) | –0.02** (0.01) | –0.03*** (0.00) |
| Flexibility | –0.17 (0.22) | –0.04*** (0.01) | –1.60*** (0.50) | 0.17 (0.25) | –0.06*** (0.02) | –0.04*** (0.01) |
| Constant | 1.29 (0.90) | 0.06** (0.03) | 1.07 (1.85) | 1.56* (0.94) | 0.14 (0.09) | 0.06** (0.03) |
| Observations | 4022 | 3409 | 452 | 3570 | 388 | 3021 |
| Number of companies | 499 | 439 | 66 | 433 | 58 | 381 |

*Note*: A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively. The financial flexibility is approximated with retained earnings and cash holdings. A dummy variable is equal to one if the company has cash holdings or retained earnings above the sample medians by industries.

*Source:* authors.

Table 11. **Managerial entrenchment testing**

| Variables | whole sample | whole sample | high-tech | non-high-tech |
|---|---|---|---|---|
| | z | ltd | z | z |
| Size | -0.89*** (0.10) | 0.02*** (0.00) | -0.58*** (0.13) | -0.98*** (0.13) |
| Profitability | -0.37 (0.43) | -0.10*** (0.02) | -0.51 (0.52) | 0.60 (0.51) |
| Tangibility | -0.13 (0.48) | 0.07*** (0.02) | 1.43* (0.82) | -0.27 (0.56) |
| MBratio | 0.26*** (0.07) | -0.03*** (0.00) | 0.22*** (0.08) | 0.13* (0.078) |
| Insider ownership | 0.02 (0.01) | 0.001** (0.00) | 0.03* (0.02) | 0.00 (0.01) |
| Independent directors (%) | -0.02* (0.01) | -0.001*** 0.00 | -0.00 (0.01) | -0.02** (0.01) |
| Board size | -1.05** (0.42) | 0.01 (0.01) | -1.08* (0.62) | -0.56 (0.49) |
| Constant | 5.01*** (1.12) | 0.17*** (0.04) | 4.03** (1.57) | 5.43*** (1.35) |
| Observations | 4057 | 2955 | 1107 | 2950 |
| Number of companies | 1951 | 1442 | 538 | 1413 |

*Note*. A firm is treated as zero-leverage (ZL) if it has no long-term debt in a given year. ***, **, and * indicate the significance at the 1%, 5%, and 10% levels, respectively. The managerial entrenchment is approximated with ownership and governance indicators..

*Source:* authors.

tives and factors leading to the zero-debt puzzle for high-tech firms. We try to demystify the mystery of zero-leverage for high-tech sectors.

Based on a sample of Russell 3000 companies for 2004-2015, we provided evidence showing the increasing number of unlevered high-tech firms over the considered period. A similar trend among non-high-tech firms is not as dramatic. We show that size, profitability, tangibility, and growth opportunities usually described as common determinants of corporate structure cannot fully explain why high-tech firms choose a zero-debt policy.

In the second part of the paper, we test the possible motives for avoiding debt financing. First, we demonstrate that high-tech firms are more financially constrained than non-high-tech firms. Thus, high-tech firms more often have no access to debt financing, automatically resulting in zero leverage. So, zero leverage is not always a choice.

Second, we investigate unconstrained companies. We show that financial flexibility is even more critical for unconstrained high-tech firms than for firms in traditional industries. This is an important result since we show that high-tech firms tend to choose zero-leverage not only when they face financial constraints, but also due to financial flexibility factors.

Third, we reveal the different effects of managerial entrenchment on high-tech and traditional companies. Managerial entrenchment aggravates the choice of high-tech firms for zero leverage. We show that insiders' ownership increases the probability of choosing a zero-debt policy for high-tech firms. At the same time, the board of directors plays a more critical role for traditional companies. As controversial as it may sound, people matter even more in high-tech companies.

As the role of high-tech firms in the economy increases, we expect to see more firms with zero or close to zero debt policies. High-tech sector-specific factors make us consider a zero-debt policy as a new best practice rather than a conservative debt policy.

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