International Research Journal of Finance and Economics
ISSN 1450-2887 Issue 89 (2012)

http://www.internationalresearchjournaloffinanceandeconomics.com

Capital Structure of ICT vs. Non-ICT Firms: Evidence from the UK

Dani Aoun
Business Department, Arab Open University, Beirut, Lebanon
E-mail: daoun@aou.edu.lb
Tel: +961-1-392139 ext.: 612

Abstract

This paper offers a model of dynamic capital structure based on a sample of UK firms, it specifies an adjustment model where firm-specific and time-specific factors determining the speed of adjustment are identified and their impacts are quantified and estimates the unobservable optimal capital structure using a wide range of observable determinants. Firms are divided into two groups, Information and Communication Technology (ICT) and non-ICT, in order to test whether the uniqueness of the former has any different implications. For a panel of ICT and non-ICT firms the results reveal that the leverage ratio of an ICT firm is more affected by income variability, uniqueness, and the dot-com crisis compared to non-ICT firms.

Keywords: Capital structure, debt, panel data, ICT.

1. Introduction

The last decades of academic development have made capital structure one of the most important subjects in modern finance theory. This is echoed in the formal appreciation as well as the continued attention it has received from researchers. The theories suggest that firms select capital structures depending on characteristics that determine the various costs and benefits associated with debt and equity financing.

Most existing empirical research uses observed leverage ratios as proxies for the optimal levels (Titman & Wessels, 1988; or Rajan & Zingales, 1995). Others used a dynamic model in order to study the factors that determine the range of capital structures of a firm rather than studying the temporal behavior of capital structure (Fischer, et al., 1989). Vilasuso and Minkler (2001) developed a dynamic model that incorporates the issues of agency cost and asset specificity. Results based on data from the Compustat data base using an unbalanced panel of 28 publicly-held firms in transportation equipment and the printing and publishing industries show that these two factors are significant determinants of the optimal capital structure of firms. Jalilvand and Harris (1984) examine the issuance of long-term and short-term debt and new equity for U.S. corporations. Rajan and Zingales (1995) investigate the determinants of capital structure choice by analyzing the financing decisions of public firms in the major industrialized countries. In the last several years, researchers have been trying to study the so called information technology sector; Two studies (Hyytinen and Pajarinen, 2005; Hogan and Huston, 2005) attempted to study the financing of technology-intensive small businesses by analyzing their capital structure. They find that the leverage ratio of small high-tech firms is more conservative than that of other small businesses.

To the best of our knowledge, this is the first paper studying and comparing the capital structure of ICT firms to non-ICTs using a dynamic model, since we believe that the rapid development, the complexity of the technology and the presence of the network effects of an ICT industry may have implications on determining their financing patterns. By estimating the dynamics of capital structure adjustment, simultaneously with the optimal capital structure, we are able to capture effects which earlier studies could not. The results also provide evidence that the observed leverage of firms is frequently different from their target leverage, and that the leverage ratio of an ICT firm is more sensitive to the firm's income variability, uniqueness and the dot-com crisis. Moreover, the speed of adjustment is generally higher for non-ICT firms. These findings highlight the importance of using a dynamic model for studying capital structure, and suggest that errors from not doing so can be large with serious implications for the relevancy of the results and efficacy in capital structure choice and utilization.

What distinguishes this paper from the existing literature is the following: First, we differentiate between the observed and the estimated optimal debt ratio levels. Second, we empirically identify factors determining the optimal debt levels. Third, we capture the dynamics of capital structure adjustments by modelling movements towards optimal debt ratios. Fourth, we specify an adjustment model where firm-specific and time-specific factors determining the speed of adjustment are identified and their impacts are quantified. Fifth, the model is used to study the capital structure of a sample of 2,598 ICT and non-ICT UK firms observed between 1995 and 2005. Finally, we included a crisis variable in order to account for the effect that the dot-com crisis had on both sectors.

The remainder of the paper proceeds as follows. Section 2 reviews the theory of capital structure. Section 3 describes the uniqueness of the ICT sector, followed by section 4 which offers an explanation of the Dynamic Model. Section 5 covers the data and section 6 lists the determinants of leverage and the speed of adjustment. Section 7 discusses the results and section 8 concludes the paper.

2. The Theory of Capital Structure

The modern theory of capital structure is said to have begun with a seminal paper by Modigliani and Miller (1958). Since then a number of theories have been proposed to explain the variation in debt ratios across firms. The capital structure theory suggests that firms determine what is often referred to as a target debt ratio, which is based on various tradeoffs between the costs and benefits of debt versus equity. Assuming a perfect and complete capital market structure; Modigliani and Miller, (1958) postulate that the leverage of a firm is independent from, and thus uncorrelated with, its market value. In the real world, however, bankruptcy costs, agency costs, costs derived from asymmetric information and incompleteness in markets are common, and there is a growing literature that tries to incorporate such issues in the determinants of capital structure. In this section, some theoretical factors that determine the capital structure and speed of adjustment of firms are discussed. There are three important and common theories developed to explain the capital structure's relevancy to firm value, which are based on bankruptcy costs, agency costs, and costs derived from asymmetric information.

2.1. Bankruptcy Costs

Bankruptcy costs refer to costs that occur when a firm fails to pay back its debt. As debt increases, the possibility of default rises. In such a case firms may face financial distress. For example, firms might not be able to distribute dividends on preferred stocks and, consequently, their creditors might not provide them with new credit. Such restrictions or limitations can adversely affect a firm's value and performance, especially when a firm forgoes attractive investments. Since an increase in firm value caused by a reduction in income tax may be offset by an increase in expected bankruptcy costs, such a trade-off implies that an optimal capital structure exists and can be found.

2.2. Agency Costs

Agency costs arise because of differences in the interests of principals and agents. The principal usually imposes some set of restrictions on the agent's behavior to align his actions with the principal's objectives. This usually involves monitoring the behavior of agents. Jensen and Meckling (1976) identified agency costs, which may be monetary or non-monetary, as consisting of monitoring cost, bonding cost, and residual loss. Accordingly, there can be two types of agency costs, namely, agency costs of equity associated with the issuance of stocks (equity), and agency cost of debt associated with the issuance of debt.

The agency cost of debt occurs when a conflict of interest exists between shareholders and debtholders; such a conflict may interrupt further investment or financing activities. Shareholders may be strongly tempted to maximize their own interests rather than to maximize the entire value of the firm, which may lead to a cost on the debtors. As the debt of a firm increases the agency cost also rises, it is through this argument that agency costs can be incorporated into the capital structure decision.

2.3. Pecking Order Theory

Pecking order theory of capital structure states that firms have a preferred hierarchy for financing decisions. The highest preference is to use internal financing (retained earnings and the effects of depreciation) before resorting to any form of external funds. If a firm must use external funds, the preference is to use the following order of financing sources: debt, convertible securities, preferred stock, and common stock. (Myers, 1984) This order reflects the motivations of the financial manager to retain control of the firm (since only common stock has a "voice" in management), reduce the agency costs of equity, and avoid the seemingly inevitable negative market reaction to an announcement of a new equity issue.

Implicit in pecking order theory are two key assumptions about financial managers. The first of these is *asymmetric information*, or the likelihood that a firm's managers know more about the company's current earnings and future growth opportunities than do outside investors. There is a strong desire to keep such information proprietary. The use of internal funds precludes managers from having to make public disclosures about the company's investment opportunities and potential profits to be realized from investing in them. The second assumption is that managers will act in the best interests of the company's existing shareholders. The managers may even forgo a positive net present value project if it would require the issue of new equity, since this would give much of the project's value to new shareholders at the expense of the old (Myers & Majluf, 1984).

3. Uniqueness of the ICT Sector

Arthur (1996) splits our world into two economic regimes: a bulk production world operating according to Alfred Marshall's[1] principles of diminishing returns, and a high-tech world operating under increasing returns. Economies subject to increasing returns are known to possess certain traits that were uncommon in the industrial economy. The same idea was revisited by Varian (2001). We believe that these characteristics have some bearing on the financial patterns pursued by ICT firms compared with their non-ICT counterparts. The key characteristics are listed below.

Network effects: The network effect causes a product to have a value dependent on the number of customers already owning or using that product. Metcalfe's law (Gilder (1993)) states that the total value of a good or service that possesses a network effect is roughly proportional to the square of the number of customers already owning that good or using that service. The network effect concept was used as justification for some of the business models for dot-coms in the late 1990s.

---

[1] Marshall's world of the 1880s was one of bulk production, commodities heavy on resources, light on know-how. In that world if production expanded it would ultimately run into diminishing returns, either rising costs or diminishing profits.

According to Hyytinen and Pajarinen (2005), the positive feedback effects of a network good increase the under-investment costs of debt and diminish the benefits of debt in limiting the capacity for over-investment. It is difficult to predict the success of an ICT firm in the presence of strong network effects (Schoder, 2000), which usually increase the firm's future cash flow volatility. Such a volatile characteristic of cash flow discourages lenders and decreases a firm's ability to raise debt.

Technicality of the ICT business: It is arduous to asses and to understand the business of ICT firms by non-technical people, such as bank clerks, due to the high technicality imbedded in the business of ICTs (Deakins and Hussain (1993)). Moreover, the exact nature of an ICT investment is usually not well defined ex ante (Hyytinen and Pajarinen (2005)) which makes it harder for lenders to finance such projects, therefore, leading to a lower capacity in raising debt.

Intangibility: Lenders rely on collateral to secure their loans and to mitigate against adverse selection (Stiglitz and Weiss, 1981), but ICT firms are known to hold low levels of tangible assets, i.e. fewer assets that could be used as collateral. The dependence on intangible assets by technology firms explains why they tend to finance their investment with equity rather than debt (Brealey and Myers (2002)).

Adverse selection: Adverse selection is present when the insiders of an ICT firm know more about the probability of the firm's success than outside investors. For instance, it may be difficult to convey the quality of an investment to outsiders due to the confidential nature of the venture (Anton and Yao (1994)), leading to asymmetry in information, thus making it harder for ICT firms to raise debt.

Fixed entry costs vs. low marginal costs: The nature of some ICT products, exhibit fixed entry costs and low marginal costs (Varian (2001)). This fact, combined with an aggressive strategy of erecting entry barriers by ICT incumbents, would make the recovery of the fixed entry costs very difficult (Koski and Majumdar (2002)). In such a case, raising debt becomes difficult.

High training costs: High-tech products are typically difficult to use. They require training costs. Once users invest in this training they merely need to update their skills for subsequent versions of the product. For instance, once Microsoft Excel has been learnt for the first time it would be easier, cheaper and less time consuming to update ones knowledge for a newer version of Excel than to start from scratch with a different software. As more market is captured, it becomes easier to capture future markets. Therefore, a firm with an established product might find it easier to raise debt compared to a firm with a new product line.

4. Methodology

Different approaches and different models have been used to study the capital structure of firms. For instance, Titman and Wessels (1988) used the LISREL system to model the capital structure of US manufacturing firms specified as: $y = \Gamma\xi + \varepsilon$, where y is $p \times 1$ vector of debt ratios, Γ is $p \times m$ matrix of factor loadings, ε is $p \times 1$ vector of disturbance terms**.** Hyytinen and Pajarinen (2005) studied the leverage usage of ICT firms by using a static regression model.

In this study we tend to identify corporate capital structure differentials across ICT, and non-ICT firms. First we distinguish between observed and optimal leverage, second we allow the latter to vary across firms and over time. Optimal leverage is denoted by LV_{it}^* for firm i at time t, and is set as a function of observable variables.

$$LV_{i,t}^* = F(X_{i,t}) \tag{1}$$

where $X_{i,t}$, represent the determinants of the target leverage that are firm and time variant. In addition, dummy variables are included to capture the unobservable industry-specific heterogeneity effects.

Assuming a world of perfect and complete capital markets, as has been hypothesized by Modigliani and Miller (1958) it would be safe to assume that the observed level of leverage should be equal to the optimal level, i.e. $LV_{i,t} = LV^*_{i,t}$. In the same spirit, the equality of the change in leverage between two periods should be expected to hold according to the following equation:

$$LV_{i,t} - LV_{i,t-1} = LV^*_{i,t} - LV_{i,t-1} \quad (2)$$

But since adjusting from one state to another is expensive, firms may be obliged to adjust partially. Thus, by introducing $\phi_{i,t}$, an adjustment factor representing the magnitude of desired adjustment between two subsequent periods or the rate of convergence of $LV_{i,t}$ to its target level $LV^*_{i,t}$, we allow the firm to adjust partially for the different reasons stated in previous sections. Accordingly, (2) can be stated as follows:

$$LV_{i,t} - LV_{i,t-1} = \phi_{i,t}(LV^*_{i,t} - LV_{i,t-1}) \quad (3)$$

Three cases are possible: If (i) $\phi_{i,t} = 1$, then the entire adjustment is made within one period and the firm's observed leverage equals its optimal leverage, (ii) $\phi_{i,t} < 1$, then the adjustment is insufficient and the new observed leverage will still be below the optimal, and (iii) $\phi_{i,t} > 1$, then the firm is over adjusting, and the observed will be higher than the optimal, which is possible in the case where firms borrow, but due to changing economic conditions, they are obliged to downsize their investments later on.

We also include a measure of the speed of adjustment, which could also be interpreted as the degree of adjustment per period, $\phi_{i,t}$. Thus, $\phi_{i,t}$ is a function of some variables affecting the adjustment cost. By setting $Y_{i,t}$ as a vector of the determinants of the speed of adjustment variables that are changing both over time and across firms, the following function is obtained.

$$\phi_{it} = G\left(Y_{i,t}\right) \quad (4)$$

In addition, dummy variables are included to capture the unobservable industry-specific heterogeneity effects.

Finally, by rearranging (3) and appending an error term $(\varepsilon_{i,t})$ to it, the following equation for observed leverage is formed:

$$LV_{i,t} = \left(1 - \phi_{i,t}\right) LV_{i,t-1} + \phi_{i,t} LV^*_{i,t} + \varepsilon_{i,t} \quad (5)$$

where, the optimal leverage $LV^*_{i,t}$ and the speed of adjustment $\phi_{i,t}$ are specified in terms of observables according to the following:

$$\begin{aligned} LV^*_{i,t} &= \alpha_0 + \alpha_1 VAROI_{i,t} + \alpha_2 GROW_{i,t} + \alpha_3 TANG_{i,t} + \alpha_4 PROF_{i,t} \\ &+ \alpha_5 NDTS_{i,t} + \alpha_6 UNIQ_{i,t} + \alpha_7 TASIZE_{i,t} + \alpha_8 SIC_{i,t} + \alpha_9 CRISIS_{i,t} + u_{i,t} \end{aligned} \quad (6)$$

$$\begin{aligned} \phi_{i,t} &= \beta_0 + \beta_1 DIST_{i,t} + \beta_2 CLR_{i,t} + \beta_3 GROW_{i,t} + \beta_4 PROF_{i,t} \\ &+ \beta_5 lINTA_{i,t} + \beta_6 TASIZE_{i,t} + \beta_7 CRISIS_{i,t} + \omega_{i,t} \end{aligned} \quad (7)$$

A general feature of this type of adjustment model is that it does not take into account the optimal leverage beyond time *t*. It is assumed that future shifts in exogenous variables affecting future optimal leverage are unforeseeable. That is, changes in factors affecting the optimal leverage are unanticipated. In the absence of major structural change, the current and past level of debt and the estimated adjustment parameters contain useful information that can be used to predict the future behavior of leverage.

As mentioned earlier, for the purpose of comparison, the following standard static model based on the following equation is also included:

$$\begin{aligned} LV^*_{i,t} &= \alpha_0 + \alpha_1 VAROI_{i,t} + \alpha_2 GROW_{i,t} + \alpha_3 TANG_{i,t} + \alpha_4 PROF_{i,t} \\ &+ \alpha_5 NDTS_{i,t} + \alpha_6 UNIQ_{i,t} + \alpha_7 TASIZE_{i,t} + \alpha_8 SIC_{i,t} + \alpha_9 CRISIS_{i,t} + u_{i,t} \end{aligned} \quad (8)$$

The dynamic model in (5) and its associated components consisting of equations (6) and (7) are jointly estimated. The model is non-linear in its parameters and an iterative non-linear estimation method is used,[2] while the static model, (8) serving as a benchmark, is linear and least squares is used. In both models, unobservable industry-specific heterogeneity effects are controlled for.

5. The Variables

A typical concern in capital structure studies involves the question of whether to employ the book value of debt and equity, or the market value (or a combination of both). A firm's choice of the optimal level of leverage is directly determined by the relative level of costs incurred in relation to the level of benefits accrued from borrowing. By borrowing, the firm should benefit from tax savings since interest is tax deductible, which will eventually have some positive effect on the firm's value. However, changes in the market value of debt have no direct effect on cash savings from the interest tax shield.

On the one hand, proponents favoring the use of book value argue that the main cost of borrowing is the expected cost of financial distress in the event of bankruptcy, and the relevant measure of debt holders' liability is the book value of debt rather than the market value. On the other hand, those arguing in favor of market value to book value contend that the market value ultimately determines the real value of a firm.

Due to data unavailability, we used the book value of leverage, measured as the ratio of total liabilities to the sum of equity and total liabilities.

5.1. Determinants of Optimal Leverage

We now turn to describe the explanatory variables recognized in the literature as possible determinants of a firms' capital structure. These variables serve as proxy for the set of factors described in the theoretical background section. They will be used in this study to examine variations in leverage, and to test the difference between ICT and non-ICT firms.

Income Variability (VAROI): Included as a proxy for business risk. Bradley, et al. (1984), Castanias (1983), Marsh (1982), and Titman and Wessels (1988) have all shown that leverage is expected to decrease with volatility, because the more volatile the income, the higher the probability of default on interest payments. Moreover, it has been argued that firms with high degrees of business risk have less capacity to sustain high financial risk, thus will use less debt. Nonetheless, Myers (1977) argues that firms with large business risk may have a lower agency cost of debt, and thus optimally borrow more. For our purpose, the variance of operating income is used as a measure of income variability as operating income is subject to interest payment.

Growth Opportunity (GROW): Firms with future growth prospects tend to rely more on equity financing (Rajan and Zingales, 1995). This can be explained by agency costs. If a firm is highly leveraged, future returns from current projects will be reaped by creditors instead of shareholders that is why, firms with future growth opportunities might rely on equity financing rather than debt in order for shareholders to benefit from the future profits (Myers, 1984). Such agency costs may be significant, and if this is so, fast growing firms with highly profitable projects are likely to depend more on equity rather than debt.[3] Thus we may expect a negative relation between growth opportunity and leverage. As a measure of growth, the annual percentage change in total assets is used.

Tangibility (TANG): This is measured as the ratio of tangible assets to total assets, and should be positively related to leverage, because firms with a high level of tangible assets would mean higher

[2] The procedure SYSNLIN in SAS is used to estimate the dynamic model.

[3] However, such negative relationship is especially for long-term debts. According to Titman and Wessels (1988), it might be possible that short-term debt ratios are positively related to growth rates for the growing firms may substitute their short-term liabilities for long-term liabilities to reduce the agency cost.

availability of collateral to raise debt. This positive relation finds many supporting empirical evidence in the literature, such as, Friend and Lang (1988) and Marsh (1982).

Size (TASIZE): Titman and Wesels (1988) suggest that firm size and leverage are likely to be positively related particularly in large firms because they typically have less direct bankruptcy costs and tend to diversify more, allowing a higher optimal debt capacity. According to Chittenden et al. (1996) large firms use more leverage than small firms because of the relatively smaller costs of monitoring the firm, as well as reduced moral hazard and adverse selection problems. By contrast, Rajan and Zingales (1995) indicate that less asymmetric information within larger firms leads to less incentive to raise debt, suggesting a negative relationship. Total assets are used as a measure of the firm's size.

Profitability (PROF): Previous studies show different results regarding the relationship between leverage and profitability. For instance, Myers and Majluf (1984) state that since profitability is positively related to equity, it should be negatively related to leverage. Jensen (1986) states that profitable firms may signal quality by leveraging up, resulting in a positive relation between leverage and profitability. The measure used in this study is net income to total assets.

Non-debt Tax Shield (NDTS): Heshmati (2002) suggests that firms face incentives for borrowing, and take advantage of interest tax shields when they have enough taxable income to justify a debt issue. Thus, the presence of other non-debt tax shields is likely to reduce the optimal leverage. By using the ratio of depreciation to total assets, the firm's use of tax shields other than interest tax shields can be accounted for.

Uniqueness (UNIQ): Uniqueness of a firm's assets is measured by the level of R&D intensity, which is the ratio of R&D expenditures to sales also used by Titman and Wessels (1988). Firms with unique products are expected to exhibit a lower leverage level because in the case of bankruptcy, a competitive secondary market for their inventory and production equipment might not exist.

Financial Crisis (CRISIS): We expect a negative relation between the 2001 Dot-Com crisis and firms' leverage. In the post-crisis period, credit companies shifted towards tighter credit policy, making it more difficult and more costly for firms to raise debt. The crisis dummy was assigned a value of 1 for years after 2001 and 0 for other years.

Finally, we include an ICT-dummy variable, where (ICT) is set equal to 1 if it's standard industrial classification (SIC) code matches OECD's (2000) classification, and a vector of 8 industry dummies, based on the SIC classification, to control for industrial heterogeneity.

5.2. Determinants of the Speed of Adjustment

Since the speed of adjustment $\left(\phi_{i,t}\right)$ is also a function of observable factors affecting the adjustment cost, what follows is a listing of these factors, some of which are partially overlapping with the factors determining the optimal debt level. It should be noted that the costs of shifting from the observed to the optimal leverage is the focus here, rather than the direct costs associated with leverage levels.

Distance (DIST): If fixed costs are an important segment of the total costs of adjusting the capital structure, firms with lower than optimal leverage would change their capital structure only if they are sufficiently far away from the optimal capital structure. The likelihood of adjustment is a positive function of the difference between optimal and observed leverage. In this model, the absolute value of the gap $\left|LV_{i,t}^{*}-LV_{i,t-1}\right|$ is incorporated as a determinant.

Current Liabilities Ratio (CLR): Firms with a high level of short-term liabilities possess the ability to adjust to a new level of leverage easier and faster than firms with a lower level of current liabilities, since short-term liabilities, can be easily raised or paid-off. The ratio of current liabilities to total liabilities is used as a measure of current liabilities.

Intangible Assets (INTA): Credit companies are more willing to lend money if they can secure collateral against it, and collateral is measured by the degree of tangible assets that a firm owns. Since the speed of adjustment is positively related to tangible assets, it should be negatively related to intangible assets. Thus, the higher the degree of intangible assets the slower is the speed of adjustment. The log of intangible assets is used as a measure for this variable.

Financial Crisis (CRISIS): The crisis variable is included because we can expect a direct and clear effect on both, optimal leverage and the speed of adjustment. After the crisis, the speed of adjustment is expected to slow down, because raising debt is expected to become more difficult.

Size (TASIZE): If changing capital structure involves substantial fixed costs, these costs will be proportionally small for larger firms, and hence, larger firms should adjust to the desired capital structure more readily than smaller firms. Moreover, larger firms may find it easier to access capital by issuing equity or debt, possibly because more information is available to and about them. We expect firm size and speed of adjustment to be positively correlated.

Growth opportunity (GROW): A growing firm may find it easier to change its capital structure since funds, whether equity or debt, are readily available to a growing firm relative to a non-growing one. Hence, firms with high growth opportunities are expected to adjust faster towards the optimal capital structure compared to non-growth firms. If the positive association between growth opportunity and a firm's external financing is combined with the low fixed costs of raising external capital, then the unit cost of raising extra funds will be lower for high-growth firms. The higher the growth opportunity, the faster the adjustment is towards the optimal capital structure. Therefore, we expect a positive relationship between expected growth measured as growth in total assets and adjustment speed.

Profitability (PROF): Profitability is measured as the ratio of net income to total assets. According to Myers and Majluf (1984), firms should prefer internal to external financing, and the more profitable the firm is, the greater the availability of internal capital should be. Hence, there should be a positive relationship between profitability and the speed of adjustment in leverage.

6. The Data

The data set used in this study included 2,598 UK firms, observed for a period of 11 years from 1995 until 2005. Information on sample firms was extracted from the DataStream (DS) database.

From the UK sample we excluded all regulated utilities, with a Standard Industrial Classification (SIC) code equal to 4900-4999 (Singh et al., 2003), and all financial firms (SIC code equal to 6000-6999), because they are known to have a different financial structure relative to other firms. The final data set used in the empirical part of this study is an unbalanced panel data. It contains 2,181 firms observed consecutively 4-11 years with a total of 18,629 firm-year observation. All monetary variables are expressed in constant 2005 prices using the producer price index as the deflator[4].

The classification of firms into three sizes is based on the OECD (2005) classification. Small firms are defined by total assets of less than $13 million, firms with total assets greater than $13 million and less than $56 million represent medium firms, while those with a total asset base of more than $56 million are considered as large firms.

The second key classification is the distinction between ICT and non-ICT firms, which is based on the industrial classification codes reported by the OECD (2000). A number of dummy variables are included in the model specification to account for industry heterogeneity.

Table 1 provides a breakdown of the sample into various categories according to size, specialization, and industry classification. Small firms comprise 19.92% of the whole sample, while medium firms (27.81%) and large firms (52.28%). 33.49% of all firms belong to the ICT sector while the remaining 66.51% were pooled together into one sector. Firms identified as manufacturing (44.36%), and services (33.64%) constitute the major industries. agriculture, forestry and fishing (0.59%), construction (2.74%) and mining (3.82%) are among underrepresented industries.

---

[4] The Producer Price Index (PPI) is reported by the Office for labor statistics. Available at: http://www.statistics.gov.uk/statbase/product.asp?vlnk=2208

Table 1: Frequency Distribution of Firms.

The Industry Classification is based on the two-digit Standard Industrial Classification (SIC) Code, were ICT firms are defined as those with an SIC code equal to 3357, 3571, 3572, 3575, 3577, 3651, 3661, 3663, 3671, 3672, 3699, 3823, 3825, 3826, 4812, 4813, 4822, 4832, 4833, 4841, 4899, 5045, or is between 3577-3579 or 3674-3679 or 7371-7379. All other SIC codes belong to the non-ICT sector. Agriculture, Forestry and Fishing firms are those with an SIC code less than 999, Mining firms (1000-1499), Construction firms (1500-1999), Manufacturing firms (2000-3999), Communication (4000-4900), Wholesale Trade (5000-5199), Retail Trade (5200-5999), Services (7000-8999).

Variable	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Specialization				
Non-ICT firms	12390	66.51	12390	66.51
ICT firms	6239	33.49	18629	100.00
Size				
Small (Total assets <= $13m)	3710	19.92	3710	19.92
Medium ($13m < Total assets <= $55.9m)	5180	27.81	8890	47.72
Large (Total assets > $55.9m)	9739	52.28	18629	100.00
Industry Classification:				
Agriculture, Forestry and Fishing	110	0.59	110	0.59
Mining	711	3.82	821	4.41
Construction	510	2.74	1331	7.14
Manufacturing	8264	44.36	9595	51.51
Communication	789	4.24	10384	55.74
Wholesale Trade	812	4.36	11196	60.10
Retail Trade	1166	6.26	12362	66.36
Services	6267	33.64	18629	100.00

6.1. Descriptive Statistics

Table 2 provides a brief description of the main variables used in this study. By comparing and contrasting ICT firms to non-ICT firms, it becomes apparent that ICTs have a lower total debt ratio relative to non-ICTs with a mean value of 0.31 in contrast to 0.35. The difference was found to be significant at the 1% level with a t-value of 11.48. ICT firms are less profitable with a mean value of 0.27 relative 0.33 for non-ICT firms. The difference is significant at the 1% level with a t-value of 4.47. Significant at the 1% level, the difference between the growth variable of ICT firms (0.53) and the growth variable of non-ICT firms (0.39) signals higher growth opportunities and better market performance for the former. Moreover, ICT firms possess less tangible assets (0.23 vs. 0.31) and higher current liabilities ratio (0.47 vs 0.46). Finally, income variability and the uniqueness of a firm's assets appear to be higher for ICT firms (0.52 and 0.62, respectively) relative to non-ICT firms (0.22 and 0.31, respectively), with a difference significant at the 1% level for both.

Table 2: Summary Statistics by Specialization (1996-2006).

The following table compares the means of the main variables used in the regression for both sectors, ICT and non-ICT, were ICT are firms belonging to the information and communication technology sector as categorized by OECD (2000), based on their SIC codes. Non-ICT firms comprise all other firms. We included a T-test to check the significance of the difference in mean variable between the two groups of firms.

Variable	Description	ICT Firms		Non-ICT Firms		t-statistics
		Mean	Std Dev	Mean	Std Dev	
TDR	Total debt ratio	0.311	24.789	0.347	25.031	11.48***
VAROI	Income variability	0.524	172.778	0.220	107.058	-15.94***

Table 2: Summary Statistics by Specialization (1996-2006). - continued

GROW	Growth	0.531	190.282	0.394	159.339	-5.47***
TANG	Tangibility	0.233	55.292	0.313	52.198	11.40***
PROF	Profitability	0.273	94.108	0.332	94.698	4.47***
NDTS	Non-debt tax shield	0.254	11.464	0.245	7.800	-8.43***
UNIQ	Uniqueness	0.617	141.282	0.310	73.984	-18.05***
CLR	Current liabilities ratio	0.474	40.493	0.460	39.224	-2.32**

Note: *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively

The Pearson correlation matrix (Table 3) reveals no multicollinearity problems between the variables. Most of the variables are significant at the 1% level, for instance, leverage was found to be positively correlated with tangibility, and non-debt tax shield, yet negatively correlated with variability, growth, profitability, uniqueness and current liabilities ratio.

Table 3: Pearson Correlation Coefficients.

This table displays the Correlation Coefficients of the variables. Where TDR is the total debt ratio, VAROI is the income variability, GROW is the growth in total assets, TANG is the volume of tangible assets, PROF is the profitability ratio, NDTS is the non-debt tax shield, UNIQ is the uniqueness ratio, and CLR is the current liabilities ratio.

	TDR	**VAROI**	**GROW**	**TANG**	**PROF**	**NDTS**	**UNIQ**	**CLR**
TDR	1							
VAROI	-0.051***	1						
GROW	-0.029**	0.083***	1					
TANG	0.224***	-0.004	-0.062***	1				
PROF	-0.087***	0.064***	-0.005	0.05	1			
NDTS	0.080**	0.005	-0.062**	0.427***	-0.038***	1		
UNIQ	-0.081***	-0.057***	0.004***	-0.045***	-0.261**	0.093**	1	
CLR	-0.137***	-0.004*	-0.004	-0.032***	-0.028***	0.024**	0.032***	1

Note: *,**, *** indicate significance at the 10%, 5% and 1% level, respectively.

7. Empirical Evidence

In estimating the relationship between determinant factors and leverage, several econometric techniques have been used including: tobit (Rajan & Zingales, 1995), logit (Opler & Titman, 1995), autoregressive distributed lag (Homaifar et al., 1994), least squares dummy variables (Allen, 1993; Michaelas et al., 1999), multivariate analysis of variance (Lopez-Gracia and Aybar-Arias, 2000), latent variables (Titman & Wessels, 1988) and non-linear methods (Vilasuso & Minkler, 2001). The dynamic and static investment models were estimated using non-linear and linear least square estimation methods, respectively. The reason for including a standard static model in addition to the dynamic is to allow for comparison between both, and to verify whether the latter offers better explanation relative to the static. The two models are not nested and as such not directly comparable, yet the static model can serve as a benchmark.

To test the fitness of the two models, we compared their respective mean square errors (RMSE) and coefficients of determination (R^2). On the one hand, Table 4 shows that the static model for ICT firms has a RMSE equal to 18.99 and an adjusted R^2 of 0.34 while the dynamic model for the same set of firms has a RMSE of 15.82 and an adjusted R^2 of 0.59. On the other hand, the RMSEs of the static and the dynamic models for non-ICT firms are equal to 22.35 and 19.20, respectively, while their adjusted R^2s are equal to 0.08 (static) and 0.41 (dynamic). A lower RMSE and a higher R^2 validates the fitness of the dynamic model relative to the static. Furthermore, the high significance of the variables determining the speed of adjustment justifies and strengthens the act of including a lag dependent variable consequently validating the usage a flexible adjustment dynamic model.

7.1. Regression Results

Regression estimates for the ICT and non-ICT sample for both models (static and dynamic) are presented in Table 4. Since the results of the static model are similar to the dynamic in terms of sign and significance, the discussion will be limited to the dynamic regression results.

Table 4: The Regression Model.

This table shows the regression results of the Dynamic Model (Panel A) and Static Model (Panel B) for the ICT and non-ICT sector. The former model was estimated using an iterative non-linear estimation method while linear least square estimation method is used to estimate the latter. The two models are not nested and as such not directly comparable, yet the static model can serve as a benchmark. For non-ICT firms the reference industry used is industry 1 (agriculture, forestry and fishing), while for the ICT firms, the reference industry is a combination of excluded industries 2, 3, 7 and 8.

Variable	Description	Non-ICT Firms		ICT Firms	
		Estimate	t-Value	Estimate	t-Value
Panel A: Dynamic Model					
Determinants of leverage					
VAROI	Income variability	-0.0082	-4.43***	-0.0317	-3.15***
GROW	Growth	-0.0024	-3.76**	-0.0033	-2.14***
TANG	Tangibility	0.0770	16.45***	0.0798	14.31***
PROF	Profitability	-0.0868	-14.53***	-0.3616	-8.04***
NDTS	Non-debt tax shield	-0.1432	4.23***	0.0730	2.56**
UNIQ	Uniqueness	-0.0143	-7.87***	-0.1399	-4.23***
TASIZE	Size by total assets	0.3233	8.55***	-0.0488	-2.01
CRISIS	Crisis	-0.0117	-5.01***	-0.2120	-2.12***
SIC2	Mining	-0.5457	-3.06**	…	…
SIC3	Construction	0.0821	0.56	…	…
SIC4	Manufacturing	-0.8164	-4.21***	-0.0197	-0.34
SIC5	Communication	0.1637	0.42*	2.2305	25.67***
SIC6	Wholesale Trade	-0.3459	-1.25	0.9727	4.81***
SIC7	Retail Trade	-0.7374	-3.64***	…	…
SIC8	Services	-0.6558	-2.43***	…	…
Determinants of the speed of adjustment					
DIST	Distance	0.2445	7.25***	0.2364	7.02***
CLR	Current liabilities ratio	0.0001	2.12**	0.0006	2.01***
GROW	Growth	0.0001	23.48***	0.0002	18.61***
PROF	Profitability	0.0007	2.15*	0.0001	1.09
lINTA	Log of intangible assets	-0.0018	-1.78	-0.0014	-2.11
TASIZE	Size by total assets	-0.0082	-14.67***	-0.0034	-6.01***
CRISIS	Crisis	-0.0028	-3.57***	-0.0018	-2.23***
RMSE	Root mean square error	19.1974	15.8226		
R^2	Adjusted R-squared	0.4120	0.5938		
Panel B: Static Model					
VAROI	Income variability	-0.0127	-6.03***	-0.0053	-3.23**
GROW	Growth	-0.0043	-1.45*	-0.0047	-1.45*
TANG	Tangibility	0.0768	17.04***	0.0716	16.59***
PROF	Profitability	-0.0366	-17.97***	-0.0268	-8.73***
NDTS	Non-debt tax shield	0.0557	2.01	0.0229	0.51
UNIQ	Uniqueness	-0.0199	-13.12***	-0.0172	-3.70***
TASIZE	Size by total assets	0.2962	8.97***	-0.0992	-6.28***
CRISIS	Crisis	-0.1222	-4.23***	-0.1155	-3.06**
SIC2	Mining	-0.5264	-1.04***	…	…

Table 4: The Regression Model. - continued

SIC3	Construction	0.2777	0.87	…	…
SIC4	Manufacturing	-0.9031	-3.56***	0.0078	0.51
SIC5	Communication	0.2414	1.54	2.5467	34.56***
SIC6	Wholesale Trade	-0.5142	-3.41**	1.2867	5.26***
SIC7	Retail Trade	-0.8048	-3.70***	…	…
SIC8	Services	-0.7533	-4.72***	…	…
RMSE	Root mean square error	22.3458	18.9861		
R^2	Adjusted R-squared	0.0765	0.3412		

Note: *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

7.1.1. Determinants of Leverage

The regression results (Table 4) show that a firm's capital structure is highly sensitive to the level of operating risk as measured by income variability. Theoretically speaking, a more volatile income suggests a higher probability of default, thus a lower debt capacity. This is supported by empirical evidence from Bradley, et al. (1984), Castanias (1983), Marsh (1982), and Titman and Wessels (1988). Moreover, the results reveal that although debt decreases for both sectors, the effect is higher for ICT firms, implying, that income variability might be a more pronounced criterion used by credit firms when lending ICTs relative to non-ICTs.

The theory of corporate finance suggests a negative relation between leverage and growth (Stulz, 1990). This is consistent with our results where the growth opportunity variable, "GROW", is negatively related to leverage for both sectors significant at the 1% level for ICT firms and the 5% level for non-ICT firms. This is a validation of Rajan and Zingales' (1995) argument that due to the under-investment problem, firms expecting high future growth use a greater amount of equity finance. It could also be related to the concept of agency costs, since growing firms might prefer to use their own equity to finance new projects in order to secure for themselves, instead of creditors, the expected future returns. Moreover, it has been argued that high-tech companies prefer to use equity instead of debt as evidenced by Hyytinen and Pajarinen (2005) and Hogan and Huston (2005). Besides, due to the unique features of the ICT sector, discussed in section 3, the cost of debt would be higher relative to non-ICT firms, thus discouraging the use of debt.

The parameter estimate of the tangibility variable is positive, statistically significant at the 1% level and in accordance with the theory, for both sectors alike. Tangible assets serve as better collateral for conservative credit lenders since they carry more certainty about value and in the event of bankruptcy are easier to cash in.

Both the ICT and non-ICT models produce negative and significant profitability coefficients which is consistent with Myers (1984) and Michaels et al. (1999). As already mentioned, for a profitable firm, the target debt to equity ratio is typically low, because such firms would prefer to rely on internal financing before seeking external loans, i.e. the pecking order theory (Myers, 1984). Another factor in support of ICT firms' preferences for internal sources is the existence of greater information asymmetries and the relatively higher cost of external equity compared to non-ICT firms. This might explain why ICT firms have a higher parameter estimate (-0.36) relative to non-ICT (-0.09). It suggests that a 1% increase in profitability results in a 0.36% decrease in leverage in the short run. If this interpretation is correct, then it also indicates that ICT firms are using retained earnings not only to finance their growth but also to reduce their debt levels.

The coefficient for the uniqueness variable is negative in both models, significant at the 1% level for both sectors. A negative relationship was expected since the more unique a firm's assets are, the thinner the market is for those assets and the lower the expected value recoverable by the lender is in the event of bankruptcy. By comparing the size of both coefficients we can attest that the capital structure of an ICT firm is more sensitive to the uniqueness of its assets relative to a non-ICT firm.

Size seems to have a diverging effect on leverage for both sectors. A positive highly significant effect was recorded for non-ICT firms while a negative insignificant effect was noted for the ICT sector. On the one hand, the positive relationship can be interpreted by the fact that large non-ICT firms are more able to raise debt than small firms and are less vulnerable to bankruptcy. On the other, a negative relation might mean that ICT firms adopt debt financing to finance their initial growth while using their internally generated profits to finance subsequent growth. This suggests a strong connection between size and profitability amongst ICT firms where additional capital is expected to come from a company's retained earnings. Moreover, one can add that this result might be due to the fact that the sample is a bit biased toward large firms since more than 52% of the sample is considered to be large firms.

The crisis variable negatively affected leverage in both sectors, significant at the 1% level for both sectors. As expected, the crisis had a larger effect on ICT firms than non-ICTs as shown by a higher estimated coefficient of -0.21 for the former and a -0.01 coefficient for the latter. Given that the March 2000 burst was mainly a dotcom crisis; companies related to the information and technology sector were most affected. Since the Dot-com burst has been extensively researched, I will refrain from offering a detailed analysis of its causes; for more information on the crisis please refer to Ofek and Richardson (2003), among others. They link the Internet bubble burst to the unprecedented level of lockup expirations and insider selling.

The industry dummies (manufacturing, retail trade and services) of the non-ICT sector have a substantially significant lower leverage level relative to the reference industry (agriculture, forestry and fishing). As for the ICT sector, wholesale trade and communication industries have a higher leverage level relative to all other industries.

7.1.2. Determinants of the Speed of Adjustment

Most of the determinants of the speed of adjustment were found to be significant. The distance (DIST) between the actual leverage level and the optimal level is positively related to the speed of adjustment, an expected result, because as the distance widens firms will have a higher incentive to adjust their capital structure.

The current liabilities ratio is positively related to leverage for both sectors with a difference noted in the significance level (1% for ICT firms vs. 5% for non-ICT firms). Based on the results, a higher level of current liabilities for an ICT firm seems to provide it with the ability to adjust to an optimal leverage faster than non-ICTs, since current liabilities are highly liquid and could be relieved easily.

The growth variable seems to have a positive relation with the speed of adjustment for both sectors significant at the 1% level. Firms that are expected to grow would be motivated to adjust their investment levels towards the target faster than slow growth firms, due to the fact that growth is a sign of strength which might increase the firm's ability to raise low cost external funds.

As expected, profitability has a positive effect on the speed of adjustment for both sectors, yet, contrary to our expectations the level of significance might be problematic. The 10% significance level recorded in the non-ICT model is reasonably logical since profitable firms possess the necessary resources to adjust-up or -down towards an optimal level of capital structure. Profitable firms can easily raise additional debt if needed in order to adjust-up towards the optimal level of leverage, and at the same time they possess enough earnings in order to pay off outstanding debt or to internally finance future projects, thus adjusting-down towards an optimal capital structure. As for ICT firms the result is unexpected, profitability seems to have an insignificant effect on the speed of adjustment. Assuming the result is correct, one might argue that even with higher profits ICT firms might not be able to raise additional debt in the case of adjusting upwards due to the many unique features of an ICT firm, discussed in section two.

The crisis variable was found to be negatively related to the speed of adjustment at the 1% level of significance for both sectors, which asserts our expectations that after the crisis, the financial environment in the UK became tighter making the act of borrowing more demanding, thereby leading to a wider gap between the observed and the optimal leverage, and, consequently, slowing down the speed of adjustment.

The intangibility variable, measured by the log of intangible assets, was found to be negatively related to leverage but the results were insignificant for both sectors. Finally, the remaining determinant, size, showed conspicuous results. We were expecting a positive relation between size and the speed of adjustment; instead we got a negative highly significant effect for both sectors. Setting aside the fact that the results might be biased towards large firms as already mentioned earlier, one might argue that large firms whether ICT or not are under no pressure to adjust quickly to an optimal level of leverage, that is why they might take more time relative to smaller firms.

7.2. Mean Variations

Referring to Table 5, the mean leverage level for all firms has been fluctuating throughout the 11 years study period starting with 26.83% in 1996 reaching 25.55% in 2005 with the highest growth and drop rate recorded in 1998 (5.9%) and 2003 (-4.72%), respectively. Moreover, the highest level of debt recorded during the 11 years was in 1998 (29.24%) while the lowest was in 2004 (25.53%). The effect of the dot-com crisis is more pronounced within the speed of adjustment variable, a 13.64% drop rate was recorded directly after the dot-com crisis with an average drop rate of 4.1% during the 5 years following the crisis in contrast to an average growth rate of 0.66% during the 4 years preceding the crisis. Moreover, if we look at the means by crisis it becomes clear that leverage and the speed of adjustment were higher before the crisis compared to the period after the crisis. Leverage dropped from 27.94% to 26.72% while the speed of adjustment dropped from 0.36 to 0.30. Examining the means by specialization, the figures show that non-ICT firms hold more leverage (by 14%) and adjust faster to their optimal level relative to their counterparts. This is understandable since the ICT sector has unique features, which might weaken the firm's ability to raise debt.

Analysing the means by industry, shows that the communications sector has the highest level of leverage (46.08%) yet the second lowest adjustment speed (0.34) followed by the construction sector at 41.98% with an adjustment speed of (0.34). the services sector holds the lowest level of debt (24.58%) and the second highest adjustment speed (0.35).

Table 5: Mean Variations

This table shows the mean of investment and speed of adjustment, based on the dynamic model.

	Mean Leverage	**Mean Speed of Adjustment**
Mean by year		
1996	0.2683	0.3520
1997	0.2761	0.3531
1998	0.2924	0.3570
1999	0.2809	0.3590
2000	0.2797	0.3601
2001	0.2797	0.3110
2002	0.2794	0.3030
2003	0.2662	0.3020
2004	0.2553	0.3001
2005	0.2555	0.2901
Mean by industry		
Agriculture, Forestry and Fishing	0.3831	0.3450
Mining	0.3439	0.3540
Construction	0.4098	0.3410
Manufacturing	0.2472	0.3500
Communication	0.4608	0.3430
Wholesale Trade	0.3124	0.3470
Retail Trade	0.3025	0.3450
Services	0.2458	0.3510

Table 5: Mean Variations - continued

Mean by crisis		
Before March 2000	0.2795	0.3562
After March 2000	0.2673	0.3012
Mean by specialization		
Non-ICT Firms	0.2865	0.3601
ICT Firms	0.2508	0.2900

8. Conclusion

This paper examined the ICT sector from a financial perspective by exploring the sensitivity of a firm's leverage to a set of financial determinants, using a dynamic model of leverage based on a sample of 2,598 UK companies, observed from 1995 till 2005. The model was applied to the ICT and non-ICT sectors separately in order to check whether the former has any additional implications, due to its uniqueness.

By comparing the results of the ICT model to those of the non-ICT, we can confirm our supposition that the unique characteristics of the ICT sector have some bearing on the financial patterns pursued by ICT firms. We argue that the pronounced difference in the determinants of leverage, whether in the significance level or the magnitude of the coefficient, could be linked to one or more of the unique characteristics detailed in section 3. For instance, the difference in the significance level of the income variability determinant between ICT and non-ICT firms, might be connected to the network effect characteristic of ICTs, since in the presence of strong network effects it becomes difficult to predict the success of a firm (Schoder, 2000), thus increasing future income volatility. Moreover, our results add more evidence to the findings reached by Hyytinen and Pajarinen (2005) and Hogan and Huston (2005) that the information technology firms prefer to use equity rather than debt when financing new projects.

Our findings have some policy implications. The fact that ICT firms have a preference towards equity financing; debt financing would be a last resort solution. We believe that policy makers should develop their financial markets in such a way that would encourage equity financing instead of debt financing. Moreover, in many countries governments support ICT firms by providing debt-related subsidies, which, based on the results of this paper may hinder investment in ICT instead of boosting it. We believe that public policy makers should enhance the availability of equity capital instead of providing subsidized debt finance for investment; for instance, promote venture capital markets or encourage foreign direct investment; this would ensure financing ICT firms, especially small and start-up firms.

Considering the speed of adjustment, the differences between the results of both sectors reinforce the ICT uniqueness argument. Because of these unique characteristics an ICT firm depends more on current liabilities and less on profitability when adjusting to an optimal capital structure compared to a non-ICT firm.

Finally, the crisis variable confirms that the dot-com crisis had a major negative effect on leverage ratios and the speed of adjustment among UK firms especially those belonging to the ICT sector.

Acknowledgements

The author would like to thank the Arab Open University-Lebanon Branch for their support and valuable comments.

References

[1] Allen, D. E. (1993). The Pecking Order Hypothesis: Australian Evidence. Applied Financial Economics, 3, 101–112.

[2] Anton, J.J., and Yao, D.A. (1994) Expropriation and inventions: Appropriable rents in the absence of property rights. American Economic Review, 84, 190–209.

[3] Arthur, W.B., 1996. Increasing returns and the new world of business. Harvard Business Review, July/August

[4] Bradley, Michael, Gregg Jarrell, and E. Han Kim, 1984, On the existence of an optimal capital structure: Theory and evidence, Journal of Finance 39, 857-878.

[5] Brealey, R. A., and Myers, S. C. (2002) Principles of corporate finance. (McGraw Hill, New York).

[6] Castanias, Richard, 1983, Bankruptcy risk and optimal capital structure, Journal of Finance 38, 1617-1635.

[7] Chittenden, F., Hall, G., & Hutchinson, P. (1996). Small Firm Growth, Access to Capital Markets and Financial Structure: Review of Issues and an Empirical Investigation. Small Business Economics, 8(1), 59–67.

[8] Deakins, D., and G. Hussain, 1993. Overcoming the adverse selection problem: Evidence and policy implications from a study of bank managers on the importance of different criteria used in making a lending decision. In Chittenden, F., M. Robertson, and D. Watkins, (Eds.), Small firms: Recession and recovery. Paul Chapman Publishing: London.

[9] Fischer, E. O., R. Heinkel and J. Zechner, 1989, Dynamic capital structure choice: Theory and tests. Journal of Finance, 44, pp. 19-40.

[10] Friend, Irwin and Larry Lang, 1988, An empirical test of the impact of managerial self-interest on corporate capital structure, Journal of Finance 43, 271-281.

[11] Gilder, G., 1993. Metcalfe's Law and Legacy. Forbes ASAP, September 13, available from: http://www.gildertech.com/public/telecosmseries/metcalf.html.

[12] Grossman, S. J., and O. Hart, 1982, Corporate financial structure and management incentives. In: The Economics of Information and Uncertainty (ed. McCall, J. J.), pp. 107-140. University of Chicago Press, Chicago.

[13] Heshmati, A., 2002, The dynamics of capital structure: Evidence from Swedish micro and small firms. Research in Banking and Finance, 2, pp. 199-241.

[14] Hogan, T., and E. Huston, 2005. Capital structure in new technology-based firms: Evidence from the Irish software sector. Global Finance Journal 15, pp. 369-387.

[15] Homanifar G., Ziets, J., & Benkatu, O. (1994). An Empirical Model of Capital Structure: Some New Evidence. Journal of Business, Finance and Accounting, 21(1), 1–14.

[16] Hyytinen, A., and M. Pajarinen, 2005. Financing of technology intensive small business: Some evidence from the ICT industry. Information Economics and Policy 17, pp. 115–132.

[17] Jalilvand, A. and R. Harris, 1984, Corporate behavior in adjusting to capital structure and dividend targets: An econometric study. Journal of Finance, 39, pp. 127–145.

[18] Jensen, M. and W. Meckling, 1976, Theory of the firm: Managerial behaviour, agency costs, and capital structure. Journal of Financial Economics, 3, pp. 305-360.

[19] Jensen, M.C. (1986) Agency costs of free cash flow, corporate finance and takeovers. American Economic Review, 76, 323–339.

[20] Koski, H. A., and S. K. Majumdar, 2002. Paragons of virtue? Competitor entry and the strategies of incumbents in the US local telecommunications industry. Information Economics and Policy 14, pp. 453–480.

[21] Lopez-Garcia, J., & Aybar-Arias, C. (2000). An Empirical Approach to the Financial Behaviour of Small and Medium Sized Companies. Small Business Economics, 14, 55–63.

[22] Marsh, Paul, 1982, The choice between equity and debt: An empirical study, Journal of Finance 37, 121-144.

[23] Michaelas, N., Chittenden, F., & Poutziouris, P. (1999). Financial Policy and Capital Structure Choice in U.K. SMEs: Empirical Evidence from Company Panel Data. Small Business Economics, 12(2), 113–130.
[24] Modigliani, F. and M. H. Miller, 1958, The cost of capital, corporation finance and the theory of investment. American Economic Review, 48, pp. 261-297.
[25] Myers, S. C., and N. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13, pp. 187–221.
[26] Myers, S.C., 1977, Determinants of corporate borrowing. Journal of Financial Economics 5, 147-176.
[27] Myers, S.C., 1984, The capital structure puzzle. Journal of Finance, 39, pp. 575-592.
[28] Ofek, E., and M. Richardson, 2003. The rise and fall of internet stock prices. Journal of Finance 58, pp. 1113-1137.
[29] Opler, T., & Titman, S. (1995). The Debt-Equity Choice: An Analysis of Issuing Firms. Boston College Working Paper.
[30] Organization for Economic Co-operation and Development, 2000. Measuring the ICT Sector. (OECD), Paris.
[31] Organization for Economic Co-operation and Development, 2005. OECD SME and entrepreneurship outlook. (OECD), Paris.
[32] Rajan, R. and L. Zingales, 1995, What do we know about capital structure? Some evidence from international data. Journal of Finance, 50, pp. 1421–1460.
[33] Schoder, D., 2000. Forecasting the success of telecommunications services in the presence of network effects. Information Economics and Policy 12, pp. 181–200.
[34] Singh, M., Davidson,W.N., and Suchard, J. (2003) Corporate diversification strategies and capital structure. Quarterly Review of Economics and Finance, 43, 147–167.
[35] Stiglitz, J. E., and Weiss, A. (1981) Credit rationing in markets with imperfect information. American Economic Review, 71, 383–410.
[36] Stulz, R.M. (1990) Managerial discretion and optimal financing policies. Journal of Financial Economics, 26, 3 –28.
[37] Titman, S. and R. Wessels, 1988, The determinants of capital structure choice. Journal of Finance, 43, pp. 1-19.
[38] Varian, H. R., 2001. Economics of information technology, mimeo, University of California, Berkeley. Available from http://www.sims.berkeley.edu/~hal/.
[39] Vilasuso, J. and A. Minkler, 2001, Agency costs, assets specificity, and the capital structure of the firm. Journal of Economic Behavior and Organization, 44, pp. 55–69.