Capital Structure and its Determinants in the United Kingdom — A Decompositional Analysis

Alan A. Bevan* and Jo Danbolt**

* CNEM/Economics, London Business School, Sussex Place, Regent's Park, London NW1 4SA.

** Department of Accounting and Finance, University of Glasgow, 65-71 Southpark Avenue, Glasgow G12 8LE.

ABSTRACT

Prior research on capital structure by Rajan and Zingales (1995) suggests that the level of gearing in UK companies is positively related to size and tangibility, and negatively correlated with profitability and the level of growth opportunities. However, as argued by Harris and Raviv (1991), "The interpretation of results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest". In this paper we focus on the difficulties of measuring gearing, and the sensitivity of Rajan and Zingales' results to variations in gearing measures. Based on an analysis of the capital structure of 822 UK companies, we find Rajan and Zingales' results to be highly definitional-dependent. The determinants of gearing appear to vary significantly, depending upon which component of debt is being analysed. In particular, we find significant differences in the determinants of long and short-term forms of debt. Given that trade credit and equivalent, on average, accounts for more than 62 percent of total debt, the results are particularly sensitive to whether such debt is included in the gearing measure. We argue, therefore, that analysis of capital structure is incomplete without a detailed examination of all forms of corporate debt.

Running Title:

Capital Structure and its Determinants in the UK

Address for correspondence:

Dr Alan A. Bevan, CNEM/Economics, London Business School, Sussex Place, Regent's Park, London NW1 4SA; E-mail: abevan@london.edu; Tel: +44 (0)171 262 5050; Fax: +44 (0)171 724 8060

Capital Structure and its Determinants in the United Kingdom — A Decompositional Analysis

1. INTRODUCTION

The pioneering work of Modigliani and Miller (1958) illustrates that the valuation of a company will be independent from its financial structure under certain key assumptions. Internal and external funds may be regarded as perfect substitutes in a world where capital markets function perfectly, where there are no transactions or bankruptcy costs, no distortionary taxation, and the productive activity of the firm is independent of its methods of financing. Once these fundamental assumptions are relaxed, however, capital structure may become relevant. Additionally, firms may find that there are restrictions to their access to external financing, and the costs of alternative forms of external finance may differ. Under such market imperfections, firms will attempt to select levels of debt and equity in order to reach an optimal capital structure.

This study attempts to extend our knowledge of capital structure and its determinants in listed UK companies. In their study of capital structure in the G-7 economies, Rajan and Zingales (1995) find gearing in the UK to be positively related to tangibility (the proportion of fixed to total assets) and the size of the company (logsales), but negatively related to the level of profitability and the market-to-book ratio. In this study we build on the UK component of the Rajan and Zingales study, by testing the sensitivity of the determinants of capital structure to various gearing measures and their sub-elements. We find that Rajan and Zingales' results are highly dependent upon the precise definition of gearing being examined. Having found evidence of significant definitional dependence, we attempt to gain a fuller understanding of our results by further sub-

dividing the debt element of our gearing measures, in order to test the relation of each of the elements to our explanatory variables. We find that the results of this analysis differ significantly depending upon whether we consider short or long-term debt elements. Consequently, our results highlight the sensitivity of the analysis to which form of debt is being considered. Given the predominance of short-term debt forms in corporate financial structure, we suggest that analyses based solely upon long-term forms of debt provide limited insight into the mechanisms which operate in the financial and corporate sectors.

Empirical analysis of capital structure is fraught with difficulty, and as argued by Harris and Raviv (1991), "The interpretation of results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest". In this paper we focus on the difficulties in defining gearing. We note, however, that many of the potential explanatory attributes are often, at best, imperfectly reflected by the variables observed in corporate accounts data. Hence Titman and Wessels (1988) note that the required explanatory variables may frequently be imperfect proxies for the desired corporate attributes, so inducing 'errors-in-variables' problems to regression analysis. Moreover, complex attributes frequently are not reflected by a single, unique, explanatory variable, nor do variables reflect a single attribute. As a result, the conclusions which may be derived from empirical analysis of corporate financial structure have the potential to become 'definition-dependent', as they may rely upon the researchers' choice of imperfect proxy variables.

This paper examines the issue of corporate financial structure and its determinants from three distinct perspectives. We utilise corporate accounts data for the United Kingdom in an attempt to replicate the analysis of Rajan and Zingales, so permitting us to test their conclusions with a larger sample of firms. We conduct our analysis on data for

1991, the same year as Rajan and Zingales. By using data from the same year, we ensure direct comparability with their work and limit the possibility that any differences in the results may be due to variations in the level of gearing over time, rather than indicating definitional dependence[1]. Secondly, given the preceding discussion, we implement the same analysis with alternative definitions of the dependent variable, gearing, in order to examine the robustness or otherwise of the results of Rajan and Zingales. As noted above, we then seek to explore this finding of definitional-dependence further, and find that the determinants of gearing vary significantly depending on the nature of the debt sub-element being analysed.

The remainder of the paper is divided into five main sections. Section 2 presents the theoretical basis for the analysis presented in this paper, predominantly based upon the work of Rajan and Zingales. Section 3 then provides a detailed description of the database which we have assembled in order to implement the analysis, the various alternative dependent and independent variables definitions which we have estimated, and the methodology applied. Our fourth section then details the results of this analysis, comparing both the various estimated gearing measures and the result of the cross-sectional regression analysis. As the results of our analysis of gearing reveal a significant degree of definitional dependence, section 5 presents a detailed decompositioning of the results, distinguishing between short and long-term debt and their sub-elements. Finally, section 6 summarises and concludes.

2. THEORY AND PRACTICE OF CAPITAL STRUCTURE

In their cross-sectional study of the determinants of capital structure, Rajan and Zingales (1995) examine the extent to which, at the level of the individual firm, gearing may be explained by four key factors, namely, market-to-book, size, profitability and tangibility. Their analysis is performed upon a firm-level sample from each of the G-7 countries, and although the results of their regression analysis differ slightly across countries, they appear to uncover some fairly strong conclusions.

The market-to-book ratio is used by Rajan and Zingales as a proxy for the level of growth opportunities available to the enterprise. This is in common with most studies which tend to apply proxies, rather than valuation models to estimate growth opportunities (Danbolt *et al.* (2000)). Rajan and Zingales suggest that, *a priori*, one would expect a negative relation between growth opportunities and the level of gearing. This is consistent with the theoretical predictions of Jensen and Mekling (1976) based on agency theory, and the work of Myers (1977), who argues that, due to information asymmetries, companies with high gearing would have a tendency to pass up positive NPV (net present value) investment opportunities. Myers therefore argues that companies with large amounts of investment opportunities (also known as growth options) would tend to have low gearing ratios.

Moreover, as growth opportunities do not yet provide revenue, companies may be reluctant to take on large amounts of contractual liabilities at this stage. Similarly, as growth opportunities are largely intangible, they may provide limited collateral value or liquidation value (in a similar spirit to the discussion of tangibility below). Companies with growth options may thus not wish to incur — nor necessarily be offered — additional debt financing.

However, the empirical evidence regarding the relationship between gearing and growth opportunities is rather mixed. While Titman and Wessels (1988), Chung (1993) and Barclay *et al.* (1995) find a negative correlation, Kester (1986) does not find any support for the predicted negative relationship between growth opportunities and gearing. Despite this controversy, however, Rajan and Zingales (1995) uncover evidence of negative correlations between market-to-book and gearing for all G-7 countries. This is thus consistent with the hypotheses of Jensen and Mekling (1976) and Myers (1977), and lends weight to the notion that companies with high levels of growth opportunities can be expected to have low levels of gearing.

Secondly, Rajan and Zingales include size (which is proxied by the natural logarithm of sales) in their cross-sectional analysis. There is no clear theory to provide *ex ante* expectations as to the effect which size should have on gearing. Rajan and Zingales (1995) state that:

> *"The effect of size on equilibrium leverage is more ambiguous. Larger firms tend to be more diversified and fail less often, so size (computed as the logarithm of net sales) may be an inverse proxy for the probability of bankruptcy"*.
>
> [Rajan and Zingales (1995) p.1451]

In addition, larger companies are more likely to have a credit rating and thus have access to non-bank debt financing, which is usually unavailable to smaller companies. While the prior empirical evidence with regard to the relationship between size and gearing is rather mixed[2], Rajan and Zingales find gearing for UK companies to be positively related to sales, as hypothesised.

Thirdly, consistent with Toy *et al.* (1974), Kester (1986) and Titman and Wessles (1988), Rajan and Zingales find profitability to be negatively related to gearing. Given, however, that the analysis is effectively performed as an estimation of a reduced form, such a result masks the underlying demand and supply interaction which is likely to be taking place. Although on the supply-side one would expect that more profitable firms would have better access to debt, the demand for debt may be negatively related to profits. Stiglitz and Weiss (1981) illustrate that the inability of lenders to distinguish between good and bad risks *ex ante* prevents them from charging variable interest rates dependent on the actual risk. In this event lenders are forced to increase the general cost of borrowing, which will tend to induce a problem of adverse selection as good risks are driven from the market by the high costs of borrowing. Due to this information asymmetry, companies will tend to prefer internal to external financing, where available.

Modigliani and Miller (1963) argue that, due to the tax deductibility of interest payments, companies may prefer debt to equity. This would suggest that highly profitable firms would choose to have high levels of debt in order to obtain attractive tax shields. However, others such as Miller (1977) highlight the limitations of his and Modigliani's 1963 arguments by additionally considering the effect of personal taxation. Moreover, DeAngelo and Masulis (1980) argue that interest tax shields may be unimportant to companies with other tax shields, such as depreciation. An alternative hypothesis regarding the relationship between profitability and gearing relates to Myers and Majluf (1984) and Myers (1984) pecking-order theory. Based on asymmetric information, they predict that companies will prefer internal to external capital sources. Consequently, companies with high levels of profits will prefer to finance investments with retained earnings than by the raising of debt finance. The finding of Rajan and

Zingales of a negative relationship between gearing and profitability is consistent with Myers' pecking-order theory.

Consistent with the findings of Bradley *et al.* (1984) and Titman and Wessels (1988), Rajan and Zingales' study of capital structure in the G-7 economies produces evidence to suggest a positive relation between tangibility, which they define as the ratio of fixed to total assets, and gearing. Following the theories of Scott (1977), Williamson (1988) and Harris and Raviv (1990), Rajan and Zingales suggest this may reflect the fact that debt may be more readily available to a firm which has high amounts of collateral upon which to secure debt, thus reducing agency problems[3].

The results of Rajan and Zingales thus provide some reasonably strong priors with which to judge further work. We firstly test these priors by replicating the work of Rajan and Zingales for the United Kingdom in 1991. In so doing, we assembled and made use of a dataset containing a sample substantially larger than that of Rajan and Zingales. The richness of this dataset also permitted us to examine the sensitivity of their findings to definitional changes in the dependent variable, with some enlightening results. Furthermore, by decomposing the individual gearing elements, we are able to clarify both the factors which influence these results and the extent of their influence, so gaining a fuller understanding of the underlying relations which determine corporate financial structure. Therefore section 3 below presents a detailed description of the dataset, together with a discussion of the methodological rationale for our various dependent and independent variables and the manner in which they were calculated.

3. DATA AND METHODOLOGY

The data used for the empirical analysis was derived from the commercial database maintained by Datastream International Ltd. This database contains balance sheet, profit and loss, and cash flow statement information for both current and extinct companies in a host of countries. For the purposes of this investigation, we utilised this database to obtain the required variables, where available, for all non-financial companies in the United Kingdom.

In the first instance, we took great care to define the dependent and independent variables to be used in our regression analysis, in order that they were consistent with those of Rajan and Zingales (1995). Notably, Rajan and Zingales acknowledge that "the extent of leverage [gearing] — and the most relevant measure — depends on the objective of the analysis" (p. 1427). However, whilst they define and calculate several alternative measures of gearing, their cross-sectional regression analysis is merely based upon one of these gearing measures. Therefore, in order to examine the sensitivity or otherwise of their cross-sectional results to the definition of the gearing variable, we constructed their suggested alternative definitions of gearing. Of these we define four gearing measures used in our analysis as:

- Non-Equity Liabilities to Total Assets: At book value this gearing measure is defined as the ratio of total debt plus trade credit and equivalent, to total assets (Equation 1B). The market value of non-equity liabilities is calculated by adjusting the total assets value, by subtracting the book value of equity and adding the market value of equity (Equation 1M).

$$\frac{TD + TTCE}{TA} \qquad (1B)$$

$$\frac{TD + TTCE}{TA - ECR + MV} \quad (1M)$$

where TD refers to total debt, TTCE to trade credit and equivalent, TA to total assets, ECR to the book value of equity capital and reserves, and MV to the market value of equity.

Rajan and Zingales propose that this measure acts as a proxy for the liquidation value of the firm. They argue, however, that this measure may be unreasonably inflated, as trade credit and equivalent may be financing transactions rather than assets.

- Debt to Total Assets: This is a simple ratio of total debt to total assets (Equation 2B). The market value measure is again calculated by adjusting assets in the denominator, by subtracting the book value of equity and adding back its market value (Equation 2M).

$$\frac{TD}{TA} \quad (2B)$$

$$\frac{TD}{TA - ECR + MV} \quad (2M)$$

- Debt to Capital: This is the ratio of total debt to capital, with the capital calculated as total debt plus equity, including preference shares (Equation 3B). Again, market value is calculated by adjusting for the market, rather than the book, value of equity in the denominator (Equation 3M).

$$\frac{TD}{TD + ECR + PS} \tag{3B}$$

$$\frac{TD}{TD + MV + PS} \tag{3M}$$

where PS refers to the book value of preference shares.

- Adjusted Debt to Adjusted Capital: This is the measure of gearing adopted by Rajan and Zingales. Adjusted debt is defined as the book value of total debt less cash and marketable securities. Rajan and Zingales argue that these elements should be treated as excess liquidity, and therefore reducing the effective level of indebtedness. Similarly the adjusted book (market) value of equity measure which appears in the denominator of the gearing variable is defined as the book (market) value of equity plus provisions and deferred taxes, less intangibles, as given in equations 4B (book value) and 4M (market value), below. These adjustments are made, as Rajan and Zingales suggest that provisions and deferred taxation may be better regarded as components of equity, while intangibles may be distorted by the treatment of acquired goodwill.

$$\frac{TD - TCE - MS}{TD + ECR + PS + PROV + DTAX - INTANG} \tag{4B}$$

$$\frac{TD - TCE - MS}{TD + MV + PS + PROV + DTAX - INTANG} \tag{4M}$$

where TCE refers to total cash and equivalent, MS to marketable securities, PROV to reserves and provisions, DTAX to total deferred taxation, and INTANG to the capitalised value of intangible assets.

As noted above, Rajan and Zingales suggest several additional gearing measures, and we were careful to test all of these in our regression analysis. While we find the key gearing definitions suggested by Rajan and Zingales produce well-specified distributions, and thus required minimal outlier elimination, some of the more esoteric measures produced unstable gearing values and regression results. Although further elimination of outliers may have rectified this situation, we wished to maintain the integrity of our dataset, whilst capturing the key elements of capital structure. Hence we focus upon the above four key measures of gearing, which produce the most robust results.

As discussed above, the choice of appropriate explanatory variables is potentially controversial (Titman and Wessels (1988) and Harris and Raviv (1991)). However, following Rajan and Zingales, we adopt four independent variables, defined as follows:

- Market-to-book (MTB) ratio: the ratio of the book value of total assets less the book value of equity plus the market value of equity, to the book value of total assets (Equation 5);

$$MTB = \frac{TA - ECR + MV}{TA} \tag{5}$$

- Logsales: the natural logarithm of sales (Equation 6);

$$LOGSALE = Ln(Sales) \tag{6}$$

- Profitability: the ratio of earnings before interest, tax and depreciation (EBITDA), to the book value of total assets (Equation 7);

$$PROFITABILITY = \frac{EBITDA}{TA} \qquad (7)$$

- Tangibility: the ratio of the book value of depreciated fixed assets (FA) to that of total assets (Equation 8);

$$TANGIBILITY = \frac{FA}{TA} \qquad (8)$$

In an attempt to isolate the analysis from the potential reverse causality which exists between the independent and dependent variables, Rajan and Zingales lag their independent variables, and hence we follow this procedure. Moreover, Rajan and Zingales smooth their independent variables by averaging them over four periods — hence their regression analysis contains the 1991 gearing measure as the independent variable, with average market-to-book, logsales, profitability and tangibility for the period 1987-1990 as the independent variables. However, in order to maximise our sample size, we instead follow Titman and Wessels (1988) in adopting three year averages for our right hand side variables. In the course of this investigation we also performed the same regression analysis with non-averaged one year lags of the independent variables, with no significant change in the results.

Although our assembled data appeared to be relatively clean, the largest outliers were eliminated by winsorising all dependent and independent variables at the one percent level[4]. The resulting values are reported in the following section, together with the results of our regressions for our chosen four gearing measures.

4. ANALYSIS AND RESULTS

4.1 Gearing in the UK

In the first instance we attempt to replicate Rajan and Zingales' results for gearing in the UK in 1991, and test the robustness of their results to changes in the definition of gearing. Summary statistics for gearing in the UK are given in Table 1. As can be seen from this table, the level of indebtedness of UK companies varies significantly depending on the measure of gearing adopted.

The first debt ratio is a broad measure of gearing, referring to the ratio of total debt plus trade credit and equivalent, to the book value of total assets. At book value, non-equity liabilities to total assets account for 49% of the book value of assets in 1991. The level of gearing is, not unexpectedly, lower when a proxy for the market (rather than book) value of assets is applied, at 42%. Given that book values in the UK are reported on a depreciated historical cost basis, these values tend to underestimate the market value of assets. (This is confirmed by the market-to-book (MTB) variable, which indicates that the market values of the companies in the sample on average equal 1.47 times the book value of their total capital employed. We discuss this further below).

==========

Table 1 about here

==========

By contrast, the straight total debt to total asset ratio is found to be 18% at book value, and 17% at market value. The large difference between the values for non-equity liabilities and total debt indicate that trade credit and equivalent account for a significant proportion of debt for listed UK companies, a point returned to in section 5 below.

The ratio of total debt to capital is captured in the third gearing measure. As total debt is substantially less than total liabilities, total capital is less than total assets. Consequently, as the denominator is smaller than for debt to total assets (the second gearing measure), the reported gearing measures are higher. Based on a definition of gearing as debt to capital, the mean level of indebtedness of UK companies amount to 27% (24%) of assets at book (market) value.

The fourth gearing measure – adjusted debt to adjusted capital – is the measure adopted by Rajan and Zingales in their cross-sectional analysis of capital structure in the G-7 economies. As noted above, this gearing measure involves several adjustments, the most significant of which is the deduction of total cash and equivalent from total debt. Given that UK companies tend to hold fairly significant amounts of liquid assets on their balance sheet, it is not surprising that this measure of gearing indicates substantially lower levels of indebtedness (at 13% or 15% depending on whether book or market values are applied) than do the other gearing measures.

Summary statistics for the explanatory variables are also provided in Table 1. The market-to-book (MTB) value at 1.47 indicates that book values do not adequately reflect the value of UK companies. If book values provide fair estimates of replacement values or the value of assets in place, a market-to-book value substantially in excess of unity indicates that UK companies on average have valuable investment opportunities or growth options[5]. As noted above, we follow Rajan and Zingales in using the natural logarithm of turnover as a proxy for size. The mean of logsales (expressed in £000s) over the period from 1988 to 1990 indicates that the average turnover of companies in our sample was approximately £64m (median £54m). The third explanatory variable is profitability. Over the period from 1988 to 1990 (as applied in the regressions of 1991

gearing ratios), the average return on assets was 16%. Net (depreciated) fixed assets on average account for approximately 35% of total asset values for UK companies.

4.2 Cross-sectional analysis of 1991 gearing levels

Rajan and Zingales estimate their regressions of market-to-book, logsales, profitability and tangibility against gearing, using maximum likelihood and a censored Tobit model. They argue, however, that "The ordinary least squares (OLS) results are very similar [to those obtained using alternative techniques]". Similarly we perform censored Tobit analysis, at various degrees of left and/or right censoring, as well as OLS estimation. We too find the results to be extremely robust to the estimation technique adopted. However, as we perform a series of regressions with different gearing measures as the dependent variable, we report only our OLS results: it is not clear that the different gearing measures should be censored at the same points, and hence we wish to facilitate direct comparability between the regressions based upon alternative gearing definitions[6].

The estimated regression model may be represented as:

$$\text{Gearing}_{i,t} = ß_1 + ß_2\text{Market-to-Book}_{i,t-3} + ß_3\text{Logsale}_{i,t-3} + ß_4\text{Profitability}_{i,t-3} + ß_5\text{Tangibility}_{i,t-3} + \varepsilon_{i,t} \quad (9)$$

where *i* refers to the individual firms, *t* to the time period of the gearing measure (measured at the accounting year end), and *t-3* to the average for the previous three years. The results of our analysis are reported in table 2 below, where we include the results of Rajan and Zingales (in italics) for comparison, and we now consider the interpretation of the coefficients associated with each independent variable, in turn.

==========

Table 2 about here

==========

4.2.1 Market-to-Book

Consistent with Barclay *et al.* (1995) and Rajan and Zingales (1995), we find a significant negative relationship between gearing and the level of market-to-book when gearing is measured at market value[7]. At book values of gearing, however, the market-to-book regression coefficients tend to be small and not universally significant. For some of the gearing measures, the results contradict the hypothesis, suggesting a positive relationship between the level of gearing and growth opportunities[8].

4.2.2 Logarithm of sales

The study of Rajan and Zingales (1995) leads us to expect a positive correlation between gearing and the size of the company. This is indeed generally what we find. However, while the coefficients are significantly positive for all book value measures of gearing, the size of the coefficients tend to be small. At market values, logsales is not statistically significant. Our results are similar to those observed by Rajan and Zingales for the UK, who also found logsales to be significantly positively related to book gearing, but not correlated with gearing measured at market values.

4.2.3 Profitability

Our results are consistent with the pecking-order theory, but contradict the tax shield hypothesis. The regression coefficients for the effect of profitability on corporate gearing are systematically negative and highly statistically significant. Indeed, profitability has generally the strongest explanatory power of the cross-sectional variation in UK gearing levels, regardless of the definition of gearing applied. In their

study of capital structure in the UK, Rajan and Zingales (1995) also find a negative correlation between profitability and gearing, although their coefficient at book value is not statistically significant.

4.2.4 Tangibility

As can be seen from table 2, our analysis provides conflicting evidence of the relation between gearing and tangibility, depending on the measure of gearing applied. Adjusted debt to adjusted capital (model 4) is equivalent to the definition of gearing applied by Rajan and Zingales. As can be seen from the table, this measure of gearing (at both book and market value) is significantly positively correlated with tangibility. These results are consistent with those of Rajan and Zingales, although our tangibility coefficients are somewhat smaller in magnitude than theirs. Similarly, we find a significantly positive, although smaller, coefficient for tangibility when gearing is measured as the simple ratio of total debt to total assets (model 2).

However, significant negative coefficients for tangibility are obtained when gearing is defined as non-equity liabilities to total assets (model 1). The differences between this gearing measure and the remaining gearing measures appear to relate to the treatment of trade credit and equivalent. In non-equity liabilities to total assets, these liabilities are included as part of liabilities in the numerator. The tangibility coefficient thus changes sign when the gearing measure is changed from total debt to adjust for trade credit and equivalent.

In addition, in order for the tangibility coefficient to change sign from the debt to total assets gearing measure to the trade-credit adjusted gearing measure (non-equity liabilities to total assets), trade credit and equivalent not only need to be large — in proportion to other forms of debt — but also to be negatively correlated to tangibility[9].

The tangibility variable measures the ratio of fixed to total assets, assets which tend to be long term in nature. The reciprocal of the tangibility variable will therefore capture predominately current assets[10]. The negative correlation between tangibility and the gearing measure adjusted for trade credit thus implies that trade credit and equivalent (which are current liabilities) are used to finance non-fixed assets (predominately current assets). This is indeed what we would expect in a well functioning capital market with companies aiming to match maturities of assets and liabilities (Brealey and Myers (1996)). As noted above, we test this perceived result by decomposing our gearing measures to their constituent elements, and estimating the extent to which they may be related to our four explanatory variables. The results of this analysis are reported in the following section.

5. DECOMPOSITIONAL ANALYSIS

5.1 Decomposition of corporate debt structure

The preceding analysis suggests that it would be somewhat disingenuous to claim that there is one 'universal truth' of capital structure and its determinants. Rather, our analysis illustrates that alternative definitions of gearing result in both substantially different absolute values, and different correlations with determining factors. As noted above, casual observation suggests that these differences result from the fact that alternative definitions of gearing reflect differing aspects of capital structure. In this light, it is perhaps not surprising to find that the nature of the 'truth' depends crucially upon the precise question being asked.

Therefore, in an attempt to gain a more thorough understanding of the underlying forces driving our previous results, we decompose our gearing measures into their constituent

elements, before performing regression analysis in the same manner as that reported in section 4 above. Table 3 below reports the mean and median of each element, normalised by total assets.

==========

Table 3 about here

==========

The first row of table 3 illustrates that total liabilities on average amount to 48.59 percent of the book value of total assets. Total liabilities is then further sub-divided into total loan capital — repayable in more than one year — and total current liabilities, which correspond to 8.53 and 40.06 percent of total assets respectively. If we consider total debt to represent long-term forms of debt and total current liabilities to represent short-term forms, it is thus clear that for the companies in our sample, the vast majority (82.45 percent) of debt finance is short-term.

At the next level of sub-division, table 3 illustrates that the 17.55 percent of debt that is long-term is fairly evenly split between bank borrowing repayable in more than one year (around 56 percent of total loan capital) and securitised debt (44 percent). By contrast, trade credit and equivalent is shown to be by far the largest component of short-term debt, comprising around 76 percent of total current liabilities. This reliance on trade credit most likely reflects a rational corporate debt policy, given that other forms of borrowing entail significant costs. Asymmetric information is generally regarded to increase the cost of bank borrowing, as the inability of lenders to distinguish between good and bad risks *ex ante* may be limited, resulting in them overcharging low risk customers. Equally there are significant costs associated with issuing paper on the corporate bond market. In contrast to the sub-division of long-term debt, the vast majority (more than 84 percent) of the 24 percent of short-term debt which is accounted

for by short-term borrowing is in the form of borrowing from banks, with only 16 percent occurring in terms of securitised paper.

In general, we may thus conclude that the firms in our sample derive the majority of their finance from short-term debt forms, and that the majority of this short-term debt is derived in the form of trade credit and equivalent. Total bank borrowing accounts for only around 27 percent of debt finance, with around 63 percent of this being short-term borrowing. By contrast, although only a mere 10.64 percent of total debt is represented by corporate paper, the majority (around 72 percent) is long-term.

5.2 Determinants of the decomposed debt structure

Table 4 presents the results of cross-sectional regression analysis conducted upon each of the debt elements reported in table 3. In each case, the same three-year averaged and one period lagged independent variables used in the cross-sectional analysis of our four gearing definitions above, were regressed against each debt element[11]. All dependent variables are measured at book value.

==========

Table 4 about here

==========

The first row of table 4 illustrates that each of our four independent variables —market-to-book ratio, logsales, profitability and tangibility — are significantly correlated with total liabilities. The estimated coefficients, however, do not all concur with those of our gearing analysis presented previously. The coefficients for logsales and profitability are of the expected sign, implying that large firms tend to hold more debt — perhaps because they are regarded as being ‘too big to fail’ and therefore receive better debt

access — and that more profitable firms hold less debt — as the relative cost of borrowing encourages use of retained earnings. By contrast, the positive and highly significant coefficient of the market-to-book ratio indicates that, contrary to expectations, firms with growth opportunities generally hold more debt. Moreover, we find a highly significant, negative correlation between tangibility and total debt; a result which explains our apparently contradictory findings in the gearing analysis reported previously in table 2, and for which our debt decomposition procedure provides a clear explanation.

While the regression analysis of total liabilities has a relatively high explanatory power and produces highly significant coefficients, the analysis in table 4 clearly illustrates the importance of considering long and short-term debt separately. As argued by Van der Wijst and Thurik (1993), Chittenden *et al.* (1996), Barclay and Smith (1999) and Hutchinson *et al.* (1999), analysis of the determinants of gearing based on total liabilities may mask the significant differences between long-term and short-term debt.

As revealed in table 4, the results vary depending on which component of long-term or short-term debt is being studied. Our results clearly illustrate a significant distinction between long-term debt forms, with which tangibility is positively correlated, and the negative correlation which exists with short-term forms of debt. Consistent with the results of Hutchinson *et al.* (1999), we find evidence in support of the maturity matching principle: long-term debt forms are used to finance fixed assets, while the reciprocal of tangibility — non-fixed assets (which consist mainly of current assets) — are financed by short term debt. Consequently, it is clear that the determinants of the level of debt issued by UK companies vary significantly depending on which element of gearing is being analysed.

In addition, our decomposition procedure reveals a somewhat unexpected result in terms of size. Whilst size is found to be positively correlated with total liabilities and, at the sub-level, all long-term forms, there is mixed evidence amongst the short-term debt forms. Logsales is found not to be significantly correlated with aggregate short-term debt; however, further disaggregation reveals that while size is positively correlated with both trade credit and equivalent and short-term securitised debt, it is negatively correlated with short-term bank borrowing. The fact that small companies are found to borrow short rather than long-term, may indicate that they are supply constrained, in that they do not possess sufficient credit rating to allow them access to long-term borrowing (Bank of England (1998)). In addition, the positive and significant correlation between size and short-term securitised debt, suggests that small firms are further constrained in their debt choice, as they do not have ready access to the corporate bond market.

Finally, we note that the positive and significant market-to-book coefficient at the level of total liabilities appears to be driven by the trade credit and equivalent sub-element. Whilst the coefficient on all the other most disaggregated debt elements is insignificant, the correlation between trade credit and equivalent and the market-to-book ratio is positive and highly significant. Thus, *ceteris paribus*, a firm with strong future potential will prefer to finance itself with inter-enterprise credit rather than through more formal lines. This is consistent with the predictions of Barclay and Smith (1999) who argued that, when seeking debt financing, companies with high levels of growth opportunities will prefer short-term to long-term debt, as well as debt with few restrictive covenants, in order to maintain financial flexibility.

These decomposed results thus provide an explanation for our previous findings in section 4 above. The benchmark Rajan and Zingales measure and our equivalent

gearing measure ‘adjusted debt to adjusted capital’ (model 4) are predominantly based upon longer-term debt elements. By contrast, the ‘non-equity liabilities to total assets’ measure (model 1) is adjusted with short-term debt elements, in particular trade credit, the largest component of debt for the average UK company. As our decomposition reveals trade credit and equivalent to be significantly negatively correlated with tangibility, the significant negative correlation between tangibility and this gearing measure thus appears to stem from the adjustment for trade credit. Similarly, the positive correlation between the market-to-book ratio and our first gearing measure, appears to stem from the short-term nature of this measure.

It should be noted, however, that we do not wish to imply that longer-term gearing measures are inappropriate — the appropriate measure of gearing depends on the purpose of the analysis. Rather we would reiterate our initial premise that the significant differences between gearing measures and their determining factors illustrate that the perceived fundamental relations in corporate financing depend crucially upon which element of capital structure one wishes to examine. Nonetheless, one should be aware that the exclusion of short-term debt elements precludes analysis of a major element of gearing for the majority of UK companies.

6. SUMMARY AND CONCLUSIONS

While in a Modigliani and Miller (1958) world capital structure may be irrelevant under assumptions of perfect capital markets, market imperfections — such as taxation, transaction costs, costs of bankruptcy or financial distress, and information asymmetry — may result in companies preferring certain types of financing to others. In this paper we have analysed the determinants of capital structure for a sample of 822 UK companies, using a variety of gearing measures.

We applied four different measures of gearing, ranging from a broad measure of total liabilities to total assets, to a measure of gearing where cash and marketable securities are deducted from the debt measure. Not unexpectedly, the level of gearing of UK companies was found to vary substantially with the definition of gearing applied.

Following Rajan and Zingales (1995), we analysed the correlation between gearing and a proxy for investment opportunities (the ratio of market-to-book value of total assets), the size of the company (natural logarithm of sales), the profitability of the company (measured as EBITDA/total assets) and the tangibility (the ratio of fixed to total assets). However, while Rajan and Zingales identified various definitions of gearing, only one measure of gearing was applied in their cross-sectional analysis. We have extended Rajan and Zingales' analysis of the UK firstly by analysing the robustness of their conclusions to variations in the gearing measure, and secondly by decomposing the analysis into long and short-term debt and their sub-elements.

Having applied the same gearing definition as Rajan and Zingales, based on a larger sample than that utilised in their analysis, our findings were very similar to theirs. We found gearing to be significantly positively correlated with tangibility and logsales (for book values of gearing), and significantly negatively correlated with the market-to-book ratio and the level of profitability. However, further analysis revealed that the results are highly model specific. In particular, when the debt measure was adjusted for trade credit and equivalent, a significant *negative* correlation between gearing and tangibility was observed.

By decomposing total liabilities into its sub-components, we uncovered significant differences in the determinants of long and short-term debt components. We found that

the various short-term elements were negatively correlated with tangibility, while the long-term elements demonstrated a positive correlation: thus providing evidence of maturity matching. In addition, size was found to be significantly negatively correlated with short-term bank borrowing, and positively correlated with all long-term debt forms and short-term paper debt. This may indicate that small firms in our sample have difficulty in obtaining long-term credit and issuing paper. Contrary to expectations, we found firms with high levels of growth opportunities (as reflected by a high market-to-book ratio) to have higher levels of debt than their counterparts with lower market-to-book ratios. However, this result appears to be driven entirely by trade credit and equivalent, and no significant market-to-book effect was found for other forms of debt.

Given that trade credit and equivalent, on average, accounts for more than 62 percent of total liabilities, our results illustrate its significance as an element of corporate financial structure. This suggests that analyses of gearing based solely upon long-term debt provide only part of the story, and a fuller understanding of capital structure and its determinants requires a detailed analysis of all forms of corporate debt.

ACKNOWLEDGEMENTS

This paper was prepared under the ACE project '*Financial Flows and Debt Structures in Transition and Market Economies: Bulgaria, Hungary and the United Kingdom*'. The authors wish to express their gratitude to the European Commission for funding under its Phare/ACE programme, research grant number P96-6081-R. In addition we wish to thank Diderik Danbolt, Neil Garrod, Ian Hirst, Robbie Mochrie, Bill Rees, Mark Schaffer, and the participants at the ACE project workshop, Budapest, 15th May 1999, for helpful comments on earlier drafts, and Kirsty MacCallum for library assistance. Any remaining errors are our own.

BIBLIOGRAPHY

Bank of England (1998) Finance for Small Firms, www.bankofengland.co.uk

Barclay, M.J. and Smith, C.W. (1999) The Capital Structure Puzzle: Another Look at the Evidence, *Journal of Applied Corporate Finance*, **12**(1), Spring, 8-20.

Barclay, M.J., Smith C.W. and Watts, R.L. (1995) The Determinants of Corporate Leverage and Dividend Policies, *Journal of Applied Corporate Finance*, **7**(4), 4-19.

Bevan, A.A., and Danbolt, J. (1999) *Capital Structure in the United Kingdom 1991-1997 – A Dynamic, Cross-Sectional Approach*, paper presented at the ACE project workshop *Financial Flows and Debt Structures in Transition and market Economies: Bulgaria, Hungary and the United Kingdom*, Budapest, 15th May.

Bradley, M., Jarrell, G. and Kim, E.H. (1984) On the Existence of and Optimal Capital Structure: Theory and Evidence, *Journal of Finance*, **39**, 857-878.

Brealey, R.A. and Myers, S.C. (1996) *Principles of Corporate Finance*, 5th international edition, McGraw-Hill.

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

Chung K.H. (1993) Asset Characteristics and Corporate Debt Policy: An Empirical Investigation, *Journal of Business Finance and Accounting*, **20**(1), 83-98.

Crutchley, C.E. and Hanson, R.S. (1989) A Test of the Agency Theory of Managerial Ownership, Corporate Leverage and Corporate Control, *Financial Management*, **18**(4), 36-46.

Danbolt, J., Hirst, I. and Jones, E. (2000) *Measuring Growth Opportunities*, University of Glasgow, Department of Accounting and Finance, Working Paper 2000/6.

DeAngelo, H. and Masulis, R. (1980) Optimal Capital Structure under Corporate and Personal Taxation, *Journal of Financial Economics*, **8**(1), 3-29.

Harris, M. and Raviv, A. (1990) Capital Structure and the Informational Role of Debt, *Journal of Finance*, **45**(2), 321-349.

Harris, M. and Raviv, A. (1991) The Theory of Capital Structure, *Journal of Finance*, **46**(1), pp. 297-355.

Jensen, M. and Meckling, W. (1976) Theory of the Firm: Managerial Behaviour, Agency Costs and Capital Structure, *Journal of Financial Economics*, **3**, 305-360.

Kester, C.W. (1986) Capital and Ownership Structure: A Comparison of United States and Japanese manufacturing Corporations, *Financial Management*, 5-16.

Miller, M.H. (1977) Debt and Taxes, *Journal of Finance*, **32**(2), 261-275.

Modigliani, F. and Miller, M.H. (1958) The Cost of Capital, Corporate Finance, and the Theory of Investment, *American Economic Review*, 48, 261-297.

Modigliani, F. and Miller, M.H. (1963) Corporate Income Taxes and the Cost of Capital — A Correction, *American Economic Review*, **53**(3), 433-443.

Myers, S.C. (1984) The Capital Structure Puzzle, *Journal of Finance*, **34**(3), 575-592.

Myers, S.C. and Majluf, N.S. (1984) Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have, *Journal of Financial Economics*, **13,** 187-221.

Rajan, R.G. and Zingales, L. (1995) What Do We Know about Capital Structure? Some Evidence from International Data, *Journal of Finance*, **50**(5), 1421-60.

Remmers, L. Stonehill, A. Wright, R. and Beekhuisen, T. (1974) Industry and Size as Debt Ratio Determinants in Manufacturing Internationally, *Financial Management*, Summer, 24-32.

Scott, J. (1977) Bankruptcy, Secured Debt, and Optimal Capital Structure, *Journal of Finance*, **32**(1), 1-19.

Stiglitz, J.E. and Weiss, A. (1981) Credit Rationing in Markets with Imperfect Information, *American Economic Review*, **71**, 393-410.

Toy, N., Stonehill, A., Remmers, L., Wright, R. and Beekhuisen, T. (1974) A Comparative International Study of Growth, Profitability and Risk as Determinants of Corporate Debt Ratios in the Manufacturing Sector, *Journal of Financial and Quantitative Analysis*, 875-886.

Titman, S. and Wessels, R. (1988) The Determinants of Capital Structure Choice, *Journal of Finance*, **43**(1), 1-19.

Tuckey, J.W. (1962) The Future of Data Analysis, *Annals of Mathematical Statistics*, **33**, 1-67.

Van der Wijst, N. and Thurik, R. (1993) Determinants of Small Firm Debt Ratios: An Analysis of Retail Panel Data, *Small Business Economics*, **5**, 55-65.

Williamson, O., (1988) Corporate Finance and Corporate Governance, *Journal of Finance*, **43**(3), 567-591.

Table 1
Descriptive Statistics

Variable	Equation	Mean	Median	N
Book values				
Non-Equity Liabilities to Total Assets	1B	0.49	0.49	822
Debt to Total Assets	2B	0.18	0.17	822
Debt to Capital	3B	0.27	0.26	822
Adjusted Debt to Adjusted Capital	4B	0.13	0.17	822
Market values				
Non-Equity Liabilities to Total Assets	1M	0.42	0.40	822
Debt to Total Assets	2M	0.17	0.14	822
Debt to Capital	3M	0.24	0.20	822
Adjusted Debt to Adjusted Capital	4M	0.15	0.12	822
Explanatory variables				
Market-to-Book		1.47	1.33	822
Logsales		11.07	10.90	822
Profitability		0.16	0.16	822
Tangibility		0.35	0.33	822

The table displays mean and median values of gearing in the UK, as well as the mean and median values of the three year lagged explanatory variables. The various gearing measures are as defined in equations 1to 4 in the text, where the letter B refers to gearing measures based on book values of asset or capital values, while M refers to market value measures of gearing. Market-to-Book is our chosen proxy for growth opportunities; Logsales refers to the natural logarithm of sales (turnover); and Profitability to the ratio of earnings before interest, taxes and depreciation, to total assets, and Tangibility refers to the ratio of fixed to total assets.

Table 2
Cross-Sectional Analysis of Gearing in the UK, 1991

Model	Constant	Market-to-Book	Logsales	Profitability	Tangibility	Obs	Adj R^2	Fstat
1B	0.3994***	0.0356**	0.0169***	-0.5460***	-0.1811***	822	0.1318	32.17***
2B	0.1338***	-0.0031	0.0088***	-0.4014***	0.0575**	822	0.0822	19.39***
3B	0.1540***	0.0169	0.0197***	-0.7423***	-0.0086	822	0.1126	27.03***
4B	0.1673**	-0.0591**	0.0102*	-0.7896***	0.1787***	822	0.0906	21.44***
RZB		*-0.13***	*0.026***	*-0.34*	*0.41***	*522*	*0.18*[†]	
1M	0.6984***	-0.1148***	0.0014	-0.4942***	-0.1246***	822	0.2882	84.09***
2M	0.2586***	-0.0528***	0.0011	-0.3415***	0.0801***	822	0.1599	40.06***
3M	0.3910***	-0.0867***	0.0046	-0.5492***	0.0414	822	0.1881	48.54***
4M	0.3062***	-0.0801***	-0.0006	-0.5569***	0.1506***	822	0.1016	24.21***
RZM		*-0.06***	*0.01*	*-0.47***	*0.27***	*544*	*0.19*[†]	

*, **, and ***, significant at the 10, 5, and 1 % level, respectively. The gearing measures are as defined in equations 1B to 5M in the text, where B refers to book value measures of debt and M to market value measures of debt. Model 1 measures non-equity liabilities to total assets, model 2 the ratio of total debt to total assets, model 3 debt to capital, and model 4 to adjusted debt to adjusted capital. This is the gearing measure adopted by Rajan and Zingales (1995) in their analysis of capital structure in the G-7 economies, and their results are reported in the table for comparison as gearing measures RZB and RZM, with gearing measured at book and market value, respectively.

[†] As Rajan and Zingales compute censored Tobit regressions, they report corresponding pseudo-R squared values, which are thus not directly comparable with the R squared values we report from our OLS regressions. Notably, however, we obtain similar, and in many cases greater, pseudo-R squared values when performing censored Tobit regressions under our robustness checking procedure.

Table 3

Decomposed Debt Elements 1991

Variable	Mean	Median	N
Total Liabilities	0.4859	0.4851	822
of which:			
Total Loan Capital	0.0853	0.0593	822
of which:			
Bank Borrowing Repayable in more than 1 Year	0.0479	0.0046	822
Long-term Securitised Debt	0.0372	0.0100	822
Total Current Liabilities	0.4006	0.3869	822
of which:			
Total Trade Credit and Equivalent	0.3038	0.2906	822
Borrowing Repayable in less than 1 year	0.0966	0.0660	822
of which:			
Short-term Securitised Debt	0.0145	0.0045	822
Bank Borrowing Less than 1 Year	0.0815	0.0517	822

Note: All variables normalised by total assets

Table 4

Cross-Sectional Analysis of Decomposed Debt Elements in the UK, 1991

Dependent Variable	Constant	Market-to-Book	Logsales	Profitability	Tangibility	Obs	Adj R^2	F
TLIABS	0.3979***	0.0351***	0.0171***	-0.5448***	-0.1814***	822	0.1322	32.26***
Long term debt								
TLTD	-0.0724***	0.0010	0.0132***	-0.1703***	0.1063***	822	0.1294	31.49***
BBGT1	-0.0045	-0.0003	0.0041***	-0.0943***	0.0395***	822	0.0261	6.50***
LTSD	-0.0769***	0.0013	0.0091***	-0.0743***	0.0670***	822	0.1261	30.61***
Short term debt								
TCL	0.4703***	0.0342***	0.0039	-0.3745***	-0.2877***	822	0.1673	42.23***
TTCE	0.2656***	0.0377***	0.0082***	-0.1383**	-0.2400***	822	0.1576	39.37***
BRLT1	0.2041***	-0.0039	-0.0043**	-0.2310***	-0.0481***	822	0.0597	14.04***
STSD	0.0026	-0.0009	0.0014***	-0.0209*	0.0035	822	0.0109	3.27***
BBLT1	0.2052***	-0.0018	-0.0059***	-0.2230***	-0.0570***	822	0.0730	17.17***

*, ** and ***, significant at the 10, 5 and 1 percent level respectively. All dependent and independent variables are scaled by total assets. TLIABS refers to total liabilities, which is defined as the sum of total long-term debt and total current liabilities; TLTD refers to total long-term debt (repayable in more than one year); BBGT1 refers to bank borrowing repayable in more than one year; LTSD refers to long term securitised debt; TCL refers to total current liabilities; TTCE refers to total trade credit and equivalent; BRLT1 refers to borrowing repayable in less than one year; STSD refers to short term securitised debt, and BBLT1 refers to bank borrowing repayable in less than one year.

NOTES

[1]As this paper focuses upon definitional dependence, and in order to achieve maximum comparability with Rajan and Zingales, we report results based upon 1991 data. Our database does, however, extend until 1997. Analyses based upon more recent data confirm the high degree of definitional dependence in the determinants of gearing, although the level of some coefficients change over time. A discussion of the time series characteristics of gearing in the UK is beyond the scope of this paper, and is instead discussed in Bevan and Danbolt (1999).

[2] For example: Crutchley and Hanson (1989) find a significant positive correlation between company size and gearing; Remmers *et al.* (1974) find no size effect; Kester (1986) uncovers an insignificant negative effect, and Barclay *et al.* (1995) find that the correlation between size and gearing reverses polarity, dependent upon whether the estimation is a pooled OLS, or a fixed-effects panel regression.

[3] It should be noted that the positive correlation between gearing and tangibility is inconsistent with the tax-based hypothesis of DeAngelo and Masulis (1980). Based on their hypothesis, companies with high levels of depreciation would be expected to have low levels of debt. If the proportion of fixed to total assets (i.e., tangibility) provides a reasonable proxy for the availability of depreciation tax shields, DeAngelo and Masulis would expect a negative rather than a positive correlation between tangibility and gearing.

[4] See Tukey (1962) for details.

[5] A MTB ratio in excess of unity does not unequivocally indicate that a company has valuable growth opportunities, as the MTB ratio will also exceed unity if the company has invested in positive NPV projects. However, while MTB may not directly measure growth opportunities, it provides a good proxy. Barclay and Smith (1999) find the MTB variable to produce results very similar to those obtained with other proxies for growth opportunities in cross-sectional regressions of capital structure.

[6] In addition, it should be noted that we also find our results to be robust when utilising White standard errors and robust regression techniques based upon Cook's distance measure.

[7] As discussed in e.g., Barclay *et al.* (1995) and Barclay and Smith (1999), negative MTB coefficients with market value measures of gearing may be driven by the fact that the market value of the firm appears on both sides of the regressions (in the denominator of the gearing measure and in the numerator of the MTB ratio). However, although analysis of the correlation matrix reveal negative correlations between MTB and the market value gearing measures, these correlation coefficients (ranging from –0.2071 to –0.4354) are not sufficiently large to cause colinearity problems in the regressions. It should also be noted that negative correlations between MTB and gearing are also obtained for the book-value gearing measures (although substantially smaller, at –0.0131 to –0.2046). The negative MTB regression coefficients are thus robust.

[8] See section 5.2 below for details.

[9] This is discussed further in section 5 below.

[10] We acknowledge, however, that the reciprocal of tangibility will also, where applicable, include some intangible assets.

[11] As before, all regression elements, other than logsales, are normalised by total assets.