FINANCIAL PRESSURE AND BALANCE SHEET ADJUSTMENT

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Financial Pressure and Balance Sheet Adjustment by UK Firms*

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Abstract

This paper examines the financial policies and balance sheet adjustment of companies. Using a large panel of quoted UK firms, we estimate models for dividends, new equity issuance and investment, relating them to debt adjustment. The results suggest that while dividends are sticky in the short run, they are an important means of balance sheet adjustment in the long run. Other evidence supports the idea that companies actively target their balance sheet by variation in dividends, new equity issues and investment. There is evidence for financial pressure effects of debt-servicing costs on investment and dividends but not new equity issuance.

JEL Classification: G35, C23, E52.

Key Words: Financial pressure; dividends; equity issues; debt; investment; company panel data.

1 Introduction

Since Modigliani and Miller (1958), the role and importance of corporate financial policies has been the subject of widespread controversy. This reflects the variety of issues where corporate financial behaviour is relevant, including corporate tax policy, the possible role of the financial system in encouraging capital investment, the relationship between company debt and financial stability, and the impact of monetary policy on corporate spending.

The present study examines the empirical determinants of dividends, equity issuance and investment among UK firms. It considers how financial pressure affects companies and how companies adjust their balance sheets in the light of this. This is important in analysing the transmission of financial shocks throughout the economy. In particular, we consider how outcomes at the company-level–both financial and real–are related to the financial pressure of debt-servicing. An important focus of our analysis is on the relative importance of balance sheet adjustment via financial policies, notably dividend distributions and new equity issuance, compared to that occurring through real investment decisions. This extends the analysis of Nickell and Nicolitsas (1999) who consider how financial pressure affects a number of other firm-level outcomes, employment, wage growth and productivity, but do not consider financial policies nor fixed investment outcomes.

The paper is organised as follows. Section 2 describes the theoretical background to the paper, in terms of the resolution of balance sheet pressures by various means. Section 3 contains data description and estimation of models for the level of debt, the level of dividend payment, the propensity to issue new equity and rates of investment of a panel of 2,062 UK firms. Section 4 concludes.

2 Economic background: The resolution of balance sheet pressures

Whatever their motivation, all corporate financial decisions are bound together by the budget constraint linking the sources and uses of funds. For the tax-paying firm, this can be written in terms of its end-of -period net debt as:

$$B_{t+1} = B_t + P_t^I I_t + D_t - (1-\tau)(\Pi_t - r_t^B B_t) - N_t \tag{1}$$

where B is the stock of debt, τ is the corporate tax rate, P^I is the price of investment goods (net of tax allowances), I is the volume of gross capital investment, D is the dividend, Π is nominal profits, r^B is the interest rate paid on corporate debt, N is the value of new shares issued. This expression states that debt increases when outlays on investment and dividends are greater than post-tax profits and the proceeds from new share issues.

Collecting terms in the initial level of debt and dividing through by the beginning of period capital stock leads to the following expression for corporate gearing:

$$b_{t+1} = \frac{(1 + (1-\tau)r_t^B)}{(1+g)} b_t + d_t - n_t + i_t - (1-\tau)\pi_t \tag{2}$$

where lower case letters denote shares of the capital stock and g is its nominal growth rate. This difference equation is dynamically unstable when the post corporate tax interest rate $(1-\tau)r_t^B$ is greater than the growth rate, g.[1] In this case, either dividends d, new issues n, investment i, or profitability π, need to vary

[1] The interest rate is greater than the growth rate in a dynamically efficient economy. While tax deductibility may mean that $(1-\tau)r_t^B < g$ for tax-paying companies, this is unlikely to be the case for tax exhausted companies and those who face a significant premium on their borrowing costs.

sufficiently to prevent the debt stock and gearing b, rising or falling without limit. How these sources or uses of funds are actually used in balance sheet adjustment is the subject of this paper.

In principle, at least under frictionless markets, balance sheet adjustment would occur through the financial, rather than the real, decisions of firms. Firms already maximising profits should not be able to increase the rate of profit in response to balance sheet pressures. Moreover, in the absence of taxes, asymmetric information or agency problems, the Modigliani-Miller theorem would hold and the optimal investment rate would be independent of financing considerations. Under these conditions, the debt stock would need to be stabilised by changes in dividend payments or new share issues even though this would not affect overall company valuations. But, in practice, Nickell and Nicolitsas (1999) find significant effects of financial pressure on employment, wage growth and productivity and, by implication, profitability. While this paper focuses on the possible effects of financial pressure on dividend payments, new share issues and investment, some comparisons are made between the size of these effects and those estimated by Nickell and Nicolitsas (1999).

The process of balance sheet adjustment has been debated in both the finance and tax literatures. The finance literature (Fama and French, 2000; Shyam-Sunder and Myers, 1999) has contrasted the 'trade-off' with the 'pecking-order' models of capital structure. According to the trade-off model, companies have an optimal capital structure where they trade-off the tax benefits of increased indebtedness against possible costs associated with the greater risk of insolvency. These costs would include the direct costs of re-organisation in the event of insolvency as well as indirect costs that arise when companies get into financial difficulty (Barclay et al, 1995, Myers, 2001). But, according to the pecking order model of Myers and Majluf (1984) the theoretical benefits of achieving an optimum capital structure are second-order when compared to the effects of asymmetric information between insiders and outsiders in valuing companies. This leads to a situation where firms prefer internal to external finance and, when external finance is needed, prefer debt to equity. According to this pecking order approach, "each firm's debt ratio... reflects its cumulative requirement for external financing" (Myers, 2001). In effect, the pecking-order predicts that corporate gearing should show no tendency to revert to an equilibrium level. This is in direct contrast to the trade-off model where, by (2), any desired capital structure would need to be brought about by varying one of the variables on the right hand side. Under either of these views, capital investment could be affected by financial considerations. With the trade-off model, investment *could* be lower than otherwise when a company is attempting to reduce debt to its optimal level (investment need not be affected since the adjustment could be made by raising new equity). With the pecking order model, investment is lower than otherwise when external finance is needed to fund it, reflecting a higher cost of capital.

The tax literature has contrasted the 'new view' of dividend taxation developed by Auerbach (1979) and King (1977) and reviewed by Auerbach (2001), which claims that dividend taxation has no effect on corporate investment decisions, with the 'traditional view' that dividend taxation imposes an additional tax wedge on corporate investment. A critical prediction of the new view, according to Auerbach and Hassett (2000) is that firms obtain their equity funds for investment through the retention of earnings, and distribute residual funds as dividends, rather than using new equity as the marginal source of finance as in the traditional view. This implies that dividends respond positively to cash flow and vary inversely with the rate of investment. Auerbach and Hassett (2000) go on to suggest that dividends might be sticky in the short-term, with short-term borrowing adjusting to meet financing needs, but moving in the longer term to achieve an optimal debt-equity ratio.

These different views of corporate finance and its relationship to capital investment have a number of different empirical implications. First, the trade-off model predicts that corporate gearing varies over time to achieve a target level, suggesting that gearing will be mean-reverting provided that the target itself is not changing randomly over time. Second, in this model the target level of gearing will tend to be higher for more profitable firms reflecting lower expected insolvency costs and for firms with few other tax shields which may be associated with investment levels (DeAngelo and Masulis, 1980). Third, both the new view and the trade-off model predict that dividends would vary to bring about a desired capital structure, implying a relationship between dividends and the level of indebtedness. Furthermore, the pecking order and new view tax model imply that dividends respond positively to cash flow and negatively to rates of investment (Auerbach and Hassett, 2000). Fourth, under both pecking order and new view models, new equity finance is seen as a last resort. This implies an inverse relationship between cash flow and the propensity to issue new equity. Fifth, the models also imply a positive relation between equity issuance and investment. The notion that companies use equity issuance to adjust their balance sheet in response to high levels of gearing also implies that the propensity to issue equity responds positively to high levels of gearing. Sixth, the Modigliani-Miller model predicts that capital investment is unaffected by financial factors, while the pecking-order model and the new view predict that investment is lower than otherwise when external finance is used to fund it. These various empirical predictions are considered for the UK in the next section.

The above discussion summarises some of the theoretical influences on corporate financial and investment decisions and how they relate to balance sheet adjustment. Our contribution is not to test between the different models but to quantify the scale of the various effects, focusing on the implications for balance sheet adjustment.

3 Estimation and Results

3.1 Data Description

The data employed are derived from company accounts records held on Datastream, the on-line service covering all companies quoted on the London Stock Exchange (LSE). The data refer to non-financial companies over the period 1973 to 1998. We select on a minimum number of four time-series observations per company. The resulting total number of companies for which data on all variables (with the exception of equity issuance) are available is 2,062. The number of company-year observations is 22,095.

Table 1 presents summary statistics on the key variables during different sub-periods. The first eight rows refer to the dependent variables in our various models, for dividends, investment, debt (gearing, either scaled by the replacement cost of capital stock, B/K, or by market capitalisation, B/MV) and new equity issuance. The proportion of companies issuing new equity considers whether this is issued solely for cash or also in an acquisition and for two different threshold amounts. For the new equity issuance (binary) outcomes, as well as any positive outcome we also consider a threshold of two per cent of market capitalisation being issued as new equity. Companies may issue some equity for reasons other than to finance investment (eg. as part of their remuneration policies). The two per cent threshold was employed by Auerbach and Hassett (2000) for this reason. The remaining rows of Table 1 describe the data for the further explanatory variables used in our analysis. These variables refer to cash flow (CF/K), the borrowing ratio term (br) defined as the ratio of interest payments to profits favoured by Nickell and Nicolitsas (1999) as a measure of financial pressure, Tobin's Q (Q) as a measure of investment opportunities facing the firm, real sales (S/P) and sales relative to capital stock (S/K).

Over the period, the mean ratio of dividends to sales is 0.020, with this company-level mean increasing during the sample period from 0.014 in 1973-78 to 0.031 in the 1994-98 period; clearly there is also a great deal of variation across companies.[2] Around 37 per cent of company-year observations involve equity issuance, having increased from 22 per cent during 1973-78 to 48 per cent in 1989-91 and exceeded 50 per cent in the 1984-88 period. The 2 per cent issuance threshold applies to 15 per cent of observations over the period. We also report figures for equity issuance

[2] Further data analysis of the distribution of dividend payments relative to company sales and company profits and how these distributions vary over time, is provided in Benito and Young (2001).

for cash.[3]

The mean of the borrowing ratio, br, increases in the early 1980s and early 1990s reflecting joint variation in the level of interest rates, debt and corporate profits. Again, there is a large amount of variation across companies in this variable as the standard deviation exceeds the mean in each period. Q averages 1.77 during the period, increasing during the later periods; its distribution is positively skewed, the median value being 1.04. High average values at the end of the period may reflect an increase in the number of service sector companies whose value depends on intangible capital. It is also worth noting that we measure Q at the end of the calendar year in question whereas some other authors (Blundell et al, 1992) measure it at the beginning of the accounting year.

Table 2 considers financial 'regimes' of companies in a particular year in the form of whether a company pays a dividend and/or issues equity. Annual averages for the different sub-periods are shown again separately for the any issuance and 2 per cent threshold definitions for both all equity issued and equity issued for cash. Using the 2 per cent issuance thresholds, the overwhelming majority of firms (around 80 per cent) are in the dividend payment, no equity issuance category. There has been an increase in the proportion of firms issuing equity (see also Table 1) and this has occurred amongst firms that also pay a dividend. In order to economise on the fixed costs of issuance, companies should prefer to issue larger amounts of equity (itself favouring larger companies) rather than repeatedly paying a dividend and issuing equity in the same year. Table 3 considers the number of years that our 1,847

[3] This might appear to be a cleaner measure of the raising of funds for investment purposes but since our measure of investment includes merger and acquisition activity, the case for excluding equity issued for acquisition is not unambiguous.

companies on which we have share issuance data (or 1,751 companies in the case of issuance for cash) both pay a dividend and issue 2 per cent equity in the same year. The figures support the proposition that this is not a financial activity undertaken repeatedly by the same companies. Bond and Meghir (1994) suggest the occurrence of joint dividend payment and new share issuance may also reflect the existence of transaction costs for trading equity and a signalling role for dividends. Around 2 per cent of firms neither pay a dividend nor issue (2 per cent) new equity. Less than 1 per cent of companies omit a dividend but issue new equity. (Table 2).

3.2 Estimation results

Our empirical strategy is to examine the behaviour of the level of dividends, investment and the use of new equity finance as functions of company financial characteristics. Of key importance is the possible response of each of these to balance sheet pressures as represented by measures of indebtedness or its servicing cost. As such, the determinants of indebtedness are not modelled directly, instead they can be recovered from the budget constraint, as represented by (2) and the estimated behavioural relationships. The behavioural relationships that are estimated for dividends and investment are as follows:

$$\frac{D}{S}_{it} = \alpha_i + \alpha_1 \frac{D}{S}_{it-1} + \alpha_2 \frac{CF}{K}_{it-1} + \alpha_3 br_{it-1} + \alpha_4 \frac{I}{K}_{it-1} + \alpha_5 Q_{it-1} + \alpha_6 \frac{B}{K}_{it-1} + \alpha_7 \ln(S/P)_{it-1} + \gamma_t^D + \varepsilon_{it}^D \quad (3)$$

$$\frac{I}{K}_{it} = \beta_i + \beta_1 \frac{I}{K}_{it-1} + \beta_2 Q_{it} + \beta_3 Q_{it-1} + \beta_4 \frac{S}{K}_{it} + \beta_4 \frac{S}{K}_{it-1} + \beta_5 \frac{CF}{K}_{it} + \beta_6 \frac{CF}{K}_{it-1} + \beta_7 br_{it} + \beta_8 br_{it-1} + \gamma_t^I + \varepsilon_{it}^I \quad (4)$$

where the variable definitions follow those given above. α_i and β_i are the company-specific fixed effects that control for time-invariant unobservables in the dividends and investment equations, respectively. γ_t^D and γ_t^I denote common time effects in the two equations with assumed serially uncorrelated error terms ε_{it}^D and ε_{it}^I.

The specification for dividends, normalised on the cash value of company sales following Bond et al (1996), encapsulates the salient features of the models referred to in the previous section. This specification allows dividends to respond to cash flow and investment with a possible role for debt. We also include investment opportunities proxied by a Tobin's Q variable reflecting the demand for funds and the log of real sales as a control variable for scale of the company capturing any agency considerations or the volatility of cash flows. All right hand side variables are lagged to reduce possible endogeneity. Our specification for investment is based on that of Blundell et al (1992) supplemented by the financial pressure variable, br.[4] All variables are included contemporaneously and with one lag. Both dividend and investment equations allow for persistence through the inclusion of lagged depen-

[4] Recent investigations concerning the role of Q have highlighted the importance of measurement error in Q and associated attenuation bias (Bond and Cummins, 2000; Erickson and Whited, 2000). To consider this point is beyond the scope of this paper.

dent variables. In the case of dividends, the persistence estimate, α_1, is of special interest following Lintner's (1956) suggestion that companies are averse to cutting the dividend, attempting to maintain it at a sustainable level. This would tend to retard balance sheet adjustment through dividends.

For both equations we estimate dynamic fixed effects models using the GMM-System estimator proposed by Arellano and Bover (1995) and examined in detail by Blundell and Bond (1998).[5] This estimator is an extension of the GMM estimator of Arellano and Bond (1991) and estimates equations in levels as well as in first-differences. Where there is persistence in the data such that the lagged levels of a variable are not highly correlated with the first difference, also estimating the levels equations with a lagged difference term as an instrument can counter the bias associated with weak instruments (see Blundell and Bond, 1998). The system GMM estimator is a combination of the GMM differenced estimator and a GMM levels estimator. Several variables display high levels of serial correlation. The estimation method requires that there be evidence of significant negative first order serial correlation in differenced residuals and no evidence of second order serial correlation in the first differenced residuals. Blundell, Bond and Windmeijer (2000) report Monte-Carlo evidence showing that when this method is used the Sargan test of the overidentifying restrictions tends to over-reject, especially when the number of observations per company is large.

For the new equity issuance decision, since the outcome we model is binary, panel data probit models are estimated that incorporate a random effects term for the company-specific unobservables (see Arulampalam, 1999 for discussion). The

[5] Our analysis therefore relaxes the assumptions of Fama and French (2000) and Shyam-Sunder and Myers (1999) that the regressors are strictly exogenous.

specifications use the same explanatory variables as in the dividends equation except that all variables are included contemporaneously.

These outcomes describe the possible mechanisms by which balance sheets are adjusted. To verify that such adjustment occurs in practice, we estimate the speed of debt adjustment in the reduced form, estimating a debt equation as a function of its lagged value whilst also controlling for firm fixed effects and time effects.

3.2.1 Debt adjustment

We report results for a net rather than gross debt measure, $(B - C)$, although this does not make much difference to the results. This is scaled by either market capitalisation (MV) or replacement cost capital stock (K) in the results reported in Table 4. The time effects control for the tax changes common across companies, whilst the existence of company-specific target debt levels would be controlled for through the fixed effects.

In all specifications, there is no evidence of second-order serial correlation in the first-differenced residuals, the key requirement for our estimation strategy to be valid. Nevertheless, the results using instruments dated from $t-2$ in the differenced equation and at $t-1$ in the levels equation are associated with significant values for the Sargan test statistic. We therefore move to using deeper lags starting at $t-3$ in the differenced equation and $t-2$ in the levels equation in columns 2 and 4. Under these estimates, the Sargan test statistic falls short of significance at the 10 per cent level for the capital gearing measure and we focus on these results.

The results indicate that the speed of adjustment of the level of debt is around 30 to 35 per cent per year, substantially faster than the rate of 7 to17 per cent per annum estimated in the US and described as "suspiciously slow" by Fama and French (2000, p30). This indicates that companies actively adjust their balance sheets to prevent levels of debt becoming excessive. The remainder of the paper considers methods by which this adjustment may be achieved.

3.2.2 Dividends

Results for dividends are shown in Table 5. Support for the main predictions from the previous discussion is obtained. Dividends respond positively to cash flow, and negatively to levels of investment. These terms are highly significant, with t-statistics (robust to heteroskedasticity) in excess of four. A further key feature of the results is the degree of persistence in dividends. At 0.829 (0.129), the coefficient (robust standard error) on the lagged dependent variable reveals a high level of persistence indicating that companies are slow to adjust their balance sheets through dividends.

The indebtedness term, B/K, is significantly negative. A high level of indebtedness restricts the amount companies tend to distribute to shareholders.[6] This is one of the channels by which the balance sheet is brought under control. The dependence of dividends on the level of gearing partially offsets the effect of interest payments in the debt accumulation process shown in (2).[7]

The Q term is signed positively, although not significantly, and this may reflect

[6] In the results reported, we employ a gross debt variable and control for cash flow separately. Using the net debt variable, ((B-C)/K) in a specification otherwise equivalent to that in column 1 is associated with similar results with the debt term again being significant but the cash flow term (CF/K) loses significance.

[7] When re-normalised on the capital stock, the coefficient on gearing is -0.03 in the long run solution to the dividends equation.

the fact that Q will in part pick up current profitability rather than purely opportunities for investment. Companies with a high value for Q may also feel more confident about paying a higher dividend.

The scale term falls short of significance. This is likely to be because, in a fixed effects model, it is the time-series variation that is being exploited; following an increase in sales a given company may not reduce its dividend distributions in the same way as a comparison between a small and large firm might imply.[8] In column 2 we drop instruments dated $t-2$ in the differenced equation and instruments dated $t-1$ in the levels equation; the main results described above remain intact.

In column 3 we consider the financial pressure variable br, (the ratio of interest payments to profits) added to our previous regressor set. This is Nickell and Nicolitsas's (1999) preferred measure of financial pressure facing a company. The analysis of Nickell and Nicolitsas (1999) looking at real outcomes such as employment, as well as Fazzari et al's (1988) analysis of investment, is predicated on the notion that balance sheet adjustment through purely financial outcomes such as dividends or external finance is imperfect and some adjustment is necessary through real decisions of the firm such as investment and employment.

In the context of dividends the results suggest that a role for the borrowing ratio term depends upon the precise specification employed. In particular when included alongside the cash flow and debt terms, the borrowing ratio is not significant. This is not entirely surprising since the 'br' variable can be thought of as (rB/π) where r is the effective rate of interest, B is the amount of debt and π is profits which is

[8] In support of this, a pooled cross-sectional model, ie omitting the fixed effects, results in a significantly positive coefficient on the lagged sales term (coefficient (robust standard error) of 0.000251 (0.000094)).

closely related to cash flow. Including the term alongside controls for cash flow and debt is therefore asking rather a lot. It might seem preferable to consider a role for the variable in place of the cash flow (CF/K) and debt (B/K) terms. This is done in column 4 and the borrowing ratio variable is now on the margins of significance with a 't-ratio' of 1.85. This specification also omits the Q term since we believe that in part picks up current profitability.

The impact of financial pressure can be quantified using the same experiment as Nickell and Nicolitsas (1999) by considering the impact on individual companies of an increase in interest rates from 5 to 8 per cent.[9] Under the assumption of no fixed rate debt, this implies an increase in br of 60 per cent. Evaluated at the means ($\overline{br} = 0.21$; $(\overline{D/S}) = 0.021$), the estimates imply a reduction in dividends of 3.1 per cent in the short-run and by 18.0 per cent in the long-run, but given the high degree of persistence this takes a long time to come through. Recall that such effects are quantitatively smaller and statistically insignificant when we control for cash flow. For the same increase in financial pressure, Nickell and Nicolitsas (1999) estimate a short-run (long-run) effect of 2.9 per cent (10 per cent) on employment; 2.3 per cent (2.5 per cent) on wages and a very small positive effect on productivity of 0.5 per cent in the long-run. Balance sheet adjustment by dividends is therefore quantitatively important but slow-acting.

Nevertheless, the fact that the financial pressure variable, br, is insignificant when included alongside the cash flow and debt terms tells us something about the best way to proxy financial pressure in this context. If we think of these specifica-

[9] Since such a change would have significant general equilibrium effects, this partial experiment is best considered as a change in 'financial pressure' for an individual company equivalent to a change in interest rates of this amount.

tions as asking the data to 'fight it out' statistically as to which factor related to financial pressure matters most, the results favour cash flow and debt rather than the ratio of debt-servicing payments to profits.

In sum, although we can isolate a significant effect from the borrowing ratio term, br, depressing levels of dividends, this requires the omission of the cash flow and indebtedness terms. Where these terms are included jointly, the borrowing ratio term loses its significance, whilst the cash flow and debt terms remain significant. The cash flow and underlying indebtedness variables appear to do a sufficient job of picking up any role for financial pressure type effects.

Within this preferred specification (column 2 of Table 5), dividends can be thought of as adjusting gearing to a target level. This target level can be derived from the estimated equation and depends positively on cash flow and negatively on investment.[10] The negative influence of investment on target gearing comes about because this generates an alternative tax shield to debt and so reduces the attractiveness of higher gearing under the new view and trade-off models. Under the pecking order model, there is no well-defined target level. But an inverse relation between gearing (or its long-run solution) and investment could come about under a more complex version of this model if firms are concerned with both current and future financing costs and higher investment levels encourage firms to maintain debt capacity rather than forego future investments or using costly equity to finance them. The positive effect of cash flow on target gearing reflects the lower probability

[10] The dividend equation can be written explicitly as a means of debt adjustment $d_t = \lambda_0 d_{t-1} + \lambda_1 (b_{t-1} - b^*_{t-1})$ and variables other than dividends and debt interpreted as driving the target gearing level, b^*.

and expected cost of insolvency under the trade-off approach. It is not consistent with the pecking order model, where higher profitability reduces gearing.

3.2.3 New Equity Issues

Under the pecking order model, companies are generally averse to new equity finance because of information asymmetries, using it when investment is high relative to cash flow. Under the new view, incentives to issue equity are dependent on taxes. In the UK, at least until 1997, the tax system encouraged new equity issues (Benito and Young, 2001), although this may have been offset by transactions costs, which are likely to be larger for smaller firms. Under the trade-off model, new equity issues would be more likely when gearing is above its target level. Taking these views into account would suggest that new equity issues are used when investment is strong relative to cash flow and when gearing is high, with possible effects depending on firm size.

Carpenter and Petersen (2002) emphasise that the literature examining the financing and investment decisions has tended to focus on debt finance with the role of new equity finance being largely neglected. They present descriptive statistics of a set of US (technology-based) firms. Our analysis of the propensity for firms to issue new equity can be motivated by similar concerns but adopts a more formal approach. Table 6 presents results for the estimation of random effects probit models for share issuance. Again, we consider the propensity to issue new equity finance as a function of cash flow (CF/K), investment (I/K), Tobin's Q (Q) as a proxy for investment opportunities, and debt (B/K). We also include a control for scale (log real sales, S/P). A role for the financial pressure variable (br) is also considered.

Note that data on new equity issues are available for a slightly restricted period, so our sample periods are restricted accordingly.

A key result is that the cash flow term (CF/K) is highly significant and negatively signed. As predicted by the pecking order and new view models, companies with high levels of cash flow are less likely to resort to equity issues to finance investment since the availability of internal funds reduces their need to resort to external equity finance. The likelihood of using new equity finance increases significantly in the level of debt (B/K) and rate of investment (I/K) of the firm. The former is consistent with the notion that companies have a target gearing level, with equity issuance being one response to excessive levels of debt. The positive relation between propensity to issue equity and rate of investment is as expected, reflecting the fact that equity finance will tend to be used more by those companies with substantial investment programmes.

The results also suggest that larger firms are more likely to use equity finance than smaller firms controlling for these other financial characteristics and this may reflect fixed costs of issuance. The Q term is also highly significant and suggests that firms with higher investment opportunities are more likely to use new equity finance. It could also be that managers of high Q firms think that the shares are over-valued and are issuing more to benefit the existing shareholders. Note also that the estimate of the parameter ρ, which reflects the proportion of the total variance accounted for by the unobserved heterogeneity term, is approximately 0.22 (in the 2 per cent issuance threshold model) and is well-determined.

In the equation that considers any equity issued as the dependent variable, the debt term (B/K) is insignificant. Redefining the dependent variable to equity issuance of 2 per cent of market capitalisation alters this result, with the results indicating that in this case, a high level of debt increases the probability of equity issuance. With the exception of this result for the debt term, the other results are not sensitive to specifying the dependent variable using a zero versus 2 per cent threshold for equity issues.

The addition of the financial pressure variable, br, indicates that this is not significant. Instead, equity issuance responds as anticipated to the underlying indebtedness of the company (B/K) and its cash flow (CF/K), rather than a term reflecting the flow of interest payments on debt relative to profits. This suggests equity issues are related to more fundamental aspects of indebtedness rather than the short-term financial pressure associated with its servicing. This is consistent with the notion that equity issues are used for more 'low frequency' movements in the target debt-equity ratio with companies perhaps using short-term borrowing to smooth variations in its debt-equity ratio at higher frequencies.

It is clear from Table 6 that the results for equity issuance for cash are very similar to those reported above for cash and acquisition-related issuance. Each of the coefficients attracts the same sign and similar level of significance.

How important, quantitatively, is each variable? Table 7 presents the marginal effects, evaluated at the means. These effects indicate the change in the probability of observing an equity issue for a 1-unit change in the explanatory variable holding constant the other factors, evaluated at the means. These calculations employ the correction recommended by Arulampalam (1999) for the normalisation in the coefficient estimates present in random effects probit models. The use of the 2 per cent issuance threshold reduces the quantitative importance of each variable (with the exception of the debt term, B/K). The marginal effects indicate that a 10 percentage point increase in cash flow, lowers the probability of issuing equity by 0.02 (-0.171/10). Recall that the mean company cash flow is 0.26 and the mean proportion of companies issuing equity is 0.37 with the proportion issuing equity to the value of 2 per cent of market capitalisation or more being 0.15. A change in the probability of this order is by no means small. The probability of equity issuance is more sensitive to investment. A 10 percentage point increase in investment raises the probability of new equity issuance by 0.04 under both the zero and 2 per cent issuance threshold results. The marginal effect for Q indicates that an increase in Q of 0.1 (the mean value being 1.70) increases the probability of equity issuance by 0.003. The model for a 2 per cent threshold for equity issuance indicated a significant relation between the propensity to issue equity and the amount of debt. Under these estimates an increase in debt of 10 percentage points is associated with an increase in the probability of 0.004.

3.2.4 Investment

The paper thus far has concentrated on the financial policies of UK firms. We now consider the real side of the balance sheet in the form of levels of investment. This follows a large number of previous studies (see Hubbard, 1998, for a review). Our contribution in presenting these results is first, to present these models in the context of the wider financing decisions of UK corporates estimated above and second, to consider the potential role of the financial pressure variable, br, in a UK firm-level study of fixed investment for the first time.

We begin our results with estimates for a basic Q model without financial variables, presented in column 1 of Table 8. The results accord with our priors. Investment responds positively to the value of Q at the beginning of period (dated $t-1$) with a t-value of 5.7. As in Blundell et al (1992) there is a significantly negative coefficient on the contemporaneous sales to capital ratio, (S/K) and positive coefficient on the lagged value. Columns 2 to 5 are again conservative in their definition of the instruments selecting these from $t-3$ in the difference equation and $t-2$ in the levels equation, though this does not materially affect our results, the standard errors on some terms increasing slightly.[11]

Column 3 adds cash flow terms and we find a significantly positive effect, supporting models where internally generated funds are the cheapest source of finance to the firm.[12] While this is consistent with the financial constraints literature, the

[11] Here, the Sargan test typically returns a value in excess of the standard critical value, although the M_2 statistic indicates the key condition for the validity of this method holds. We use conservative definitions of the instruments to help counter the possibility of invalid instruments. As we note above, Blundell et al (2000) report that the Sargan test over-rejects when the data are persistent and the number of time series observations is large.

[12] Several studies have considered whether these cash flow effects are greater for certain types of firms which are more likely to be financially constrained (eg. Bond and Meghir, 1994). We therefore interacted the cash flow terms with indicators for dividend omission, omission but former dividend payment and smaller scale (in the bottom quartile of the sales distribution). Considered alternately, these terms (contemporaneous and lagged) were individually and jointly insignificant. Recently, debate has focused on whether these indicators instead proxy the types of firms for which market information and the Tobin's Q variable is likely to be more imperfect such that cash flow effects may proxy investment opportunities (eg. Alti, 2001). For this reason and given the insignificance of such interaction terms, we do not

importance of cash flow could reflect other factors. For example if current cash flow is correlated with future profitability it could simply reflect an improvement in prospects. The inclusion of cash flow terms lowers the significance of the lagged Q, suggesting perhaps that both serve as indicators of future prospects. In column 4 the borrowing ratio term is considered as a financial variable (omitting the cash flow term) with the terms being significant and negatively signed. This suggests that the financial pressure of debt servicing plays an important role in influencing investment levels of firms. This extends the results of Nickell and Nicolitsas (1999) who consider a role for this variable in the employment, wage growth and productivity levels of UK firms. Real outcomes at the firm-level respond to the financial pressure effects whilst above we found that purely financial variables such as dividends and equity issuance were not responsive to this variable, instead being affected by longer-term notions of indebtedness of the firm. Moreover, adding the cash flow terms in column 5, the borrowing ratio variable remains significant, the lagged variable having a 't-ratio' of -3.40, with the cash flow terms also being significant. This provides strong evidence in favour of a financial pressure effect on investment at the company-level, at least in the short-term and is another of our key results.

The addition of a debt term, when controlling for cash flow does not improve on this model in column 5. The debt term, B/K, in such a specification falls short of significance when entered in place of the borrowing ratio term, with a t-ratio on the B/K_{it} term of -1.27.

discuss these results in detail.

The results for a change in investment associated with a given change in financial pressure may again be derived and compared to those of Nickell and Nicolitsas (1999) for other company outcomes. For a change in financial pressure equivalent to a permanent increase in the interest rate from 5 to 8 per cent, the estimates in column 4 imply a 5.7 per cent reduction in investment in the short-run and 13.5 per cent reduction in the long-run. Under the estimates in column 5 (controlling for cash-flow) the results imply a 2.3 per cent short-run and 11.4 per cent long-run effect, evaluated at the means. This compares to the short-run (long-run) impact on dividends of 3.1 (18.0) per cent, when not controlling for cash flow (the effect being insignificant when controlling for cash-flow). Nickell and Nicolitsas (1999) found an impact on employment of 2.9 per cent in the short-run and 10 per cent in the long-run, with smaller offsetting on wages and productivity.

4 Conclusions

This paper has examined methods of balance sheet adjustment of UK firms and the forces to which such adjustments respond. A special emphasis has been placed on adjustment in response to financial pressure. In this context, we have considered debt adjustment, levels of dividend payment, the propensity to issue new equity and rates of investment using company-level data.

The analysis has produced novel results in several respects. First, our analysis of dividends identifies a number of influences. Dividends respond positively to cash flows and negatively to rates of investment for UK firms, in a manner consistent with the new view approach (Auerbach, 2001) and pecking order models. The new view model of taxation and corporate finance which bases a hierarchy of funds on tax discrimination has important implications for the design of tax policy. Dividends are also negatively influenced by the level of indebtedness of the company. This result highlights the use of dividends as an adjustment mechanism to maintain gearing on a sustainable path.

Second, we find large persistence effects in levels of dividends, with coefficients on the lagged dependent variable in our models in excess of 0.8. Companies are slow to adjust their balance sheets through their dividend payment. Thus, in response to some financial shock companies will use other means in the short-term to adjust their balance sheets in addition to that through the level of dividend distributed to shareholders.

This analysis of the role of dividend adjustment is important for wider reasons. A large literature has developed examining how investment is affected by cash flow in a manner consistent with financial constraints (eg. Fazzari et al (1988)). This literature, and its macroeconomic analogue, that of the financial accelerator (eg Bernanke et al, 1996), has neglected the potential role of dividend adjustment in such a process. The emphasis instead has been on the notion that companies will need to resort to external finance which, if available only at a cost premium over internal funds, will imply that companies will forego investment opportunities following a shock to cash flow. Since dividend adjustment potentially offers an alternative means of making such funds available, our analysis has attempted to make clear this potential role whilst also illustrating why in practice they may not be adjusted immediately in response to such pressures. That is, the high degree of persistence in dividend payments that we find may reflect large adjustment costs perhaps associated with a signalling role for dividends. This then makes other forms of adjustment, such as external finance and/or deferred real investment levels preferable to the firms involved.

Third, we have considered external finance through the propensity for companies to issue additional equity. We have shown that companies do not generally pay a dividend and issue new equity in the same year, or at least not on an ongoing basis. Further, companies with low levels of cash flow, high levels of debt and in particular, high levels of investment are more likely to issue equity. Our analysis of each of these outcomes, dividends, equity issuance and investment has considered the role of the financial burden of debt-servicing. We thereby extend the analysis of Nickell and Nicolitsas (1999) of how financial pressure affects companies. In this context, our results for the different outcomes produced an interesting contrast. Evidence was found to support the notion that debt-servicing costs affect the real outcome of investment whereas we were unable to isolate a significant effect of this financial pressure variable on the level of dividend (when controlling for cash flow) or the propensity to issue equity. These latter outcomes instead respond more clearly to cash flow and longer-term measures of indebtedness of the firm.

Table 1: Summary statistics

		1973-78	1979-83	1984-88	1989-93	1994-98
(D/S)	Dividends	0.014 (0.015)	0.016 (0.021)	0.020 (0.031)	0.026 (0.022)	0.031 (0.034)
(I/K)	Investment	0.155 (0.159)	0.142 (0.160)	0.201 (0.235)	0.186 (0.226)	0.164 (0.187)
(B/K)	Gearing	0.141 (0.234)	0.110 (0.173)	0.152 (0.299)	0.197 (0.317)	0.237 (0.602)
(B/MV)	Gearing	0.425 (1.749)	0.360 (2.737)	0.184 (1.431)	0.204 (0.898)	0.214 (1.440)
(N/MV) > 0	New Equity	0.220	0.304	0.523	0.637	n.a.
(N/MV) ≥ 0.02	New Equity	0.125	0.123	0.205	0.201	n.a.
(N_c/MV) > 0	Issuance for cash	n.a.	0.231	0.394	0.614	0.720
(N_c/MV) ≥ 0.02	Issuance for cash	n.a.	0.061	0.087	0.128	0.103
(CF/K)	Cash flow	0.236 (0.184)	0.178 (0.157)	0.290 (0.292)	0.302 (0.287)	0.327 (0.310)
br	Borrowing ratio	0.167 (0.192)	0.272 (0.301)	0.197 (0.227)	0.249 (0.274)	0.160 (0.194)
Q	Tobin's Q	0.870 (0.968)	1.011 (1.433)	2.160 (2.518)	2.168 (2.252)	2.835 (3.089)
(S/K)	Sales/capital	3.846 (5.812)	3.321 (3.630)	3.723 (3.982)	3.830 (4.910)	4.195 (6.196)
S	Sales	269.4 (1164.3)	330.6 (1588.0)	437.1 (2009.1)	467.0 (1826.3)	495.5 (1836.3)
Observations		6162	4653	3955	3880	3445

Note: Means and standard deviations (in parentheses, where applicable). Equity issuance, N, data end in 1991. Equity issuance for cash, N_c, is only available from 1981. The variables (N/MV) > p indicate the proportion of company-year observations with equity issuance greater than p. See Data Appendix for variable definitions.

Table 2: Dividend Payment and New Equity

	1973-78	1979-83	1984-88	1989-93	1994-98
For cash and acquisition					
Any issuance					
D=1 & N=0	0.763	0.677	0.460	0.343	n.a.
D=0 & N=0	0.017	0.019	0.017	0.020	n.a.
D=1 & N=1	0.217	0.301	0.516	0.628	n.a.
D=0 & N=1	0.003	0.003	0.007	0.009	n.a.
2 per cent issuance					
D=1 & N=0	0.857	0.856	0.776	0.776	n.a.
D=0 & N=0	0.018	0.020	0.019	0.024	n.a.
D=1 & N=1	0.124	0.122	0.200	0.195	n.a.
D=0 & N=1	0.001	0.002	0.004	0.006	n.a.
For Cash					
Any issuance					
D=1 & N=0	n.a.	0.745	0.588	0.358	0.267
D=0 & N=0	n.a.	0.024	0.019	0.027	0.013
D=1 & N=1	n.a.	0.229	0.389	0.605	0.711
D=0 & N=1	n.a.	0.002	0.005	0.009	0.009
2 per cent issuance					
D=1 & N=0	n.a.	0.914	0.892	0.839	0.878
D=0 & N=0	n.a.	0.025	0.020	0.032	0.019
D=1 & N=1	n.a.	0.060	0.084	0.124	0.101
D=0 & N=1	n.a.	0.002	0.003	0.004	0.003

Note: D refers to a dividend payment; N is new equity for cash or acquisition (any issuance or to the value of 2 per cent of market capitalisation); N_c is new equity for cash.

Table 3: New Equity Issues and Dividend Payments

No of years a company pays a dividend and issues 2% equity in the same year.	Issuance for cash or acquisition		Issuance for cash	
	Number	per cent	Number	per cent
0	791	42.8	1,014	57.9
1	459	24.9	398	22.7
2	223	12.1	204	11.7
3	139	7.5	75	4.3
4	95	5.1	38	2.2
5	59	3.2	15	0.9
6	36	2.0	5	0.3
7	21	1.1	2	0.1
8	15	0.8	0	0.0
9 to 12	9	0.5	0	0.0
	1,847	100.0	1,751	100.0

Table 4: Debt adjustment

	[1]	[2]	[3]	[4]
	(B-C)/MV		(B-C)/K	
(B-C)/MV$_{it-1}$	0.612 (0.135)	0.641 (0.098)		
(B-C)/K$_{it-1}$			0.610 (0.091)	0.727 (0.059)
Year effects	yes	yes	yes	yes
Sargan Test (p-value)	0.00	0.00	0.00	0.11
Instruments	t-2..t-5; Δt-1	t-3..t-5; Δt-2	t-2..t-5; Δt-1	t-3..t-5; Δt-2
M$_1$	-1.94; p=0.00	-2.21; p=0.00	-5.76; p=0.00	-6.33; p=0.00
M$_2$	0.72; p=0.47	0.70; p=0.49	1.24; p=0.21	1.22; p=0.23
Firms	2,062	2,062	2,062	2,062
Observations	22,033	22,033	22,033	22,033

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M$_j$ is a test of jth order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1). Asymptotic robust standard errors reported in parentheses. In columns 1 and 3 instruments are (B-C)/MV$_{it-2}$ to (B-C)/MV$_{it-5}$ in the differenced equations and Δ(B-C)/MV$_{it-1}$ in the levels equation. In columns 2 and 4 instruments are (B-C)/MV$_{it-3}$ to (B-C)/MV$_{it-5}$ in the differenced equations and Δ(B-C)/MV$_{it-2}$ in the levels equation.

Table 5: Dividends

$(D/S)_{it}$	[1]	[2]	[3]	[4]
$(D/S)_{it-1}$	0.829 (0.129)	0.835 (0.127)	0.826 (0.134)	0.829 (0.140)
$(CF/K)_{it-1}$	0.623 (0.155)	0.559 (0.242)	0.558 (0.229)	
br_{it-1}			-0.229 (0.282)	-0.538 (0.292)
$(I/K)_{it-1}$	-0.533 (0.110)	-0.750 (0.367)	-0.949 (0.383)	-0.562 (0.327)
Q_{it-1}	0.024 (0.018)	0.055 (0.040)	0.058 (0.041)	
$(B/K)_{it-1}$	-0.209 (0.100)	-0.127 (0.068)	-0.112 (0.064)	
$ln(S)_{it-1}$	-0.082 (0.059)	-0.112 (0.066)	-0.106 (0.064)	-0.134 (0.084)
Year effects	yes	yes	yes	yes
Sargan Test (p-value)	0.00	0.00	0.00	0.11
Instruments	t-2..t-5; Δt-1	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2
M_1	-3.64; p=0.00	-3.69; p=0.00	-3.69; p=0.00	-3.67; p=0.00
M_2	1.43; p=0.15	1.45; p=0.15	1.46; p=0.15	1.44; p=0.15
Firms	2,062	2,062	2,062	2,062
Observations	22,033	22,033	22,033	22,033

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M_j is a test of jth order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1). Asymptotic robust standard errors reported in parentheses. Instruments as stated. Coefficients and standard errors multiplied by 100, with the exception of those associated with the lagged dependent variable.

Table 6: New Equity Issuance

	Issuance for cash or acquisition			Issuance for cash		
	any	2 per cent		any	2 per cent	
$(CF/K)_{it}$	-0.648 (0.118)	-0.816 (0.109)		-0.704 (0.113)	-0.736 (0.107)	
br_{it}			-0.010 (0.072)			0.096 (0.077)
$(I/K)_{it}$	1.602 (0.088)	2.238 (0.080)	2.011 (0.073)	0.842 (0.082)	1.560 (0.074)	1.379 (0.069)
Q_{it}	0.118 (0.015)	0.098 (0.013)	0.026 (0.010)	0.156 (0.013)	0.082 (0.011)	0.024 (0.008)
$(B/K)_{it}$	-0.011 (0.069)	0.211 (0.057)	0.252 (0.059)	-0.093 (0.052)	0.110 (0.036)	0.108 (0.036)
$\ln(S)_{it}$	0.414 (0.016)	0.154 (0.012)	0.157 (0.012)	0.416 (0.016)	0.069 (0.011)	0.072 (0.012)
Year effects	yes	yes	yes	yes	yes	yes
log-likelihood	-7635.775	-6199.427	-6228.284	-6434.336	-3953.979	-3978.161
S_{α}	0.941 (0.028)	0.534 (0.024)	0.546 (0.024)	0.920 (0.030)	0.405 (0.030)	0.406 (0.030)
ρ	0.469 (0.015)	0.222 (0.015)	0.229 (0.015)	0.458 (0.016)	0.141 (0.018)	0.141 (0.018)
Firms	1,847	1,847	1,847	1,751	1,751	1,751
Observations	17,091	17,091	17,091	17,091	17,091	17,091

Notes: Maximum likelihood estimates for random effects probit model are shown. Standard errors in parentheses.
ρ is the proportion of the total variance that is accounted for by the company-specific component.

Table 7: Marginal Effects for New Equity Issuance

	any	2 percent	
For cash or acquisition			
$(CF/K)_{it}$	-0.171	-0.153	
br_{it}			0.002
$(I/K)_{it}$	0.423	0.419	0.376
Q_{it}	0.031	0.018	0.005
$(B/K)_{it}$	-0.003	0.040	0.047
$\ln(S)_{it}$	0.109	0.029	0.029
For cash			
$(CF/K)_{it}$	-0.207	-0.105	
br_{it}			0.014
$(I/K)_{it}$	0.247	0.222	0.198
Q_{it}	0.046	0.012	0.003
$(B/K)_{it}$	-0.027	0.016	0.016
$\ln(S)_{it}$	0.122	0.010	0.010

Note: The table reports marginal effects of a unit change on the probability of observing y_{it}=1 evaluated at the means. The marginal effects are calculated as $\frac{d[prob(y=1|x)]}{dx_k} = \phi\left(\overline{x}\beta\sqrt{1-\rho}\right)\left(\sqrt{1-\rho}\beta_k\right)$where $\phi(\cdot)$ is the standard normal density function, $\overline{x}$ is the vector of mean characteristics, β the vector of coefficient estimates with β_k the coefficient estimate on regressor x_k (see Arulampalam (1999) on the adjustment to the standard expression for marginal effects by the $\sqrt{(1-\rho)}$ correction factor in a random effects probit model).

Table 8: Investment

$(I/K)_{it}$	[1]	[2]	[3]	[4]	[5]
$(I/K)_{it-1}$	0.139 (0.015)	0.148 (0.050)	0.236 (0.049)	0.083 (0.047)	0.178 (0.048)
Q_{it}	-0.003 (0.006)	-0.007 (0.006)	-0.010 (0.006)	-0.010 (0.006)	-0.012 (0.005)
Q_{it-1}	0.034 (0.006)	0.033 (0.007)	0.010 (0.006)	0.032 (0.063)	0.012 (0.005)
$(S/K)_{it}$	-0.014 (0.003)	-0.014 (0.005)	-0.021 (0.005)	-0.014 (0.004)	-0.021 (0.005)
$(S/K)_{it-1}$	0.013 (0.003)	0.013 (0.004)	0.016 (0.004)	0.014 (0.004)	0.017 (0.004)
$(CF/K)_{it}$			0.423 (0.077)		0.407 (0.079)
$(CF/K)_{it-1}$			-0.151 (0.060)		-0.172 (0.059)
br_{it}				-0.079 (0.041)	-0.032 (0.041)
br_{it-1}				-0.093 (0.030)	-0.098 (0.029)
Year effects	yes	yes	yes	yes	yes
Sargan	0.00	0.00	0.00	0.00	0.00
Instruments	t-2..t-5; Δt-1	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2	t-3..t-5; Δt-2
M_1	-17.50; p=0.00	-9.83; p=0.00	-10.64; p=0.00	-9.70; p=0.00	-3.67; p=0.00
M_2	1.02; p=0.31	0.62; p=0.54	1.58; p=0.12	-0.18; p=0.86	1.44; p=0.15
Firms	2,062	2,062	2,062	2,062	2,062
Observations	22,033	22,033	22,033	22,033	20,033

Notes: Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell and Bond, 1998; Arellano and Bond, 1998). Sargan is a Sargan Test of over-identifying restrictions. M_j is a test of jth order serial correlation in the first-differenced residuals, asymptotically distributed N(0,1). Asymptotic robust standard errors reported in parentheses.

Data Appendix

Panel Structure

Table A.1 tabulates the number of time-series observations per company.

Table A.1: Panel structure

No of records	4	5	6	7	8	9	10	11	12	13	14	15
Companies	254	187	143	185	203	154	132	102	90	94	74	59
No of records	16	17	18	19	20	21	22	23	24	25	26	Total
Companies	50	32	30	40	16	12	22	26	19	26	112	2,026

Variable Construction

Dividends (D)
Ordinary dividends net of Advance Corporation Tax. (Datastream Item 187)

Debt (B/K)
Total loan capital (DS321) divided by replacement cost of capital stock K (see below) or market capitalisation (MV). Net debt subtracts cash and equivalent (DS375) from the numerator.

Leverage (B/MV)
Total loan capital (DS321) divided by market capitalisation of the company (Item mv).

Equity issued (N)
Two definitions of equity issuance are used. Equity issued for cash (DS412) and equity issued for cash and acquisition (DS406). The former is only available up to 1991 whilst the latter is available from 1981 and both before and after the introduction of the cashflow standard FSR1 and FRS1(Rev) which became compulsory in March 1992. Both figures are net of share repurchases.

Investment (I/K)
Owing to changes in company accounts definitions in 1991, a different method for calculation is used pre- and post-1991. Up to 1991, investment is calculated as Total new fixed assets (DS435) less sales of fixed assets (DS423). From 1991, this is calculated as total payments for fixed assets of the parent (DS1026) plus those of any subsidiaries (DS429), net of sales of fixed assets.

Capital stock (K)
Capital stock is measured on a replacement cost basis. The procedure employed uses a perpetual inventory method as has been used in a number of company accounts panel data studies (eg. Blundell et al., (1992)). $K_{t+1} = K_{it}(1-\delta) + I_{it}$ where δ is the rate of depreciation assumed to be 0.08. I is investment. For the company's first observation, the replacement cost is assumed equal to the historic cost total net fixed assets (DS339), adjusted for inflation.

Tobin's Q (Q)
$Q = \left(\frac{mv+B-C}{K}\right)$

where mv is market capitalisation of the company at December 31 in year t (Datastream Item mv); B is book value of outstanding debt (DS321); C is book value of cash and equivalent (DS375). The top 1 per cent of values are recoded to the 99th percentile.

Cash flow (CF)
Profit after tax and preference dividends (DS186) plus depreciation of fixed assets (DS136).

Borrowing ratio (br)
Interest payments (DS153) divided by profit before tax (DS157) plus interest received (DS143). Where companies have a negative value for the denominator their borrowing ratio is set equal to 1.

Real Sales (S/P)
Total company sales S (DS104), deflated by the GDP deflator (P).

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