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An empirical model of companies' debt and dividend decisions: evidence from company accounts data

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Ms G Chowdhury

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CONTENTS

AN EMPIRICAL MODEL OF COMPANIES' DEBT AND DIVIDEND DECISIONS: EVIDENCE FROM COMPANY ACCOUNTS DATA

1 There is no consensus amongst economists on the key determinants of companies' financial decisions. Despite the vast amount of econometric work undertaken, much of it in connection with large macro-models, there is still no agreement on, for example, the impact of changes in tax rates, of capital expenditure or of expected profit flows upon debt finance, dividend payments and new equity issues.(1)

2 Whilst there is no generally accepted model (either theoretical or empirical) of company financial behaviour, no-one doubts the relevance of analysing financing decisions. In the UK it is particularly important to have an idea of the key determinants of company finances at a time when the environment in which the financing decisions are taken is rapidly changing. Recent changes in the system of company taxation may have a profound impact on the way in which firms finance their expenditure and upon their dividend policy. At the same time the role of banks as the key financial intermediaries between lenders (historically the personal sector) and borrowers is likely to alter both as a result of these tax changes and, more importantly, because of the major institutional developments now taking place in the City of London. Such institutional developments may well result in significant changes in the relative costs of different forms of finance. Quite how companies will respond to all of these developments is hard to predict without a fairly comprehensive model of their behaviour.

3 In a previous paper Chowdhury, Green and Miles (1986) estimated a model of companies' short term financing decisions (choices between liquid asset accumulation, trade credit and short

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(1) For an indication of the type of applied work undertaken on company finances and the very different conclusions drawn from it see, for example, Modigliani and Miller (1958); Dhrymes and Kurz (1967); Fama (1974); Bain (1975); Smirlock and Marshall (1983); Castanias (1983); Poterba and Summers (1984); Cuthbertson (1985); Edwards, Mayer, Pashardes and Poterba (1985); King (1986); Chowdhury, Green and Miles (1986); Anderson (1986).

term bank debt) taking as given dividends, longer term debt flows and new equity issues. It was argued that the short term financing flows, in total, acted as a buffer and the "strategic" financing flows (dividends, longer term debt flows and new issues) reflected choices made at a higher level in a hierarchy of decisions. This paper aims to push the modelling effort back up the hierarchy using the same source of disaggregated data.

4 The advantages of using company specific data were discussed in our earlier paper and will not be repeated here. We were sufficiently encouraged by the results of that research to continue the project of modelling company financing decisions believing that insights might be gained which, for various reasons[(1)], could not be uncovered with aggregate data. This paper consequently extends the earlier study. It deals with company decisions relating to dividends and external debt. Data are drawn from the published accounts of a large sample of 653 UK companies to estimate a model of these "strategic" financial decisions. Each of the companies reported in every year between 1969 and 1984.

5 In Section I we consider the theory of company financial decisions. In Section II the broad trends in financing patterns revealed by our sample are assessed and in Section III we develop a model of debt and dividend flows. In Section IV the issues involved in the econometric estimation of this model are considered. In Section V the results of estimating the model are discussed and an attempt is made to assess how companies might respond to the kind of changes that have occurred in the UK in recent years.

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(1) Briefly, the two major advantages of company specific data are:

(i) it allows one to ignore issues of aggregation bias because the data describe the actions taken by the agent which economic theory focuses upon: the firm.

(ii) the massive increase in the number of observations over that available at the aggregate level allow one to estimate models of greater complexity, and to estimate such models with more precision, than is usually the case in applied research.

SECTION I THE THEORY OF COMPANY FINANCES:

6 Companies' actual financing decisions present the economic theorist with major problems. The two dominant, but incompatible, themes in the theoretical literature on company finance are that financial decisions are irrelevant (see Modigliani and Miller (1958), Miller (1977), Miller and Scholes (1978), Auerbach and King (1983) and King (1986)) and that the interaction of the personal and company tax systems make extreme financing rules (eg finance all expenditure by debt, or pay zero dividends in all periods) optimal (Modigliani and Miller (1963), King (1974, 1977), Stiglitz (1969, 1973)). Neither theory is consistent with observed behaviour.

7 Attempts have been made to prove rigorously that either bankruptcy costs combined with uncertainty or principal-agent aspects of the manager-shareholder relation can imply that financial policy "matters" and that internal solutions (use of non-debt finance and non-zero dividend payments) generally exist (see Brennan and Schwartz (1978), Chen (1978), Kim (1978), Ross (1977), Bhattacharya (1979)). There are, however, problems with these models. First, the conditions which might make dividends act as a useful signal to shareholders about the state of the firm do not obviously hold. For example, it is far from clear that firms who do not possess the attribute which the signal is supposed to reveal should find it prohibitively costly to pay dividends; nor is it obvious that no other tax-efficient means of revealing the attribute is available. Second, the direct costs of bankruptcy, which one might expect to be significant if they are to explain why nearly all companies have a financing structure very far from the extreme forms predicted by some models, appear to be relatively small (see Warner (1977))[1].

8 Other theories which aim to explain why companies do not follow extreme financial policies and regularly pay dividends whilst avoiding very high debt/equity ratios are not wholly

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1 The adverse effect on the reputations, and more immediately on the jobs, of managers who run companies which become bankrupt may, however, provide a major incentive to avoid bankruptcy.

convincing. Feldstein and Green (1980) consider four other theories which appear to be in accord with the facts but find problems with each of them:

(i) The idea that shareholders prefer a steady stream of dividends to lumpy payments when shares are sold (which would provide income if firms retained profit rather than paid dividends) implicitly relies upon a level of transaction costs associated with share sales which seems implausible.

(ii) The argument of Miller and Scholes (1978) that shareholders can offset tax on dividends against tax deductible interest payments cannot explain the UK experience where interest costs are not deductible.

(iii) The bird in the hand argument, that shareholders distrust management and fear that retained profit might be wasted, is fallacious. As Edwards (1984) points out, if a firm reduces its dividend its shareholders can immediately sell shares and do not need to leave their funds in the corporate sector.

(iv) Auerbach (1979), Bradford (1979) and King (1977, 1986) have argued that dividend payments are consistent with equilibrium even when, for tax reasons, retentions might seem preferable. This is because under certain conditions the market value of a pound of retained earnings is less than one pound. This is the so-called trapped equity model. The theory relies upon the assumption that funds can never be distributed to shareholders except as dividends. Takeovers and mergers, however, provide one means of getting funds to shareholders and it is only if the costs of these transactions are sufficiently high that the argument holds [see King (1986)].

9 The model which Feldstein and Green themselves develop depends upon shareholder risk aversion, differences in tax rates across investors, and uncertainty over the profitability of firms. If the returns on investments made by different firms in different states of the world are not perfectly correlated, risk averse shareholders will want to hold shares in the different firms. Shareholders with low or zero rates of tax on dividend income ("institutions") will favour dividend payments against retentions

whilst others facing relatively low rates of capital gains tax ("households") will favour retentions. If the firm aims to maximise its share price it will balance the demands for its stock from institutions and households by paying some dividends and retaining part of its distributable income. The problem with this model is that once one allows firms to offer different commodities, as is the case with risk averse shareholders and different patterns of returns across companies, the hypothesis that shareholders will be unanimous in favouring share price maximisation is without foundation. Indeed it has been shown [Auerbach and King (1983)] that in a wide range of models the conditions which are necessary for shareholders to be unanimous in supporting share-price maximisation imply that if tax rates vary across investors, shareholders will be segmented into two groups: one specialised in equity and one in debt. The relative wealths of these groups determine the aggregate financial structure of the corporate sector but each firm will be indifferent to its financial policy (a Miller equilibrium).

10 Attention has been paid in a series of recent papers to the phenomenon of tax exhaustion[(1)] (see De Angelo and Masulis (1980), Auerbach (1984) and Mayer (1986)). Tax exhaustion is, especially in the UK, very common and the increasing probability that a firm might become tax exhausted as a result of an extreme financial policy implies that a non-trivial, internal optimum for the financing decisions can generally be shown to exist. These models do not rely upon bankruptcy or transaction costs nor upon the use of dividends (or other quantifiable company decision variables) to act as a signal of underlying performance. Rather, they rely upon firms being able to perceive the tax advantages of following certain strategies and upon perceptions of the probabilities of becoming or staying tax exhausted. Whilst not doubting the theoretical consistency of these tax related models we do not believe that they can constitute a complete theory of company financial behaviour. Companies as corporate bodies have been in existence for well over 100 years issuing debt, equity and

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(1) A company is tax exhausted when it cannot offset a tax deductible expense against its tax liability because that liability is zero.

paying dividends all the while. Tax exhaustion is a relatively recent phenomenon and cannot, therefore, explain away the puzzles of corporate finance.

11 It seems almost inevitable to us that in fact no single, unified theory of company financial decisions can explain the behaviour over time of a large group of companies. An empirical model which is to have any claims as an explanation of behaviour will, of necessity, reflect several diverse influences acting on companies. What we can hope to do in constructing an empirical model is to assess the relative significance of, for example, changes in the system of company taxation and in the riskiness of a specific company's trading environment, or of changes in current and expected future profitability, in determining its finances.

SECTION II: TRENDS IN FINANCING

12 Our data source comprises the published accounts of 653 UK companies who have each reported in every year from 1969 to 1984 (including reports published in the first quarter of 1985). The sample was selected by applying filters to all those companies which have continuously supplied accounts to DATASTREAM over the sixteen year period. The filters applied were the same as those described in Chowdhury, Green and Miles (1986). Briefly, these filters exclude companies whose activities are predominantly overseas, companies for which the sources/uses statement on the DATASTREAM tape contained apparent errors, financial companies and trust funds. The resulting sample of firms have a total capital employed which is equivalent to 40% of that of all UK Industrial and Commercial Companies (ICCs). Comparison of the total profits flows of this sample with CSO aggregates is difficult because this sample of firms does not distinguish foreign profits, which are excluded in the aggregate figures. Making a crude adjustment for this[1] suggests that the sample again accounts for just under 40% of the total. The companies are drawn from a wide range of sectors of the economy and vary enormously in size. Capital employed, for example, varies from several billion pounds (Shell,

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(1) By scaling down each company's reported profit by the ratio of domestic sales to total sales.

General Electric and ICI) to less than £500,000 for some firms. Details of the sample of companies are presented in the Annex.

13 Table 1 represents an aggregated constant price, sources/uses statement for the firms in our sample. It shows the aggregate flows of profit, tax payments and investment and stockbuilding, dividend payments, new equity issues and quick finance. (Quick finance here is defined as net trade credit received minus net additions to the stock of liquid assets).

14 The variability in the aggregate flows of debt, new equity and of quick finance is apparent. Quick finance is particularly volatile, varying, for example, from -£2/3bn to over £1bn between 1978 and 1979 and falling to near zero in the following year. This would seem to be consistent with the hypothesis that quick finance acts as a buffer in the short-run. Dividend payments (Column 3), in aggregate, appear less volatile than the other financial flows (Columns 4, 5 and 6).

15 Table 2 shows the relative contributions of debt and equity in more detail. In nearly all years debt (defined here as issues of new loan capital plus the flow of all short-term debt) was well over twice the size of new equity issues. Furthermore, the table shows that whilst around one half of companies used debt as a source of funds in a given year the proportion of companies that issued equity was generally around 1/4.

16 The relation between stocks of debt and the total value of the capital employed of the sample is shown in Table 3. The weighted average (by company size) of the gearing ratio was similar at the end of the period to what it was at the beginning. Throughout the period variability (in aggregate) is low with the ratio never falling below 20% and only marginally exceeding 25% in the peak year of 1972. The second column shows the unweighted average of company specific gearing ratios for each year. The contrast is interesting. The unweighted average gearing ratios are significantly lower than the weighted averages and have also increased markedly over the whole period. This implies that smaller firms have had consistently lower gearing than larger firms but that between 1969 and 1984 the gearing of small firms

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TABLE 1

Aggregate Flow of Funds of Sample of 653 companies

(£ million, 1980 prices)[1]

	Profits	Investment[2] & Tax	Dividends[3]	New Equity	Total Debt	Quick Finance
1969	12483	12909	2449	1125	2602	-764
70	12395	13484	2478	942	2644	94
71	13208	12704	2439	587	1763	-313
72	15360	17281	1877	2339	4166	-2591
73	18326	19500	2251	578	3695	-840
74	18442	23373	1813	143	4812	1908
75	15528	15174	1390	998	1411	-1259
76	17806	17606	1462	1140	1791	-1633
77	14637	14586	1481	727	1349	-653
78	16074	15977	1585	558	1605	-678
79	16040	18243	2200	608	2519	1241
80	13206	13478	1822	564	1525	-49
81	13744	14100	1582	930	2370	-1400
82	13761	14029	1692	450	1829	-381
83	15073	13362	1749	1084	127	-1259
84	16526	18933	1977	1133	3055	-55

1 Subject to small errors in individual accounts and to rounding the rows will add up: columns 1-2 = 3-4-5-6.

2 includes stockbuilding and acquisition of non liquid financial assets.

3 Comprising almost entirely ordinary dividends.

TABLE 2

Debt and Equity Flows

	Total of debt and new equity raised (£80M)	of which new equity	(percent of sample raising funds from new issues)	of which debt	(percent of sample raising funds from debt)	percent of sample raising both debt and equity finance
1969	3727	30.2%	(19.0)	69.8%	(37.1)	14.2
70	3586	26.3%	(16.5)	73.7%	(35.5)	12.4
71	2350	25.0%	(20.1)	75.0%	(32.8)	12.2
72	6505	36.0%	(25.4)	64.0%	(51.8)	17.2
73	4273	13.5%	(23.9)	86.5%	(60.8)	18.2
74	4955	2.9%	(17.8)	97.1%	(60.9)	13.6
75	2409	41.4%	(21.3)	58.6%	(39.8)	8.7
76	2931	38.9%	(19.8)	61.1%	(53.2)	12.2
77	2076	35.0%	(23.1)	65.0%	(49.0)	12.6
78	2163	25.8%	(27.1)	74.2%	(52.1)	17.5
79	3127	19.4%	(27.7)	80.6%	(60.5)	19.3
80	2089	27.0%	(26.3)	73.0%	(49.5)	16.1
81	3300	28.2%	(30.3)	71.8%	(50.4)	18.1
82	2279	19.7%	(28.3)	80.3%	(54.7)	17.6
83	1211	89.5%	(31.5)	10.5%	(50.5)	16.5
84	4188	27.0%	(38.0)	73.0%	(57.4)	25.7

TABLE 3

Gearing:

Total debt/total capital employed:[1]

	Weighted Average	Unweighted Average (Coefficient of variation in brackets)[2]	
1969	22.6%	10.5%	(1.22)
1970	23.7	10.9	(1.20)
1971	24.4	12.4	(1.05)
1972	25.2	16.0	(0.82)
1973	24.9	16.7	(0.87)
1974	26.0	17.9	(0.91)
1975	25.0	15.9	(0.87)
1976	24.1	15.6	(0.86)
1977	22.6	14.4	(0.88)
1978	21.3	13.6	(0.90)
1979	20.8	14.2	(0.82)
1980	21.0	14.7	(0.83)
1981	21.4	14.7	(0.85)
1982	22.0	16.1	(0.82)
1983	20.7	16.2	(0.78)
1984	21.5	17.0	(0.77)

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1 Capital employed is measured at historic cost.

2 ie

$$\left\{ \sum_{i=1}^{N} (g_{it} - g_t)^2 \Big/ N \right\}^{1/2} \Big/ g_t$$

where g_{it} is gearing for firm i in period t, gt is average gearing accross all N firms in t.

has tended to rise and that of large firms has tended to fall. Thus, the coefficient of variation of the company gearing ratios has fallen.

17 The stock of debt held by the sample of firms represents between 40% and 45% of the stock issued by all UK companies whilst the proportion of the aggregate capital employed accounted for by the sample was just under 40%. This suggests that average gearing is marginally higher for our sample of companies than for all ICCs. This is consistent with the idea that larger companies, who are more heavily represented in the sample than in the economy generally, have, on average, higher gearing than smaller firms.

18 Chart 1 and Table 4 give a more detailed picture of the dividend flows for our sample of companies. The chart shows the payout ratios for each year and reveals that there has been significant variability in the ratio of dividends(1) to available internal funds (profits net of tax). Comparing the dividend payout ratio with the measure of the rate of return suggests that in years when profits have been high (1972/3, 1976, 1983/4) the payout ratio has fallen and in years when profitability is relatively low (1970, 1980, 1981) the ratio rises. This is consistent with the notion that shareholders prefer a smooth path of payments and that dividend payments reflect the longer term prospects of the company.

19 Despite this it is apparent from Table 4 that companies are not unwilling in certain circumstances to cut dividends even in nominal terms. In 1974, for example, nearly half the companies in the sample reduced their dividends from the level in the previous year. This is not necessarily inconsistent with the idea that dividends act as a signal of a company's performance. Shareholders, although unaware of many aspects of the health of their particular company, no doubt have a good feel for the state of companies in general. If dividends do act as a signal it is therefore only to reveal company specific factors which differ from the norm. To cut dividends along with other companies does not show that a firm is doing unusually poorly.

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(1) Dividends paid after April 1973 have been grossed up for pre-payment of tax by companies.

CHART 1 : DIVIDEND PAYOUT RATIO AND PROFITABILITY

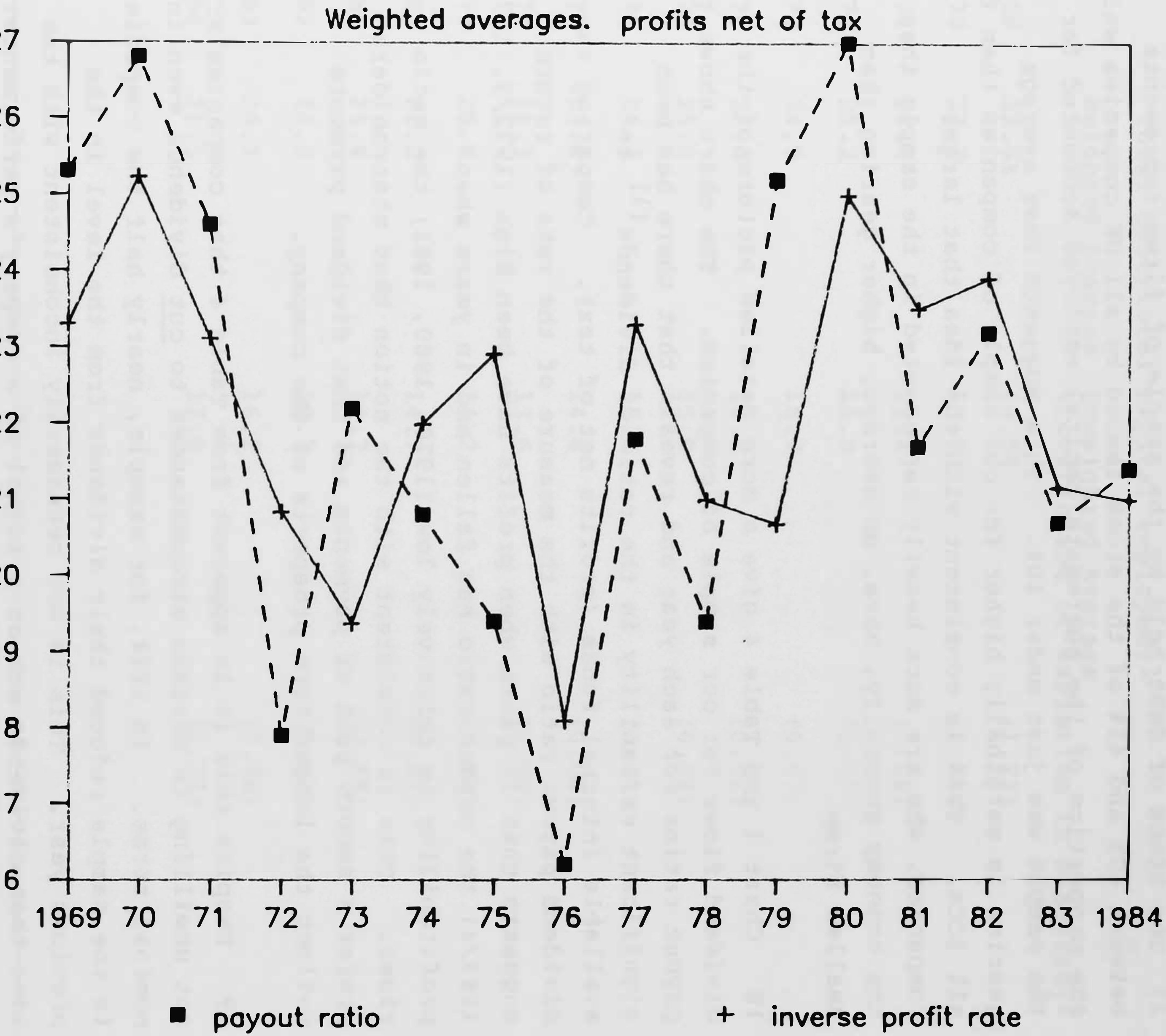

TABLE 4

Dividend payments

	Proportion of companies which pay a dividend	Proportion of companies which cut total dividend payments (in nominal terms)
1970	96.8%	12.0%
1971	97.0	10.9
1972	96.5	28.9
1973	98.2	22.5
1974	98.6	47.2
1975	97.4	33.8
1976	98.3	9.0
1977	97.9	12.4
1978	99.1	9.0
1979	98.5	12.1
1980	98.0	28.2
1981	95.1	33.4
1982	93.1	22.8
1983	93.1	18.9
1984	91.7	11.0

20 Whilst, at times, quite a lot of companies bring themselves to cut dividends they do seem very reluctant to pay no dividend. The proportion of firms in our sample paying some dividend has never fallen beneath 90% and has usually been around 97%. Since 1979, however, there has been a significant increase in the proportion of firms paying no dividend. This may be linked to the abolition of dividend controls (see below).

21 The stylised facts which emerge from a study of the behaviour of our sample of firms might be summarised briefly: companies have financed the larger part of their requirement for outside funds by debt but have also relied upon new equity issues for a sizeable proportion of the total. Indeed a small but significant number of firms have consistently issued both debt and equity in the same financial year. Nearly all companies pay dividends the level of which, relative to funds available for distribution, moves anti-cyclically.

22 As noted above, these stylised facts are not consistent with some of the key results in the theory of corporate finance and the phenomenon of tax exhaustion has been presented as a possible explanation. For the companies in our sample tax exhaustion is common. There is no exact way of knowing whether a company is tax exhausted (at the margin) from its published accounts. However, a company which counts a part of its current ACT payment as irrecoverable is certainly tax exhausted and expects to remain so for some considerable time. Table 5 shows the proportion of companies in our sample paying irrecoverable advanced corporation tax (ACT). The table also shows estimates made by the Institute of Fiscal Studies (IFS) of the proportion of firms not able to claim ACT in a sample of some 400 companies reporting between 1969 and 1981. (Companies with irrecoverable ACT are a strict subset of those firms that have unrecovered ACT.) Column 1 of the table shows that by the 1980's around 1/3 of the sample were, and expected to continue to be, tax exhausted. Column (2) suggests that there have also been a significant proportion of companies which although not certain that any ACT paid would never be recovered were nonetheless currently tax exhausted. Given that tax exhaustion has been, and still is, widespread, the desire to avoid becoming tax exhausted might therefore be a determinant of a firm's financing decisions.

TABLE 5: - TAX EXHAUSTION

	Proportion of sample with irrecoverable ACT[1] (1)	IFS Estimate of proportion of companies not able to currently claim ACT offset.
1969	-	-
1970	-	-
1971	-	-
1972	-	-
1973	8.6%	29.7
1974	5.2%	48.0
1975	4.1%	40.8
1976	4.4%	36.8
1977	9.8%	37.0
1978	16.8%	38.1
1979	22.5%	42.7
1980	32.8%	47.6
1981	33.4%	52.8
1982	33.5%	
1983	27.1%	
1984	20.1%	

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1 ie Firms who do not foresee being able to offset ACT paid on dividends currently distributed against mainstream corporation tax liability. This is a sufficient, but certainly not necessary, condition for being tax exhausted.

SECTION III: A MODEL OF COMPANY FINANCIAL DECISIONS

23 The sources/uses identity of a company can be written:

$$P_t - T_t - I_t - S_t = D_t - \Delta B_t - E_t - Q_t \qquad (1)$$

P_t = profit earned in period t
T_t = tax paid
I_t = investment
S_t = stockbuilding
D_t = dividends paid
ΔB_t = the flow of new debt finance (with residual maturity exceeding one year). B_t = stock of debt.
E_t = new equity issues
Q_t = flow of net trade credit received plus short term debt finance (maturity under one year) minus net acquisitions of liquid assets.

24 We call D_t, ΔB_t and E_t strategic financing flows. Q_t is quick finance and conforms to the definition in Chowdhury, Green and Miles (1986). We assume that the strategic financial flows are simultaneously determined and that the elements of Q_t are determined conditional on these flows. Q_t in total acts as a buffer. We assume that the factors which determine issues of longer term (or stragic) debt are different from those which influence decisions about overdraft finance and other short term debt. The shorter maturity debt is part of quick finance the determinants of which were investigated in Chowdhury, Green and Miles (1986). In this paper we model strategic debt flows and payments of dividends. New equity issues are not modelled directly and because of the buffer role for quick finance no specific equity issues equation is implied by our estimates. Any factors which affect equity issues will, however, almost certainly influence debt and dividend flows.

25 It is far from clear, either theoretically or empirically, whether financing decisions are made conditional upon company profits and investment flows or are simultaneously determined. In their classic paper Modigliani and Miller showed that under strong conditions the financing and investment decisions were

independent. The existence of tax advantages to certain financing strategies does not, in itself, alter this result. But real and financial decisions are not independent if the possibility of tax exhaustion is a major concern of companies. If risks of bankruptcy matter to firms then once again the independence of financing and investment decisions is, in theory, unlikely. When both time lags and costs of adjustment are considered it does, however, seem plausible that profits and investment are determined prior to current debt and dividend flows. Profits are the result of employment, production and pricing decisions of the firm and of economy-wide developments outside its scope; they are likely to be predetermined with respect to current financial flows. This is not to say that the balance sheet structure of firms does not impact upon pricing and output decisions but rather that such feedbacks are not immediate: decisions on the productive activities of the company (including investment) require more time because the cost of implementing them, and especially of subsequently reversing them, are likely to be higher than with financing decisions. It also seems likely that tax payments, which are a function of past profit and expenditure decisions[1], are predetermined with respect to current financial flows.

26 We therefore consider it reasonable to assume hierarchical decision making with company income and capital expenditure determined at a higher point in a decision tree than financial flows. If this is so it is valid in estimation to condition dividends and the flow of debt finance upon post tax, profits, investment and those variables which reflect the relative advantages of equity, retentions and debt[2]. We do not,

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(1) With one exception, namely when ACT is paid but not recovered in which case tax paid and current dividends are simultaneously determined (see below).

(2) An indirect test of the validity of the assumption that investment is independent of financial flows is feasible using tests of statistical exogeneity (see below). The empirical evidence on the independence of investment decisions and financing decisions is mixed; Fama (1974) and Smirlock and Marshall (1983) find that the decisions are independent, Dhrymes and Kurz (1967) that they are not.

however, believe that stockbuilding can be taken as (weakly) exogenous with respect to dividend payments, strategic debt issues or capital issues. We believe that the level of stocks, whilst being more costly to change rapidly that elements of quick finance, may well be simultaneously determined with, and perhaps dependent upon, the other, longer term, financial flows.

27 We assume that decisions about strategic debt and dividends are made simultaneously and will to a large extent depend upon the same factors. As a starting point for estimation we therefore include a common set of explanatory variables for the two equations. The explanatory variables are listed in Table 6. They fall into seven categories.

(I) Taxation
(II) Bankruptcy/Risk
(III) Cost of funds (relative interest rates)
(IV) Adjustment costs/expectations
(V) The scale of flows
(VI) External controls
(VII) Leasing

(I) Taxation

28 The models in King (1977) and Mayer (1986) imply the relevance both of tax rates (corporation tax, income tax, imputation rate and capital gains tax rate)[1] and measures of the tax paying status of the firm (proxies for the likelihood of current and future tax exhaustion). There are serious problems in measuring the tax position of the individual firm. The clearest indicator of tax exhaustion is whether a company counts a part of its ACT as irrecoverable. This is included in a 0, 1 form.

(II) Bankruptcy/Risk

29 The stock of debt, relative to capital employed, and the level of income gearing[2], all lagged, are, plausibly, related

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(1) The way in which these tax rates determine the financial policy of a firm, in restricted models, is summarised in Chowdhury, Green and Miles (1986); p20.

(2) Interest payments as a proportion of profits net of tax.

to the probability of bankruptcy. These variables are significant in many studies which use discriminant analysis to assess probabilities of bankruptcy (see Marais 1979). The stock of debt with residual maturity of less than one year is also included since it seems likely that the level of such debt will be more closely linked to the dangers of cash flow crises than the level of longer term debt. The volatility of income is clearly relevant to the assessment of default risks and the squared change in the rate of return on capital is included as a (crude) measure of the recent variability of profits. Risks of bankruptcy are likely to be inversely related to stocks of liquid assets held. The lagged stock of highly liquid assets (cash, bank deposits and Treasury bills) is included in the specifications, and stocks of less liquid financial assets (eg gilts) are entered separately.

(III) Cost of Funds (Relative interest rates):

30 The impact of interest rates is not obvious given that dividend and debt flows are modelled conditional upon company income and investment. Three nominal interest rates are included: banks' base rate, the three month interbank rate and a five year gilt rate; the first two rates are entered as deviations from the gilt rate which is included as a level. Since most debt has a maturity of less than five years, and since the cost of servicing equity might be more closely linked to a longer term rate, one might expect debt to be more attractive when a short term rate (bank rate or the interbank rate) falls relative to a longer term rate. A more direct measure of the cost of issuing equity is the yield on equity of the FT 500. This is included along with the dividend yield (both measured as deviations from the long term rate on five year gilts).

31 The tax advantage of the interest deductibility of debt is linked to the level of interest rates as much as to the rate of tax; therefore the product of the long term nominal interest rate and the corporate tax rate is also included. Inflation (the annual rate of change of the Retail Price Index (RPI) is also included. If anything this is expected to have a negative impact upon flows of debt and dividends since unused tax losses and allowances can only be carried forward in nominal terms, thus making tax exhaustion more costly when inflation rises.

(IV) Adjustment costs/expectations:

32 Adjustment costs imply that lagged dependent variables will be significant in estimated relationships. The lagged stock of debt is included in both equations as are the first two lags of dividend payments. Longer lags of dividends are included since these flows might be slow to adjust to changes in a company's environment if shareholders prefer a smooth flow of disbursements.

33 No attempt has been made to model explicitly expectations of future available income. Two lags of profits, tax and interest payments are initially included. It is likely that the estimated effect of these lags is in part due to the impact of those flows on company expectations of future profitability. The future health of a company might, however, depend on current competitiveness and will probably be highly correlated with future investment plans. Both variables can be measured[1] and are included.

(V) The scale of flows:

34 Investment, company profits, and interest and tax payments determine the scale of flows. Endogeneity between interest payments and debt flows and between tax payments and dividends is clearly a problem. The endogeneity of tax payments can be avoided (in principle) by subtracting unclaimed ACT from total payments; the tricky thing is in identifying unclaimed (as opposed to irrecoverable) ACT. Initially we make the assumption that all unclaimed ACT is irrecoverable. Current interest payments are clearly simultaneously determined with debt flows and are excluded from all specifications. Investment has been disaggregated into physical investment and acquisitions of non physical assets. The endogeneity of both flows is questionable and is tested.

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1 Most companies show their commitments to future investment in their reports. This variable is taken as our proxy for expected investment.

(VI) External controls:

35 Controls on bank lending and on dividend payments were in force for much of the period used for estimation; 1971-1984. The bank lending controls (the Corset) probably had significantly less impact than did dividend controls and we have attempted to allow for any corset effects in a fairly crude way with 0, 1 dummies. Any effects from the introduction of Competition and Credit Control is also handled in this way. We considered it essential to try and model the impact of dividend controls with care and an iterative estimation technique was used to this end (see below).

(VII) Leasing:

36 The rise of leasing in the 1970s presented a problem. It seems likely that the decision on whether to lease assets, or to finance additions to the useable capital stock directly by debt or new issues (or increasing retentions), is made simultaneously with the decisions about the flows of debt and dividends. This means that whilst the decision over the change in the useable capital stock (ie net investment plus net new leases) might be independent of (or at least made prior to) decisions about financing, the level of direct investment is not. Ideally, the solution is to add the flow of new leases to direct investment and to include among the explanatory variables in the model the determinants of the relative attractiveness of direct acquisition of capital and of leasing. These determinants might be (i) tax status (tax exhausted as against tax paying); (ii) the level of leasing rates relative to borrowing costs. There is no (new) problem involved in proxying these determinants. The problem is in identifying from company accounts the flow of new leases, for leasing agreements written are not directly reported in company accounts for most of the period. However, interest payments on rented capital are reported and we include this variable in the equations along with leasing rates and time trends. Between them we hope these very crude proxies for leasing will pick up any effect.

TABLE 6: VARIABLES USED IN ESTIMATION:

All stock and Flow data are nominal values. Interest rates are also nominal.

Dependent Variables

	D:	Gross payments of dividends
	ΔB:	Change in the stock of debt (residual maturity exceeding one year).

Explanatory Variables

I Tax Variables	CTX:	The rate of mainstream corporation tax
	IMPT:	The imputation rate (zero pre-1973)
	MTAX:	Estimate of the economy-wide average marginal income tax rate of shareholders
	ZTAX:	Estimate of average effective capital gains tax rate
	EXH:	Tax exhaustion dummy variable; 1 if company reports non-zero irrecoverable ACT, otherwise 0
	CTEX:	EXH. CTX
	IMEX:	EXH. IMPT
II Bankruptcy/Risk Proxies	SDBT:	The stock of all debt
	SHTD:	The stock of debt with residual maturity one ye or less
	INCG:	Income gearing; (interest payments/total incom less tax)
	VARY:	The square of the change in the pre tax rate of return (a measure of volatility of income)
	LIQA:	The stock of liquid assets
	FINA:	The stock of other financial assets.
III Cost of Funds Variables	GILT5:	The nominal rate of interest on 5 year gilts
	INTK:	3 month interbank interest rate (deviation from GILT5)
	RBNK:	Clearing banks' base rate of interest (deviatio from GILT5)
	DIYL:	Dividend yield, FT all industrial shares (deviation from GILT5)
	EQTY:	Yield on equities, FT all industrial shares (deviation from GILT5)
	CTGIL:	GILT5. CTX
	INFL:	Annual rate of change of retail price index
	CTINF:	CTX. INFL

IV	Expectations/ Costs of Adjustment	NULC:	Whole economy index of competitiveness based on relative unit labour costs
		INVE:	Planned future investment
		GRTH:	Growth in capital employed (year on year)
		[Also SDBT,	SHTD, lags of PRF and DIV]
V	Variables to Determine the Scale of Flows	PRF:	Company gross trading income (net of stock appreciation) plus non-trading income
		INVT:	Expenditure on physical assets (includes stockbuilding)
		ACQS:	Expenditure on non-physical assets
		INTL:	Interest payments
		TAX:	Total tax payments
VI	External Controls	DCON:	0, 1 dummy for periods of dividend controls
		CCC:	0, 1 dummy for introduction of competition, credit control
		CORSET:	0,1 dummy for operation of corset.
VII	Leasing	RLEAS	Nominal interest rate on 7 year leases (mid point of highest and lowest) - deviation from GILT5
		HIRL	Rental payments on hired capital goods

Note: Data for all variables not derived from company accounts are aligned so as to conform with the company's report date.

SECTION IV: Estimation Technique:

37 The model that we estimate can be written:

$$D_{it} = \alpha_i + \sum_{k=1}^{K} Z_{itk} \beta_k + U_{it} \quad (2)$$

$i = 1 \ldots\ldots N$

N = number of firms

$$\Delta B_{it} = \gamma_i + \sum_{j=1}^{J} X_{itj} \varphi_j + W_{it} \quad (3)$$

$t = 1 \ldots\ldots T$

T = number of time periods

where D_{it} is the dividends paid by firm i in period t

ΔB_{it} is the flow of debt finance for firm i in period t

Z_{itk} is the value of the k^{th} observable explanatory variable, relevant to the dividends decision, for the i^{th} firm in the t^{th} period

X_{itj} is the value of the j^{th} observable explanatory variable, relevant to the debt finance decision for the i^{th} firm in the t^{th} period.

U_{it}, W_{it} are error terms.

α_i, γ_i are the firm-specific, time invariant, unobservable determinants of dividends and debt respectively. βk, φi are the slope coefficients measuring the responses of dividends, to Zk, and debt, to Xj.

38 In principle, it would be possible to estimate firm-specific slope coefficients on all, or some, of the elements of Z and X. In practice, this is not feasible as there are only 14 annual observations on each firm. This severely limits the number of explanatory variables which could be estimated, and interpretation of results would be extremely difficult with over 600 different estimates of each slope parameter.

39 Several assumptions can be made about the unobserved firm-specific effects, the most straightforward of which is that they are non-stochastic: the fixed effects model. In this case

the "within", or covariance, estimator is efficient and consistent, provided the errors satisfy the usual assumptions for the validity of ordinary least squares (OLS). The within estimator is obtained by performing OLS on the model transformed into deviations from the company specific means. This is equivalent to applying least squares to the pooled data using N step dummy variables for the intercept terms.

40 An alternative assumption for the firm-specific effects is that they are a random sample drawn from some distribution: the "random effects" model. Models of this type are associated with the Balestra and Nerlove (1966) generalised least squares (GLS) estimator which is equivalent to a weighted combination of the within and "between"[1] estimators, with weights inversely related to the variances of the two estimators. If the model is correctly specified and the α_i, γ_i are generated stochastically, then the GLS estimator is efficient, having smaller variance than either the within or between estimators, although the gains may be negligible with such a large data set. Moreover, it is frequently the case that the unobservable firm effects are correlated with the measured explanatory variables. Under these circumstances the within estimator is to be preferred as it remains consistent whereas the GLS estimator is, in general, inconsistent.

41 In addition to company specific dummies, we have also included time dummies in the equations. The time dummies pick up the effect of factors specific to a particular year but which have a common impact on all firms within that year.

42 Problems are posed by the inclusion of lagged dependent variables. The within estimator is inconsistent as N increases with T fixed, with bias of order 1/T. In this study T=14 which

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1 The "between" estimator is OLS on the company specific averages of the variables.

is reasonably large for panel data so we expect the bias to be small. The GLS estimator is consistent, provided the firm specific effects are independent of the measured explanatory variables, only under further strong conditions.(1) These considerations led us to rely mainly on the within estimator. However, we do compare the results of within estimation with those of GLS estimation. A Hausman (1978) test is used to indicate whether there is correlation between the unobserved firm effects and the measured explanatory variables.

43 The size of firms in our sample varies greatly and it would be surprising if errors from regressions using the levels of variables were homoskedastic. Heteroskedasticity would lead to inefficiency in our estimates and would bias inferences. To avoid this problem we have estimated equations in ratio form, dividing flow and stock variables from company accounts by a factor reflecting the scale of the company: adjusted total liabilities lagged one year(2). In these equations interest rates, dummy variables, tax rate terms, income and capital gearing and the other variables measured in common units across firms enter unscaled. Company specific effects are proportional to the scaling factor.

44 We have assumed that all the explanatory variables are weakly exogenous. Weak exogeneity is, we believe, a plausible assumption - but one which can, in principle, be tested. Exogeneity tests (Hausman 1978) require the estimation of correctly-specified equations for variables whose exogeneity is in question. With around 40 explanatory variables the scale of this problem is vast and estimating a string of sub-regressions for all 40 variables was not seriously considered. We did, however, investigate the exogeneity of investment expenditure and of tax payments and the results are reported below.

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(1) If either the first observation on the dependent variable is independent of the individual effect <u>or</u> it is fixed.

(2) Adjusted total liabilities consists of the firm's total liabilities (including all debt, total share capital and reserves) purged of provisions for tax and certain other long-term contractual debt of a firm.

45 Tests of structural stability of the estimated equations are important in assessing their value in explaining company behaviour. Three distinct such tests were undertaken. First, the sample was split arbitrarily into two groups of companies and parameter equality restrictions were tested. Second, the sample was split systematically into companies of above and below average size and also split by reference to growth performance and similar tests were undertaken. These tests help assess whether the same model can be used to explain the behaviour of different firms. Third, we used the total sample of companies but only over a shorter time period to see if the model was stable over time.

Estimation of the Impact of Dividend Controls

46 Allowing for the impact of dividend controls is difficult but crucial. Two points about the controls give a hint about how to model their effect. First, many companies exceeded the statutory limit.(1) Second, the limit may well have provided a norm for payments so that some companies may have paid a higher dividend than they would have done otherwise.(2) The costs of deviating from the statutory limit, in either direction, may therefore have been significant but they were clearly not infinite.

47 One way to model the impact is to assume that firms have a loss function which penalises deviations in dividend payments both from the statutory limit and from that level of dividends which the firm would pay in the absence of dividend controls. Assuming the costs are symmetric and quadratic gives a single period loss function (L) of:

$$L = \eta(D^* - D)^2 + \delta(D^c - D)^2 \qquad (4)$$

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(1) See Bank of England Quarterly Bulletin (1980), especially Chart A.

(2) A cartoon from Financial Weekly (6 July 1979), which appeared shortly after the abolition of controls, shows the chairman of a company announcing to the other board members: "fortunately, since there is no longer any dividend control, we can get away without paying anything". As noted above the proportion of firms paying no dividend has increased steadily since 1979.

where D = dividend payments

D^* = the optimal level of dividends if no controls are in force

D^C = the maximum dividend payable under the controls

$$\eta, \delta \geq 0$$

52 Minimising L gives a necessary condition for an optimum:

$$D = (1 - \lambda) D^* + \lambda D^C \quad (5)$$

where $\lambda = \delta / (\delta + \eta)$

When there are no controls, clearly $D = D^*$.

The parameters of interest which we aim to estimate are those which describe the relation between the Z variables of equation (5) and D^* ie:

$$D^* = Z\beta \quad (6) \quad \text{(in an obvious notation)}$$

Combining (5) and (6) gives:

$$D = (1 - \lambda) Z\beta + \lambda D^C \quad (7a)$$

when controls are in force and

$$D = Z\beta \quad (7b)$$

when controls are not in force.

Combining (7a) and (7b) and adding a random error u gives:

$$\tilde{D} = (1 - \lambda) Z\beta + \lambda \tilde{D}^C + u \quad (8)$$

where $\tilde{D}$ = D in control periods and = $(1 - \lambda)$ D in off periods

$\tilde{D}^C = D^C$ in control periods and = 0 in off periods

48 We aimed to estimate (8) by an iterative technique which involved first estimating (7a) using data from 'on' periods, constructing D, using the first round estimate of λ ,and then estimating (8) directly. This gives a second round estimate of λ and so on.

49 There is a special case when the procedure breaks down but in which a much simpler technique works. This is when the control bites to the same extent in all 'on' periods. That would occur if the authorities consistently set D^c equal to $Z\beta - c$, where c is a constant. In this case Z and D^c are perfectly correlated, but the dividends equation can then be written:

$$D = Z\beta - (c\lambda).DCON + u$$

50 Where DCON is a simple 1, 0 dummy for 'on', 'off' periods. We attempted both the iterative technique and the restricted version using a 0, 1 dummy; the results are reported in the next section.

51 In addition to these attempts to allow for variations in the impact of controls during the "on" periods we attempted to estimate the extent of any catch up following the abolition of restrictions. We included in our specifications a measure of the cumulative difference between actual dividends and what we estimate dividends would have been with no controls (denoted CUMUL). This measure of the backlog of dividends payments takes on non-zero values only after 1979.II. Since we were uncertain both as to the extent and the timing of any catch up effect we tested various hypotheses. In particular we considered whether any catch up took place only in the first period after controls were lifted or if the backlog of dividends was paid off gradually. We did not constrain catch up effects to equal the cumulative impact of controls from the "on" periods.

SECTION V: RESULTS

52 There are 9142 sample observations, the product of T(14) and N(653). Initially, the Z and X sets of variables were identical though testing down proceeded independently on each equation.

53 Attempts to estimate the dividend equation by the iterative method outlined above did not give encouraging results. Correlation between the maximum dividend payable, D^C, and the other explanatory variables was sufficiently high to give poorly defined coefficients on D^C. Starting with a value for λ of 0.1 the system slowly converged towards a negative coefficient on D^C which was both theoretically implausible and not well defined statistically. Similar results occurred with other starting values. Estimated equations with the simple 0, 1 dividend control dummy worked far better lending some support to the hypothesis that the bite of dividend controls, which we estimate to have been significant, changed little between 1973 and abolition in 1979.

54 Hausman tests for all specifications of both dividends and debt equations decisively rejected the null hypothesis that the firm effects were uncorrelated with the other explanatory variables.(1) This result suggests that the disaggregated equations we estimate are unlikely to be replicated at the aggregate level because of the inability to allow for these company specific factors (see Pakes (1983)).

55 A comparison of $\bar{R}^2$'s suggested that entering tax and interest rate effects linearly, as opposed to in logarithms, was superior though in both cases the differences were very small. It was also clear that proxying gearing risks with interest payments relative to capital employed, rather than relative to income, was superior and that using the dividend yield on equities gave a marginally better fit than using the total yield.

56 In the common general model it was apparent that the effect of leasing rates, of competitiveness, of base rates, and of the Corset (as proxied by a 0, 1 dummy) were weak and poorly defined in both the debt and dividend equations. Omitting these variables from each equation proved easily acceptable. Table 7, column 1, and Table 8, column 1, show the resulting models. It is clear that the exclusion restrictions which these two equations

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(1) Under the null the test statistic is distributed $\chi^2 k$, where k, the degrees of freedom, is equal to the number of slope parameters. The value of the statistic for the specifications in column 2 of Table 8 and 9 were 3200 and 586. (The critical 95% values are around 60.)

TABLE 7

THE DIVIDEND EQUATIONS

Dependent Variable: Flow of Gross Dividend Payments
- Within Estimator with time dummies; company specific variables scaled by inverse of capital employed. (t statistics in parenthesis).

		Common general model (1)		preferred restricted model (2)	
	CTX	-.120	(9.6)	-.117	(9.7)
	ZTAX	1.09	(0.1)		
TAX	IMPT	.070	(5.5)	.070	(5.6)
VARIABLES	MTAX	-.640	(.2)	-.479	(9.4)
	EXH_{-1}	-.011	(1.7)	-.011	(1.7)
	$CTX.EXH_{-1}$	.022	(1.7	.021	(1.6)
	IMEX	.009	(5.1)	.009	(5.0)
	SDBT	-.015	(5.1)	-.018	(9.2)
	SHTD	-.004	(1.2)		
BANKRUPTCY	VARY	-.01	(1.3)		
/RISK	$VARY_{-1}$	-.03	(2.3)	-.028	(2.5)
	LIQA	-.002	(.6)		
	FINA	005	(4.6)	.005	(4.7)
	GILT 5	-.007	(8.1)	-.007	(8.1)
	INTK	-.0006	(1.7)	.0007	(1.9)
COST	DIYL	-.002	(4.9)	-.002	(5.o)
OF	CTGIL	.010	(6.8)	.010	(6.7)
FUNDS	INFL	-.00003	(1.0)		
	CTINF	-.0008	(1.5)	.0003	(1.4)
	PRF	.091	(48.2)	.091	(48.6)
	PRF_{-1}	-.0008	(2 4)	-.008	(2.4)
THE	PRF_{-2}	-.015	(4.2)	-.015	(4.2)
SCALE	TAX	.122	(24.6)	.122	(25.1)
OF	TAX_{-1}	.016	(2.4)	.015	(2.3)
FLOWS	INVT	.006	(7.7)	.006	(7.8)
	ACQS	-.060	(14.5)	-.056	(14.7)
	$INTL_{-1}$	-.018	(.9)		
	HIRL	-.034	(4.5)	-.035	(4.6)
EXPECTATIONS	INVE	-.011	(7.3)	-.011	(7.3)
AND	$GRTH_{-1}$	-.0008	(2.8)	-.0008	(2.8)
ADJUSTMENT	DIV_{-1}	.293	(19.6)	.295	(19.9)
	DIV_{-2}	.100	(6.7)	.100	(6.7)
EXTERNAL	CCC	.022	(7.8)	.022	(15.7)
CONTROLS	DCON	-.009	(3.0)	-.009	(3.0)
	CUMUL	-.360	(21.6)	-.357	(21.7)
$(\text{CAPITAL EMPLOYED})^{-1}$		$-.4(10^{-4})$	(0.1)		

	(1)	(2)
$\bar{R}^2$	0.824	0.825
Residual Sum Squares	1.50249	1.50343
Standard Error	.013342	.013341
Durbin Watson	1.89	1.89
Degrees of Freedom	8440	8447

TABLE 8

THE DEBT EQUATIONS

Dependent Variable: Flow of Debt
- Within Estimator with time dummies; company specific variables scaled by inverse of capital employed. (t statistics in parenthesis).

		Common general model (1)		preferred restricted model (2)	
	CTX	-.001	(.1)	.026	(2.1)
	ZTAX	26.00	(.3)		
TAX	IMPT	.02	(.4)		
VARIABLES	MTAX	-3.40	(.3)		
	EXH_{-1}	- .022	(.7)		
	$CTX.EXH_{-1}$	.040	(.7)		
	IMEX	.016	(1.9)		
	SDBT	-.195	(15.2)	-.195	(15.3)
	SHTD	.283	(17.9)	.283	(18.0)
BANKRUPTCY	VARY	-.089	(2.5)	-.088	(2.5)
/RISK	$VARY_{-1}$	-.023	(.5)		
	LIQA	-.021	(1.8)	-.021	(1.8)
	FINA	-.001	(.2)		
	GILT 5	-.004	(.9)		
	INTK	.001	(.7)		
COST	DIYL	-.001	(.5)		
OF	CTGIL	.003	(.4)		
FUNDS	INFL	-.003	(1.9)		
	CTINF	.004	(1.7)		
	PRF	-.162	(18.8)	- .161	(19.3)
	PRF_{-1}	.025	(1.7)	.023	(1.7)
THE	PRF_{-2}	-.009	(0.5)		
SCALE	TAX	.193	(8.5)	.191	(8.6)
OF	TAX_{-1}	-0.48	(1.6)	-.056	(2.0)
FLOWS	INVT	.264	(75.1)	.264	(75.4)
	ACQS	.119	(6.7)	.119	(6.8)
	$INTL_{-1}$	-.136	(1.5)	-.136	(1.6)
	HIRL	.125	(3.6)	.125	(3.6)
EXPECTATIONS	INVE	.002	(.3)		
AND	$GRTH_{-1}$	.002	(1.8)	.002	(1.8)
ADJUSTMENT	DIV_{-1}	-.04	(.6)		
	DIV_{-2}	.074	(1.0)		
EXTERNAL	CCC	-.005	(.4)	-.006	(1.3)
CONTROLS	DCON	-.005	(.3)		
	CUMUL	.157	(2.1)	.151	(2.1)
$(\text{CAPITAL EMPLOYED})^{-1}$		-.004	(2.5)	-.003	(2.5)
$\bar{R}^2$		.498		.500	
Residual Sum Squares		31.19489		31.2343	
Standard Error		.060808		.06077	
Durbin Watson		1.66		1.66	
Degrees of Freedom		8440		8459	

suggest might be acceptable are different: the majority of the tax rate variables and the interest rate terms are individually insignificant in the debt equation whilst most of these coefficients are reasonably well defined in the dividends equation.

57 Imposing statistically acceptable restrictions to each equation separately resulted in the specifications shown as column 2 of Tables 7 and 8. In general, coefficients are well determined, especially on variables from the companies' own accounts where variability across firms is much larger than for tax and interest rates where variability arises only from differences in company year ends.

58 Lagrange multiplier tests for first order residual correlation suggested no sign of dynamic misspecification.(1) Tests of the stability, over time and across companies, of these two restricted models were undertaken. To assess stability over time the equations were estimated over the first twelve time periods only (1971-1982) and a Chow test performed. A second Chow test, to assess stability across companies, was performed by selecting a random sample of 500 of the firms (according to alphabetic ordering of names) and comparing the result of estimating the model with this sample, over all fourteen periods, with the full sample. With so many degrees of freedom these tests are particularly stringent; but as Table 9 below shows, three out of the four test statistics are acceptable and consistent with the hypothesis that the parameters of the equations are stable. The Chow test suggested some instability over time for the debt model even though the individual coefficients did not appear to change significantly in the sub-period regression.

(1) For Lagrange multiplier tests of first order serial correlation in the error the F statistics were .428 and .471 for dividends and debt respectively. The 95% significance level is 1.0

Table 9: TESTS OF STABILITY

Statistics[1] distributed as F under null with 95% critical value $\simeq$ 1.0

	Dividends	Debt
Estimate over 1971-82 using all 653 companies	.660	4.04
Estimate using 500 randomly selected companies over 1971-84	.780	.760

[1] Statistics are: $$\frac{(RSS^T - RSS^S)/d}{RSS^S/df}$$

where RSS^T = Residual sum of squares from full sample regression; RSS^S = sum of squares from subset of sample; d = difference in degrees of freedom, df = degrees of freedom for sub-sample regression.

The Results in detail

59 We consider the impact of flows of receipts and expenditure, of balance sheet structure, of tax and interest rates and of dividend controls upon the debt and dividend decisions.

Flows of Receipts and Expenditure

60 As expected, higher profits, in the short run, increase the payment of dividends and encourage firms to repay some of their debt [Table 10]. At the margin an extra £ of income increases dividends by around 9p in the short run and by nearly 12p in the long term. This compares with an average ratio of dividends to total income (gross of tax and interest payments) of around .15 and suggests that, relative to the estimation period, in the longer term firms will reduce the level of payments in relation to gross inflows.

61 An extra £ of income is predicted to reduce the stock of debt by 16p in the short run. Although high current profit flows reduce the need for debt finance, higher company income in the recent past (the first lag) seems to increase a firm's confidence

TABLE 10

THE EFFECTS OF CHANGES IN RECEIPTS AND EXPENDITURES ON DIVIDENDS AND STRATEGIC DEBT

pence per additional £1 of expenditure/receipt

	Dividend payments		Stock of strategic debt	
	Short run	Long run	Short run	Long run
Gross profits	9 *	12	-16 *	-70
Investment	1/2 *	1	26 *	135
Financial assets	-6 *	-9	12 *	60
Tax payments	12 *	23	19 *	71
Interest payments	-	-	-14	-70

* estimate statistically significant at the 95% level: Long run responses are calculated, so their standard errors are not applicable.

Sample average of (i) dividend payments is £2.1 mn (ii) stock of strategic debt is £14.9 mn.

in being able to service more debt. In the dividends equation there are also sign reversals on the lags of income flows; this is plausible since a fall in current profits conditional on past levels (ie a negative coefficient on lag income) is likely to reduce marginally the payments of dividends as expectations of future prospects are revised down.

62 Investment expenditure has a powerful impact upon debt flows and a small, though very well defined, impact upon dividend payments. Over one quarter of the extra funds needed to fund capital expenditure, at the margin, is met by new debt issues. A very much smaller proportion (12%) of the cost of acquiring non-physical assets is met by heavier borrowing. Higher investment appears to increase slightly the flow of dividend payments. This is consistent with the argument of Lee and Chang (1985) that companies wishing to invest heavily will need to persuade both shareholders and suppliers of debt that the firm is likely to be profitable; paying higher dividends may give such a sign. Higher acquisitions of non-physical assets, however, reduce the payments of dividends significantly - by almost 6p for each extra £ spent in the short run. This seems plausible since a company's holdings of non-physical assets, eg shares in other companies, are a substitute for the firm's owners holding such assets (and therefore company acquisitions are a substitute for dividend payments) in a way that physical assets are not. It does, however, suggest that just as physical investment may not be (weakly) exogenous with respect to debt flows, non-physical investment may not be (weakly) exogenous in the dividends equation.

63 Although there are severe problems involved in undertaking exogeneity tests, since these involve estimating a well specified subsidiary equation for each variable whose exogeneity is in doubt, we attempted these tests with physical and non physical investment. It proved hard to find meaningful subsidiary equations for either flow and the tests are, consequently, weak. Including residuals from the subsidiary regressions in both the debt and dividend equation (Hausman (1978)) gave mixed results. Physical investment appeared exogenous with respect to dividends, but not with respect to debt flows, while non physical investment

seemed exogenous with respect to debt but not to dividends. Instruments for the flows of investment were sufficiently poor that instrumental variable estimation gave implausible results.

64 The estimated model suggests that firms which expect to undertake higher investment in future periods, other things being equal, reduce current dividend payments. The effects are not large (at most 2p for each £1 of planned future expenditure) but are statistically precise. They suggest that the expectation of a higher requirement for funds in the future encourages firms to pay less out now but not to alter significantly their use of debt finance. In turn this suggests that the expectation of higher future investment may encourage firms to build up liquid assets in the short term.

65 The impact of tax and interest payments upon financial flows are powerful though in some cases puzzling. Higher tax payments, in the short run, need to be financed and the flow of debt, at the margin, increases by 19p for each extra £ going to the Revenue. In the longer term higher tax payments represent a reduction in available income (and thus the ability to service debt) and increase the company's incentive to issue less debt slightly offsetting the direct, short term effect. The scale of debt servicing costs are more directly measured by the lags of interest payments, higher levels of which are predicted to reduce the flow of debt and the level of dividend payments.

66 One puzzle here is that higher tax payments, both current and lagged, appear to increase the level of dividends, and by large amounts. There are two plausible arguments. First, it seems likely that one of the best indicators of whether a company is tax exhausted is its actual level of tax payments; a company with high payments is less likely to be tax exhausted and consequently more likely to be able to offset ACT, thus giving an incentive to distribute income. The second argument is that we have not taken proper account of the endogeneity of total tax payments by only subtracting irrecoverable (as opposed to unrecovered) ACT[(1)]. If this is so, instrumenting current tax payments should at least

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(1) This argument would not explain the positive impact of past tax payments on current dividends.

reduce the coefficient in the dividends equation. In fact when we attempted to instrument tax payments this did not happen and an exogeneity test suggested that tax payments were weakly exogenous with respect to dividends. We conclude that the tax exhaustion story is the more plausible.

67 Although the leasing rate proved insignificant in both equations, the flow of rental payments on hired capital was clearly relevant. The higher are rental payments, for given levels of profit, the lower are dividend payments and the greater the reliance upon debt finance.

68 Company size (as measured by the reciprocal of capital employed) had a significant effect on debt flows with larger firms, other things equal, borrowing more than small firms. This is consistent with the evidence presented in Section I of higher gearing for larger companies.

Risk and Dynamic Adjustment

69 Re-writing the debt equation in stock terms gives a lagged dependent variable with a coefficient of around 0.8. The dividends equation has well defined effects from the first two lags of dividends with the sum of the coefficients around 0.4. Thus the equations display significant lags with a major part of the effect of a change in a current dated variable still to come through after two years. This slow response is plausible in the case of dividends but more surprising with debt. The coefficients on the stock of debt are, however, very well determined in both equations with higher stocks reducing both debt flows and dividend payments. In the case of dividends it is the stock of total debt (short term plus long term) which is negatively linked to payments. A one percent point rise in total debt is predicted to reduce the flow of dividend payments by around 8% in the following period. The maturity composition of total borrowing is important in determining the impact of the balance sheet position upon flows of medium and longer term debt. Higher outstanding stocks of short term debt encourage issues of longer term debt as companies aim to reschedule their portfolio and increase average debt maturity.

70 Higher stocks of longer term debt, however, reduce the attractiveness of funding current requirements by more debt issues; this is a plausible correction mechanism and one which yields a long run stock solution to the debt equation.

71 Companies feel more able to pay higher dividends if their holdings of less liquid financial assets are high. A £ rise in holdings of gilts and shares, for example, will increase dividends by around 1p in the long run. Whilst dividends did not seem to be significantly affected by holdings of more liquid financial assets (cash, deposits, treasury bills), there was a clear impact of liquid assets stocks upon borrowing. An increase of £ in stocks of liquid assets was predicted to reduce the stock of debt by around 10p in the long run. Less liquid financial assets had no significant effect in the debt equation.

72 Variability in earnings, (proxied by VARY), has a well determined, negative impact upon both flows. The effect of a permanent 20% rise in this (rather crude) measure of risk is to reduce the stock of debt by around 0.5%. The flow of dividend payments falls by only 0.2%. Rapid growth has a further, negative impact on dividends with a rise in the rate of change of total capital employed from 10% to 15% reducing dividends by 1/4% in the long run. Such an increase in growth, if sustained, would increase reliance upon debt significantly with capital gearing predicted to be around 4% higher. This seems intuitively plausible with firms likely to be more confident about their ability to service debt the higher is recent growth.

Interest Rate and Tax Rate Effects

73 The pattern of responses to tax and interest rate effects revealed by the equations of Tables 7 and 8 is complex. Coefficients on the tax rates, and especially on the corporation tax rate, are well defined and, in case of dividends, the effects of interactive terms between tax and interest rates and between tax rates and the tax exhaustion dummy are significant(1).

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(1) This is in contrast to the recent finding of Edwards et al (1985) that in a model of dividends, estimated using company accounts data, tax effects were poorly determined when time dummies were included in the model.

74 It is difficult to untangle the net effect of isolated interest rate or tax rate changes because of these interactive terms. Table 11 shows the long run semi-elasticities of dividend payments to changes in tax and interest rates. We have calculated the impact of tax rates by setting interest rates at their average levels over 1971-1984, and vice versa. We also considered alternative assumptions in assessing the impact of the interactive effects.

75 The results proved very sensitive to the point at which the semi elasticity is calculated and need to be interpreted with great care. At average levels of interest rates, changes in the corporation tax rate have only a small net effect upon dividend payments. When the 5 year gilt rate is as little as one percentage point beneath its mean level, however, a reduction in the tax rate from .50 to .40 is predicted to increase the level of dividend payments, in the long run, by 8.0%. This reflects the net result of a powerful negative effect of the level of the tax rate and an offsetting, positive effect of the product of the tax and interest rate. That these two effects are offsetting is not implausible: given the time lags (sometimes as long as several years) between the accrual of a tax deductible expense and its use the higher is the discount rate then the lower should be the impact of a particular tax rate. Clearly this can be offset by a higher level of the tax rate.

76 Cutting the corporation tax rate from .5 to .4 is estimated to reduce the stock of debt by about 10% in the long run. It should be noted that this tax rate coefficient is not very well determined. Nonetheless the qualitative result that dividend and debt flows tend to respond in different directions to corporate tax rate changes is noteworthy. Changes which make debt relatively less desirable (a cut in rates), and therefore make equity finance relatively more attractive, encourage higher dividend payments. This might be due to a desire by the firm to make its equity more attractive to suppliers of funds.

77 As expected, reductions in the imputation rate reduce dividends; the effect is powerful. Reductions in shareholders' estimated average marginal income tax rates have an offsetting

Table 11 Effects of Tax and Interest Rate Changes on Dividends[1]

	Long Run Change in Dividends
Cut in corporate tax rate from .50 to .40	
a) with GILT5 at average rate (11.2%)	+ 2.4%
b) with GILT5 at 10%	+ 7.9%
c) with GILT5 at 12%	- 1.4%
Cut in imputation Rate from .33 to .30	-10.1%
Cut in marginal income tax rate from .30 to .29	+21.0%
Company becomes tax exhausted	
a) at average tax rates	+ 4.0%
b) at current tax rates	- 7.1%
gilt rate (5 year) up 1.0%:	
a) at average tax rates	- 9.2%
b) at current tax rates	-15.1%
interbank rate up 1% (relative to GILT5)	+ 3.2%
dividend yield up 1% (relative to GILT5)	- 9.2%

1 The table shows the impact of changing tax and interest <u>rates</u> holding the levels of tax payments and of interest payments constant. They therefore represent substitution effects.

effect and this is, somewhat implausibly, even stronger; we are doubtful that the coefficient purely reflects tax changes because the MTAX variable is very strongly trended (downwards) and could be picking up the influence of any trended omitted variables.

78 At current tax rates a company which becomes tax exhausted is predicted to reduce dividends by 7.0%. It is puzzling that at higher rates tax exhaustion seems to have less effect on dividends.

79 Increases in long term rates appear to reduce dividend payments substantially whilst increases in short rates relative to long rates raise the payout ratio. This result proved to be unstable across split sample regressions and we are wary of any firm conclusions.

80 To sum up: Dividend payments seem more sensitive than debt flows to tax and interest rates, and to the tax paying status of the company. The net effect of changes in rates upon dividend payments is often highly sensitive to the point of departure and exact, quantitative predictions about the effects of the major tax changes announced in the 1984 budget cannot sensibly be made. Nonetheless, the model does suggest that the kind of reduction in the company tax rate which has occurred since 1984, and the likely reduction in the extent of tax exhaustion, might cause a significant long term reduction in debt gearing and an increase in dividends.

Dividend and Lending Controls

81 The introduction of dividend controls appears to have had a very large impact upon dividend payments. The impact effect is estimated to have reduced payments by around 20%; the longer term effect is twice as large. This evidence is consistent with that presented by Poterba (1984) who estimated that gross dividends paid by companies may have been reduced by up to 50% as a result of controls. No significant effect of dividend controls upon borrowing was found.

82 The results suggest that the cumulative divergence between actual dividend payments and desired payments which dividend controls caused was more than made up for in the post-1979 period. The catch-up period was lengthy and we could easily reject the hypothesis that the lost dividends were re-couped within one, and even two, years. We estimate that around a third of the backlog of real dividends was paid off in each of the years following the abolition of controls; thus over 150% of the estimated effect was regained by 1984. The fact that companies appear to have more than made up for the effect of dividend controls may, in large part, just reflect shareholders' discount rates. The average lag between controls biting and firms paying back the "lost" dividends is just over six years. With a real discount rate of 5% shareholders would need to receive, in real terms, almost 140% of the total "lost" dividends to feel no worse off. Our estimates suggest that companies actually paid more than would have been necessary to compensate shareholders at a discount rate even as high as 5%. Firms were apparently keen to more than make up for the relatively low payout ratios of the 1970's. This in turn might reflect worries about the reintroduction of controls at some point in the future.

83 Although dividend controls appeared to have no significant impact on debt financing, the payment of extra dividends in the post control period appears to have marginally reduced reliance on debt. This is a puzzle. The effect is, however, not very well defined and the exclusion of the relevant variable has no impact on the other coefficients in the debt equation.

84 The Corset appeared to have no discernable effect upon either debt or dividends though the introduction of Competition and Credit Control did.(1)

Diversity in Responses across Companies

85 The stability tests reported above summarise the effect of estimating the equations over sub-periods and over random subsamples of companies. We also tested whether there were

(1) There is a problem, however, in interpreting the CCC dummy since it is almost perfectly correlated with the time dummy for 1971 and the latter had to be dropped to allow matrix inversion.

systematic differences in behaviour between different types of company by splitting the sample first according to company size and then by reference to the rate of growth of the firm's capital employed. Table 12 shows the results of testing for equality of slope parameters across those subsamples.

86 The most significant differences in behaviour across companies, in terms of differences in key parameters, occurred when the sample was split into above and below average company size, though the test statistics more clearly reject the hypothesis of coefficient equality across firms with different growth rates. The important differences in behaviour between large and small firms are common to the debt and dividend equations. Small companies appear more concerned about capital gearing and variability in company income, reducing dividend payments and debt finance by significantly more than larger firms when these measures of risk rise. Larger firms appear to pay out more of their income in dividends, and use less to pay off debt, than smaller firms. The larger companies also finance more of their investment expenditure from debt (39% against 26%). Coefficients on tax rates, interest rates and on tax payments also seem to differ across companies with larger firms generally responding more to changes. However, some of these tax and interest rate effects are not very well determined in the sub-regressions though the semi-elasticities remain large and highly sensitive to the point at which they are calculated.

87 Differences in behaviour between companies of above and below average growth are much less easy to summarise and it is difficult to draw any conclusions that are simultaneously general and interesting. It is clear that there are certain differences between companies, but this is only to be expected with such a large sample. Splitting the sample by growth performance did suggest some problem with coefficients on the acquisition of non physical assets and on current tax payments as these change dramatically between the two types of firm. This suggests to us that endogeneity problems may remain, despite the weak evidence reported above to the contrary.

TABLE 12 Tests of Parameter equality

(across large/small and fast growth/slow growth firms.)

	Dividends		Debt	
	Test 1	Test 2	Test 1	Test 2
Split by Company Size	.37	3.64	.534	2.93
Split by Company Growth Rate	2.92	20.00	5.08	8.87

Notes: test statistic 1, under the null, is:

$$\frac{(RSS^{T} - RSS^{SM})/NL}{RSS^{SM}/(NS-K)} \sim F\ (NL,\ NS - K)$$

test statistic 2, under the null, is

$$\frac{(RSS^{T} - RSS^{SM} - RSS^{LG})/K}{(RSS^{SM} + RSS^{LG})/NL + NS - 2K} \sim F\ (K,\ NL + NS - 2K)$$

where NS = no of small (low growth) company observations.[1]

NL = no of large (high growth) company observations.[1]

RSS^{T} = Residual sum of squares using whole sample;

RSS^{SM} = Residual sum of squares using small (low growth) firms

RSS^{LG} = Sum of squares using firms of above average size (growth rate);

K= no of slope parameters

Both statistics can be used to test the same null hypothesis of parameter equality. The 95% (99%) critical value for test 1 is $\simeq$ 1(1) and for test 2 is 1.4(1.6).

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1 Equal to the number of such firms multiplied by (T-1) where T is the number of time periods.

Conclusions

88 Our aim has been to estimate the prime determinants of the debt and dividend payments decisions of companies. In constructing a model of these key financial decisions we have been able to judge between different, and sometimes mutually exclusive, theories of company finance. We have also assessed how behaviour appears to vary across companies. Along with the non-linear nature of the basic model, these differences across firms mean that the results could not be obtained using aggregate data. It also means that no simple conclusions about aggregate behaviour emerge, though the assessment we make of the relative strength of different theories does make possible some broad judgments on aggregate developments.

89 Four types of model, which often overlap, were identified at the outset: those that generate irrelevance results for finance decisions; those that focus on the tax incentives for favouring certain form of finance; theories that stress the smoothing and signalling role of dividends and theories which make a firm's attention to the risks of default and bankruptcy the dominant factor in its debt and dividend behaviour. We have found evidence that there is some truth in three of these theories though the irrelevance propositions find little support: we have constructed models with well defined coefficients which fit the past well, given the nature of the data. Measures of capital and income gearing and proxies for income variability have proved significant and suggest that considerations of risk are central to financing decisions. Long lags of company income and of dividend payments were found to be relevant in determining current flows suggesting that smoothing of payments is a common phenomenon. Powerful effects of changes in tax rates and of interest rates were apparent though the interaction of the two made it difficult to derive simple predictions about the impact of changing rates; one thing was clear, namely that the effect of relative prices is made considerably more complex by the existence of tax exhaustion. However, the difficulties we have had in accurately measuring tax exhaustion mean that we cannot claim to have modelled the effect of the tax system with great precision; more work is called for here.

90 We estimate that dividend controls had a major impact upon dividend payments both during and after their period of operation. We also found that there was a significant overlap between the factors influencing debt and dividends. The advantage of estimating the two company financial decisions alongside one another lies in being able to assess the extent of this overlap. Where there are factors which influence debt flows but not dividends (the maturity structure of the stock of debt, the level of past interest payments and the extent of liquid asset holdings), or dividends but not debt (interest rates, some tax rates), it is plausible that equity issues might absorb the impact of an isolated change in one of the other flows. Thus far we have not directly estimated a model of equity issues, primarily because of the problems of using least squares estimation with so many zero entries amongst the new issues data. We do, however, believe that this data set could be used in future work to throw more light upon companies' use of equity finance.

ANNEX

TABLE 1A

THE SAMPLE OF COMPANIES:

Sector	Number of firms
Brewers and Distillers	25
Building	40
Chemicals	21
Commodity	7
Contracting	38
Electricals	16
Electronics	9
Food Mfg	25
Food Retailing	7
Health and H'Hold	6
Leisure	29
Mech Engineering	102
Metals and Forming	36
Mining Finance	2
Miscellaneous	53
Motors and Distrib	30
Newspapers and Publ	17
Office Equipment	5
Oil	9
Other Cons Goods	27
Other Ind Mtrls	11
Packaging and Paper	20
Shipping and Trans	16
Stores	43
Textiles	58
Tobacco	1
Total	653

Distribution of Companies by size

Value of stock of adjusted total liabilities in 1984 £mn	Number of firms
0-5	107
5-10	95
10-20	106
20-30	65
30-40	39
40-50	29
50-100	75
100-200	43
200-300	20
300-400	10
400-500	9
500-700	16
700-1,000	11
1,000-3,000	23
3,000-7,000	3
7,000-11,000	1
> 11,000	1
	653

1 minimum = £.4 m
maximum = £15,683 m
mean = £180.9 m

TABLE 2A

SAMPLE SUMMARY STATISTICS

N = 653 companies, T= 14 time periods 1971-1984 £mn (except tax and interest rates)

Variable	Full sample mean	Full sample variance	1984 values mean	1984 values variance	1984 values minimum	1984 values maximum
Dividend payments	2.1	115	4.0	292	0	308
Flow of all debt	2.4	497	6.2	1719	-103.9	576
Flow of short term debt	0.7	93	1.8	213	-164.7	239.2
Flow of strategic debt	1.7	306	4.4	1228	-90.6	718
profits	19.4	15452	37.5	48925	-11.1	4911.0
total investment	11.3	4419	24.4	18335	-9.1	2965.1
expected investment	4.1	928	11.2	3353	0	1145
tax payments	3.6	1037	5.7	820	-3.9	480.9
equity issues	1.0	55	2.1	120	-0.2	138.2
stockbuilding	2.9	357	6.3	1243	-33.8	697.0
total interest charges	2.5	127	4.6	328	0	280
irrecoverable ACT	0.1	3	0.1	2	-11.4	1415
Stock of total debt	21.7	12788	37.5	34803	0	3762
stock of short term borrowing	6.7	1036	12.4	3086	0	1032
Stock of strategic debt	14.9	7015	25.1	18013	0	2730
stock of capital employed	96.9	209464	180.9	624968	0.4	15683
Corporation tax rate	0.49	0.007	0.46	0.0004	0.30	0.52
Imputation tax rate	0.26	0.01	0.3	0	0.3	0.3
Capital Gains Tax rate	0.15	0.001	0.24	0	0.24	2.4
Interbank rate	10.98	8.5	9.76	0.03	9.42	9.95
Bank rate	10.56	8.02	9.46	0.04	9.08	9.67
5 year gilt rate	11.2	4.8	9.46	0.04	9.08	9.67
Leasing rate	8.85	3.17	6.01	0.57	5.22	7.57
Dividend yield	5.4	1.5	4.47	0.0004	4.45	4.50
Equity earnings	13.5	24.2	10.3	0.07	9.8	10.6

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