



Working Paper no. 276

Corporate expenditures and pension contributions: evidence from UK company accounts

Philip Bunn and Kamakshya Trivedi

October 2005

Bank of England

Corporate expenditures and pension contributions: evidence from UK company accounts

*Philip Bunn**

and

*Kamakshya Trivedi***

Working Paper no. 276

* Macro-Prudential Risks Division, Bank of England, Threadneedle Street, London EC2R 8AH.
Email: philip.bunn@bankofengland.co.uk

** Macro-Prudential Risks Division, Bank of England, Threadneedle Street, London EC2R 8AH.
Email: kamakshya.trivedi@bankofengland.co.uk

The views expressed in this paper are those of the authors, and not necessarily those of the Bank of England. We would like to thank Ian Bond, Lucy Chennells, Prasanna Gai, Patricia Jackson, Merxe Tudela, Garry Young, two anonymous referees, and seminar participants at the Bank of England, the WPEG conference (York), and the International Finance conference (Copenhagen) for helpful comments. The standard disclaimer applies: responsibility for errors and omissions rests with the authors. This paper was finalised on 15 August 2005.

The Bank of England's working paper series is externally refereed.

Information on the Bank's working paper series can be found at
www.bankofengland.co.uk/publications/workingpapers/index.htm.

Publications Group, Bank of England, Threadneedle Street, London, EC2R 8AH; telephone +44 (0)20 7601 4030, fax +44 (0)20 7601 3298, email mapublications@bankofengland.co.uk.

Contents

Abstract	3
Summary	4
1 Introduction	6
2 Economic background	7
3 Research design	11
4 Data	16
5 Econometric results	18
6 Conclusion	27
7 Appendix	28
References	36

Abstract

This paper examines how corporate behaviour is related to financial pressure, where the financial pressure is on account of pension contributions to the company pension scheme. Using a large panel of quoted non-financial UK firms from 1983-2002, we estimate generalised methods of moments models for dividends and investment. Our results suggest that dividends are reduced in response to higher pension contributions. There is only weak evidence of any impact on investment. Companies that seek to tackle underfunding of defined benefit pension schemes by raising their contributions could pay lower dividends than they would have otherwise.

Key words: Financial pressure, balance-sheet adjustment, pension contributions.

JEL classification: G35, G31, G23.

Summary

Understanding how companies react to financial pressures is an important academic and policy concern. Apart from being relevant to any comprehensive appreciation of corporate behaviour, the ways in which companies adjust their balance sheets and the size of those responses are also inextricably linked to financial stability risks. In this paper we focus on one specific source of financial pressure - contributions to company pension schemes - and investigate the empirical relationship between corporate expenditures and variation in pension contributions within a panel of non-financial UK firms.

Contributions to fund shortfalls in defined benefit pension schemes are a useful example of financial pressure because these must often be made by the sponsoring companies in line with regulatory requirements, and therefore constitute a relatively exogenous source of variation in internally generated finance. The presence of a budget constraint implies that such contributions to the pension scheme divert cash from alternative uses such as dividend payouts or investment. If a firm is financially constrained, or if external finance is costly, pension contributions could force a company to cut dividends and/or not make investments it might otherwise have pursued. Indeed, if the funding positions of pension schemes are related to the stock market (say because they are all exposed to similar equity markets) then financial pressures may affect many companies at the same time, and individual company level responses may add up to large systemic effects.

The recent financial difficulties of company pension schemes resulting from falling asset values and declining interest rates have been highlighted by the introduction of new accounting standards such as FRS 17 in the United Kingdom. There have been many estimates of the magnitude of these difficulties, but they all imply that an economically significant increase in pension contributions would be required by sponsoring companies to eliminate the current deficits faced by defined benefit pension schemes in the absence of a sustained rise in the stock market. The results of this paper can therefore be used to inform an assessment of the possible implications of these increases in contributions for company balance sheets.

Using a panel of quoted non-financial UK companies between 1983 and 2002 we estimate generalised methods of moments models for dividends and investment based on those in the existing literature. The main innovation of this paper is to augment these models with a measure

of company pension contributions. Our results suggest that firms pay lower dividends than they would have otherwise done in response to increases in pension contributions, controlling for other components of the balance sheet such as capital, cash flow, debt and investment. Dividends have a similar elasticity with respect to pension contributions as cash flow; this is plausible because pension contributions are effectively reductions in corporate cash flow. But this marginal effect implies that dividends are not reduced in response to higher pension contributions on a one for one basis, and therefore in the presence of a binding budget constraint there may also be further adjustment through other channels such as investment, debt or equity issuance. Empirically we find only weak evidence that firms reduce their investment in a statistically significant way as pension contributions rise. This result implies that adjustment to company balance sheets on account of increased financial pressure from higher pension contributions comes mainly through financial rather than real channels.

1 Introduction

'In countries where companies pay pensions ..., balance sheets will come under immense pressure'

–From *The Economist's* survey of Retirement, 27th March 2004.

Understanding how companies react to financial pressures is an important academic and policy concern. Apart from being relevant to any comprehensive appreciation of corporate behaviour, the ways in which companies adjust their balance sheets and the size of those responses are also inextricably linked to financial stability risks. In this paper we focus on one specific source of financial pressure – contributions to company pension schemes – and investigate the empirical relationship between corporate expenditures and variation in pension contributions within a panel of non-financial UK firms.

Contributions to fund shortfalls in defined benefit (DB) pension schemes are an example of financial pressure because these must often be made by the sponsoring companies in line with regulatory requirements, and therefore constitute a relatively exogenous source of variation in internally generated finance. The presence of a budget constraint implies that such contributions to the pension scheme divert cash from alternative uses such as dividend payouts or investment. For concreteness, if a firm is financially constrained, or if external finance is costly, pension contributions could force a company to cut dividends and/or investment it might otherwise have pursued.⁽¹⁾ Indeed, if the funding positions of pension schemes are related to the stock market (say because they are all exposed to similar equity markets) then financial pressures may affect many companies at the same time, and individual company level responses may add up to large systemic effects.

The recent financial difficulties of company pension schemes – precipitated by falling stock markets and declining interest rates in 2000-02 – have been highlighted by the increased transparency in company accounts disclosures induced by new accounting standards such as FRS 17 in the United Kingdom. There have been many estimates of the magnitude of these difficulties, but they all imply that an economically significant increase in contributions would be required to

(1) In the limit, financial pressures may also affect the probability of default on other types of corporate debt.

eliminate pension scheme deficits in the absence of a sustained rise in the stock market. For example, in July 2003 the CBI estimated that the aggregate deficit of UK private non-financial companies (PNFCs) was £160 billion.⁽²⁾ Furthermore, they expect that PNFCs employers' total annual pension contributions would more than double between 2001 and 2005, from £21 billion a year to £43 billion a year. By contrast, the total dividend payout for PNFCs in 2003 was about £56 billion.⁽³⁾ So if some proportion of these estimated increases in pension contributions were realised, they would represent a significant drain on corporate cash.

Our empirical results suggest that there is a negative and statistically significant relationship between pension contributions and dividends. The estimated relationship is robust to the inclusion of other determinants of dividend payouts that are considered in the literature (Benito and Young (2002) and Auerbach and Hassett (2002)). By contrast, we find only weak evidence that increases in pension contributions have any impact on investment, suggesting that firms prefer to make the required balance-sheet adjustment using financial rather than real variables.

The remainder of this paper is organised as follows. Section 2 explains the economic background, and describes a theoretical framework to motivate the subsequent econometrics. Section 3 discusses the research design in greater detail, in particular the regulatory environment governing corporate pension schemes, the empirical specifications, and the econometric techniques used. Section 4 contains a description of the data. Section 5 presents the estimation results for models of dividends and investment. Section 6 concludes.

2 Economic background

Despite the widespread academic and popular interest in the financial aspects of occupational pensions, there has been little work as yet on the empirical relationship between pension contributions on the one hand, and corporate expenditures on the other. Rauh (2003) examines the sensitivity of investment to cash flow: a discontinuity in funding rules allows him to simulate mandatory pension contributions and analyse the relation between financing constraints and investment in a panel of US firms. Its chief result is that capital expenditures display a strong negative correlation with mandatory pension contributions. Our paper is also related to research

(2) For more details and calculations see 'Focus on investment: the impact of pension deficits', *Economic Brief* by the CBI (2003).

(3) ONS *Blue Book* (2004).

on investment and dividend policy such as Blundell *et al* (1992) and Bond *et al* (1996), and to more specific research on the role of general financial pressure as well (Nickell and Nicolitsas (1999), Benito and Young (2002) and Benito (2004)). None of this research considers the role of contributions to company pension schemes. The use of this relatively exogenous source of financial pressure is the chief innovation in this paper.

To motivate our empirical strategy, the rest of this section explains the role of pension contributions within the framework of a corporate budget constraint, following the approach of Benito and Young (2002). All corporate expenditure decisions, irrespective of their motive are bound by the budget constraint that links the sources of funds with their uses:

$$b_{t+1} = b_t + p_t^i i_t + d_t - (1 - \tau)(\pi_t - r_t^b b_t) - (1 - f)n_t \quad (1)$$

The budget constraint shows that the change in debt between period t and $t + 1$, $(b_{t+1} - b_t)$, must be equal to investment (p_t^i is the price of investment goods and i_t is the volume of investment goods purchased⁽⁴⁾) and dividends (d) minus new funds raised from post-tax profits $(1 - \tau)(\pi_t - r_t^b b_t)$, where τ is the corporation tax rate, π_t is nominal profits, and r_t^b is the effective interest rate on debt) and equity issuance (n is the value of new shares issued and f is the cost of issuing a unit of equity).

To incorporate pension contributions explicitly into this budget constraint, nominal profits can be broken down into sales (s) minus labour costs other than pension contributions (w), pension contributions (pc) and non-labour costs of production (nlc).

$$\pi_t = s_t - w_t - pc_t - nlc_t \quad (2)$$

Substituting (2) into (1) and re-arranging for dividends and investment, $(p_t^i i_t + d_t)$, gives (3).

$$(p_t^i i_t + d_t) = (1 - \tau)[s_t - w_t - nlc_t - r_t^b b_t] - (1 - \tau)pc_t + (b_{t+1} - b_t) + (1 - f)n_t \quad (3)$$

Equation (3) can be used to spell out the key ideas of our paper. Companies that have committed to provide DB pension benefits to retired workers are required to increase their contributions (in line with regulatory requirements) following periods when scheme assets are unexpectedly low (eg because of stock market weakness) or when liabilities turn out to be unexpectedly high (eg

(4) For this purpose investment can be thought of as both the creation of new capital (for example building a new factory) and the acquisition of existing capital (for example if one firm buys a firm that already owns a factory and then uses that factory itself).

because of revisions to life-expectancy). Equation (3) shows that holding a company's equity and debt constant, if pension contributions increase then there must be some adjustment to the balance sheet and either investment or dividends, or both must fall.⁽⁵⁾ The other alternative is to increase profits (by increasing sales by more than the costs of production other than pension contributions), but under the standard assumption that profits are already being maximised this will not be possible.⁽⁶⁾

Of course, adjustment could also come in the form of providing less generous pension schemes or switching from defined benefit to defined contribution pension plans, so that nothing else in equation (3) needs to change. However, any such decision may be constrained because firms have to compete for employees in a labour market. Besides it is difficult for companies to change previously contracted pension arrangements quickly, and changes typically only affect new employees. Consequently, it may take many years – up to a couple of decades – for the original equilibrium total compensation to be restored. Therefore, the empirics in our paper should be read as investigating how firms respond to financial pressure in the short to medium term, where an unexpected increase in the cost of meeting previous commitments to provide DB pensions is the proximate source of financial pressure.

Is the response more likely to come through dividends or investment? Under the Modigliani-Miller theorem, investment decisions are not affected by financing considerations, and therefore adjustment should take place through financial channels such as dividends rather than real channels, although this adjustment would have no effect on overall company valuations. There are however a number of models in the literature that relax the Modigliani-Miller assumptions of no taxes, asymmetric information or agency problems which may explain how adjustment could take place through real channels.

The first set of relevant literature is that on corporate capital structure. This has two main strands: those associated with the 'trade-off' and 'pecking order' theories, see Myers (2001) for a survey.

(5) Assuming that the dividend constraint does not bind and the firm is currently paying a dividend. There are also upper limits on dividend payments to prevent firms unduly weakening their capital base.

(6) In fact, Nickell and Nicolitsas (1999) find empirical evidence that financial pressure does have a significant effect on employment, wage growth and productivity, which in turn could lead to an effect on profitability. Detragiache (2003) develops a theoretical model which suggests that increased pension contributions can only have a second-order effect on labour demand if lower cash flows and poor access to external capital markets cause firms to reduce real activity. There should be no direct effect since the marginal cost of labour is not affected by losses on accrued liabilities.

Under the ‘trade-off’ model firms have an optimal level of debt that is determined by trading off the benefits of debt against the expected costs of financial distress. Debt is beneficial because of the tax advantage that arises due to differences in the rate at which income is taxed at the corporate and shareholder level, partly due to the tax deductibility of corporate interest payments (Auerbach (2002)) and because asymmetric information may mean that equity issues are undervalued by outside investors (Myers and Majluf (1984)). Debt also reduces the surplus cash at the disposal of management (Jensen and Meckling (1976)) and does not dilute control rights in the way equity issues do (Hart (2001)). The expected costs of financial distress rise with the level of debt as taking on more debt increases the probability of a firm experiencing distress.

The ‘pecking order’ model of Myers and Majluf (1984) asserts that borrowing is always preferred to new equity issues because all other costs and benefits of holding debt are second order in relation to the effects of asymmetric information on the terms and conditions of equity finance. Therefore, there is no equilibrium level of debt and ‘changes in debt ratios are driven by the need for external funds, not by an attempt to reach an optimal capital structure’ (Shyam-Sunder and Myers (1999)).

An increase in pension contributions should not affect the optimal level of debt implied by the ‘trade-off’ theory, therefore we might expect adjustment to higher pension contributions to take place through lower dividends and possibly lower investment (or higher equity issuance). However, if defined benefit pension scheme deficits are treated as a debt-like obligation and are therefore included along with on-balance sheet debt as a component of total debt, an increase in pension contributions that reduces pension deficits may result in firms taking on more on-balance sheet debt as they substitute that for off-balance sheet debt. The implication of the ‘pecking order’ theory is that if pension contributions increase, unless they are fully offset by lower dividends, a firm will have less internal finance available to finance investment and they will increase their demand for external finance. This may mean firms take on more debt, although if external finance is costly so that it leads to an increase in the cost of capital, investment will be lower than it would otherwise have been.

The ‘new view’ of corporate behaviour developed in the tax literature, originally by King (1977) and Auerbach (1979) and surveyed recently in Auerbach (2002), suggests that adjustment is most likely to take place through changes in dividend payments. Differential taxation of corporate and

personal income causes companies to have a definite preference for one form of investment finance over another, which may affect the cost of capital and consequently their real investment decisions. 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 predicted by the traditional view. In the strict version of this approach dividends should adjust instantaneously as the residual item, but asymmetric information could lead to some stickiness because of the signalling implications of cutting dividends (see Lintner (1956)), and therefore there may be need for adjustment through other channels as well as dividends.

Overall, economic theory suggests that adjustment could take place through a number of different mechanisms. Adjustment of dividends is consistent with most of the literature, but there are theories that would also be consistent with adjustment of investment, equity issuance and debt. In this paper we focus on adjustment to corporate outlays – in particular expenditures on dividends and investment, but we also control for the levels of debt and capital on the right-hand side. The empirics investigate which of these expenditures firms adjust in practice.

3 Research design

In this section we describe key elements of our research strategy. We start by describing the regulatory environment governing pension plan funding in Section 3.1. This clarifies the important legal and regulatory details which influence the determination of the level of employer pension contributions, and also explains why pension contributions are likely to constitute a relatively independent or exogenous source of financial pressure on companies. Next, in Section 3.2, we specify the primary empirical specifications used for models of dividends and investment. The section also describes and motivates the econometric techniques used in the subsequent analysis.

3.1 Regulatory environment

The vast majority of UK defined benefit (DB) pension schemes are set up as ‘trusts’, which keep the scheme assets separate from those of the employer and ensure that third-party beneficiaries such as dependents of members have legal rights.⁽⁷⁾ There is no one statute that lays down trust

(7) Davis (2000) remarks that such *independent* trusts offer extra protection against creditors of a bankrupt sponsoring firm, compared to arrangements where the pension fund is part of the balance sheet such as for reserve funding in Germany.

law. Rather it is primarily judge-made case law – the principles of what a trustee must or must not do have been spelt out in court cases at different times. These principles form a key part of the regulatory environment governing pension plan funding, and were especially important before more explicit guidance and regulation was introduced by the Pensions Act (1995). For example, Davis (2000) notes that trustees of an occupational pension fund are bound by their duty of care to ensure that adequate funding is in place. Besides, the sponsoring employer is also party to the trust, and one of the conditions of Inland Revenue approval of a pension scheme is that the employer must commit to pay contributions to the scheme.⁽⁸⁾ This does not preclude the possibility of a contribution holiday when a surplus exists in a scheme, but it does mean that the employer must carry a substantial burden of the cost of the scheme benefits, or administration or both.

The funding requirements and role of trustees were further clarified in the Pensions Act (1995) which specifically introduced the Minimum Funding Requirement (MFR). It requires that trustees of defined benefit and hybrid occupational pension schemes must obtain, broadly every three years, a minimum funding valuation – which shows how the assets of the scheme compare with scheme liabilities calculated on prescribed assumptions. According to Davis (2000), the calculations are made on the assumption that the funding level would be sufficient, if the scheme is wound up, to buy out pensioner benefits with an insurance company, and provide non-pensioners with a fair actuarial value of their accrued rights that may be transferred to an alternative pension vehicle. Following such a valuation, the trustees must agree with the employer, and then maintain a schedule of contributions. The scheme actuary must certify that such contribution rates are adequate to maintain a 100% MFR funding level throughout the next five years in the case of a scheme fully funded on MFR assumptions, or to achieve a 100% MFR funding level by the end of ten years in other cases. Furthermore, where schemes were less than 100% MFR-funded, annual certificates giving the actuary's updated opinion on the adequacy of the contribution rates in the schedule are required. Finally, where a valuation shows a funding level of less than 90%, the employer is required to make up the shortfall below this level within three years, as well as agreeing to contribution rates sufficient to achieve the full 100% level within ten years.⁽⁹⁾

(8) Approval for the scheme from the Inland Revenue is necessary since the tax system does not allow tax relief on unfunded pension plans. For more details see Davis (2000) and the Pensions Pocket Book published by Hewitt, Bacon and Woodrow (2003).

(9) For more details of the MFR, see Hewitt, Bacon and Woodrow (2003).

Note that there is also a fiscally enforced limit to overfunding company pension schemes beyond 5% of projected obligations. Any surplus of assets in excess of 105% of liabilities has to be eliminated by benefit improvements, reduction in employer and/or employee contributions, or a taxed payment from the scheme to the employer provided certain conditions are met. The upshot of all these regulations, when considered together, is that an employer's contribution to pension schemes is a bounded variable which cannot be freely adjusted in response to the company's financial conditions. While a degree of discretion in adjusting contributions upwards or downwards is possible, it is clearly restricted. This fact is key to appreciating why pension contributions can constitute a relatively independent source of financial pressure for companies. From an econometric perspective, it is these regulatory constraints that allow us to identify the impact of pension contributions on other balance-sheet components like dividends or investment.

In reality, firms may have further incentives to contribute to underfunded schemes besides regulatory requirements. Apart from the tax incentive referred to earlier, most credit rating agencies take pension fund shortfalls into account in determining a company's rating. In this way a pension deficit would directly raise the cost of external capital and companies would have a strong reason to increase contributions in the face of material shortfalls on their pension funds, even if certain regulatory thresholds have not been breached. In either case, these required contributions can be expected to increase financial pressure on the sponsoring company.

3.2 *Econometric methodology*

Our empirical strategy is to examine the behaviour of the level of dividends and investment as functions of company financial characteristics. Our empirical specifications are consistent with the theoretical identities discussed in Section 2; but they are, in effect, behavioural relationships that are meant to capture the key influences on dividends and investment, and in this sense follow previous empirical literature in this area. For both dividends and investment, we are chiefly interested in the possible response to financial pressure on account of pension contributions.

The specification of our dividends equation is as follows:

$$ds_{it} = \sum_{j=1}^2 \alpha_j ds_{it-j} + \beta_1 cfk_{it-1} + \beta_2 ik_{it-1} + \beta_3 cgrk_{it-1} + \beta_4 br_{it-1} + \beta_5 Q_{it-1} + \beta_6 ps_{it-1} + \mu_i^D + \zeta_t^D + \varepsilon_{it}^D \quad (4)$$

where ds is dividends measured as a percentage of sales, cfk is cash flow as a percentage of

capital stock, ik is investment as a percentage of capital stock, $cgrk$ is capital gearing at replacement cost, br is the borrowing ratio, Q is average Tobin's Q , ps is pension contributions as a percentage of sales, μ_i^D are the company-specific fixed effects, ζ_t^D are the common year effects, and ε_{it}^D is the error term assumed serially uncorrelated.

The specification for dividends follows from the parsimonious dynamic specification of Bond *et al* (1996). We augment it by including other possible influences on dividends which are considered in the more recent paper by Benito and Young (2002). These include a measure of cash flow, investment expenditure, and corporate debt, besides a Tobin's Q variable reflecting demand for investment funds. We also include the Nickell and Nicolitsas (1999) borrowing ratio – the ratio of net interest payments to pre-tax profits – to proxy for general financial pressure and distinguish the effect of financial pressure on account of pension contributions. This fairly general specification should largely alleviate concerns that pension contributions could proxy for some omitted influence on dividends.⁽¹⁰⁾ All explanatory variables, including our measure of pension contributions, enter the equation as first lags, although estimation of a more general equation with both contemporaneous and first lags does not alter the results significantly. We exclude firms who have never paid a dividend from our dividends estimation since firms who do not pay dividends will not be able to respond to changes in pension contributions by adjusting their dividends. Our results should therefore be interpreted as being conditional on firms paying a dividend in at least one year.

Note that our analysis looks at pension contributions in relation to sales. Clearly, pension contributions need to be scaled to prevent the results being driven by company size. To illustrate why we scale by sales and not another possible alternative, wages and salaries, consider a capital intensive firm that has a very generous pension scheme. This implies that pension contributions are high in relation to wages and salaries, but because the business is capital intensive very few workers are employed and therefore the cost of pensions in relation to the costs of the firm as a whole is small and so the impact on their expenditure of changes in pension contributions is also likely to be small. The reverse also applies, the pension contributions of a labour intensive firm with a ungenerous pension scheme (the cost of which is therefore low in relation to wages) can be large in relation to the size of the company, purely because of the large number of workers employed. Given the different sizes and structures of the sample of firms considered in this paper,

(10) In addition, any changes that are common across companies such as a tax change should be picked up by the year effects. Similarly company-specific characteristics would be mopped up by the fixed effects.

scaling pension contributions by sales seems the best way to minimise this bias. Also, our analysis of dividends is also scaled by sales (following Bond *et al* (1996)), and therefore using the same scaling term should allow a clear assessment of the relationship between pension contributions and dividends.⁽¹¹⁾

Our dynamic specification for investment is similar to (4):

$$ik_{it} = \sum_{j=1}^2 \delta_j ik_{it-j} + \theta_1 cfk_{it-1} + \theta_2 sk_{it-1} + \theta_3 cgrk_{it-1} + \theta_4 br_{it-1} + \theta_5 Q_{it-1} + \theta_6 ps_{it-1} + \mu_i^I + \zeta_t^I + \varepsilon_{it}^I \quad (5)$$

where the superscript I denotes coefficients in the investment equation, sk is sales as a percentage of the capital stock, and the remaining variable definitions follow from those given above. Our investment equation follows from the specifications used in the dynamic panel data study of investment by Blundell *et al* (1992), and includes financial variables of the type used by Benito and Young (2002). Both the dividends and investment equations allow for persistence through the inclusion of lagged dependent variables. In the case of dividends, the persistence estimate, α , is of special interest following Lintner's (1956) suggestion that companies are averse to reducing the dividend. In a world of asymmetric information, such inertia may come about because companies are uncertain how a departure from previous dividend levels would be interpreted by the market.

Both the dividends and investment specifications are dynamic fixed effects panel data models. The main estimation problem in such models is that the lagged values of the dependent variable are correlated with the fixed effects by construction. Ordinary OLS, in this case, produces upwardly biased and inconsistent parameter estimates and even the Within group transformation produces biased estimates and relies on T being large (relative to N) for consistency. Given the large N dimension of our data, Within group (WG) estimation will produce results that are biased down. To deal with this we use the robust two-step generalised methods of moments (GMM) System estimator proposed by Blundell and Bond (1998), which uses an instrumental variables technique to take account of any correlation between right-hand side variables and the composite error term.⁽¹²⁾ This estimator is an extension of the GMM-difference 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

(11) But we choose to retain the same scaling term in the analysis of the effect on investment which is scaled by the capital stock.

(12) The estimates are computed in PcGive for GiveWin. Two-step results are reported, these employ a finite sample correction to minimise the bias in the estimated asymptotic standard errors.

differences, estimating the levels equation as well with a lagged difference term as an instrument can counter the bias associated with weak instruments.⁽¹³⁾ In Section 5, following Bond *et al* (2001) we show that the GMM-System estimator is appropriate in our case since the GMM-difference estimates of the coefficients on the lagged dependent variable lie close to or below the WG estimates.

Finally, note that for consistency, the GMM-System estimator requires that there be evidence of significant negative first-order serial correlation and no evidence of second-order serial correlation in the first-differenced residuals. Both these assumptions are testable, and relevant test statistics are reported in the results below. The Sargan test for overidentifying restrictions is also reported with the results.

4 Data

Our company accounts data for quoted UK non-financial companies are taken from Thomson Financial Datastream between 1983 and 2002. This time period is selected because data on company pension contributions (Datastream item x114) is available only from 1983 onwards. Only firms with a minimum of five complete observations for the full range of variables considered are included in the panel. The data contain 1,544 individual firms, who provide 17,710 firm-year observations. There is an average of 11.5 observations per firm and 886 firm-year observations in each year.⁽¹⁴⁾ There is further information on the number of observations per firm and the number of firm-year observations in each year in (Tables 3 and 4) in the appendix.

In the United Kingdom, 80%-90% of members of private sector occupational pension schemes are covered by defined benefit (DB) arrangements, although this is likely to change in the future.⁽¹⁵⁾ It is therefore very likely that most companies in our sample of quoted private non-financial firms that offer occupational pensions have some DB element in their schemes. It is however possible that some companies in our sample offer defined contribution (DC) schemes, and because these do not contain a pre-committment to a certain level of benefit we would not expect many changes in

(13) For more details, see Blundell and Bond (1998).

(14) There are 106 firms who never pay a dividend in any year. These are excluded from the sample for estimating dividends, this reduces the number of firm-year observations to 16,981.

(15) See for example, the eleventh survey of occupational pension schemes by the Government Actuary's Department, GAD (2003).

their contribution levels over time.⁽¹⁶⁾ In effect, such companies would tend to obscure any underlying relationship between variations in DB contributions and the dividend and investment expenditures of the sponsoring companies. To gauge the extent of the ‘signal’ in our data, we tried to match each company in our Datastream sample in 2002 with pension scheme details contained in the publication ‘Pension Funds and their Advisers’ (2002).⁽¹⁷⁾ Not all schemes appear in this publication, and for a significant proportion of schemes the relevant field of ‘scheme type’ is not available. However, of the 304 exact scheme-company matches, a reassuring 91% of schemes were DB in nature, suggesting that data concerns on this account are not severe. Indeed, when we re-estimated our dividend and investment models after excluding the small number of matched firms with DC schemes, none of our results were affected.

Our measure of pension contributions is taken from company accounts records held on Datastream. The variable code is x114 and it refers to firm’s pension cost charged in company accounts. This measure is closely related to annual pension contributions, but because accounting conventions allow a degree of smoothing, in some years it may not be exactly identical to cash contributions. In the appendix, we provide a more detailed discussion of this measure of pension contributions, but the upshot is that while it may be smoothed to a limited extent, it nevertheless displays considerable time-series and cross-sectional variation in a manner that is economically sensible. Of course, from an econometric perspective, what matters in fixed-effects models like (4) and (5) is the extent of within-firm variation in the measure of pension contribution divided by sales. A useful gauge is the fact that the R^2 from a regression of pension contributions (divided by sales) on a full set of year dummies and fixed effects is as low as 0.02, since it is the residual variation that the identification relies on.

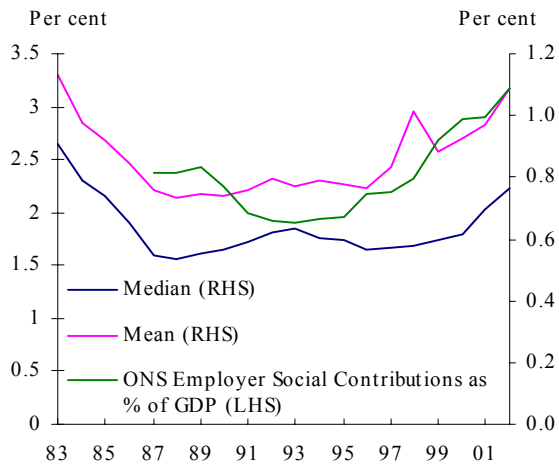
We can also validate our firm-level data on pension contributions by comparing its profile over time with aggregate data on employer contributions. Chart 1 shows mean and median pension contributions in each year from the firm-level data along with an aggregate measure of employer social contributions to funded schemes relative to GDP.⁽¹⁸⁾ The path of average pension contributions relative to sales from the firm-level data is broadly consistent with the course of

(16) In any case, such contribution changes are unlikely to reflect financial pressure.

(17) We choose 2002 – the last year of our sample – since the non-DB proportion is likely to be increasingly smaller as we go back in time.

(18) Employer social contributions to funded schemes excludes national insurance contributions and contributions to unfunded schemes (which are mainly public sector schemes). The series quoted in Chart 1 is for all private non-financial companies, both quoted and non-quoted.

Chart 1: Average pension contributions as a percentage of sales



aggregate social contributions relative to GDP.

Chart 1 also shows that mean pension contributions relative to sales are always above the median, which implies that the distribution is positively skewed, with the lower percentiles of the distribution being closer together than those at the top of the distributions. This is illustrated in Chart 2, which shows the distribution of pension contributions relative to sales over time. It shows that the distribution is relatively stable over time and that pension contributions across the distribution follow a similar trend to the averages shown in Chart 1.

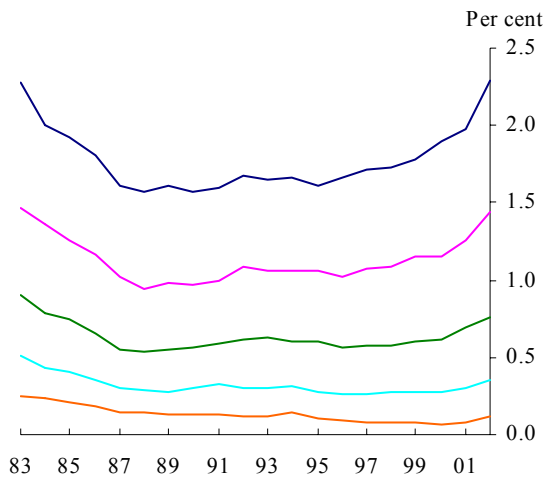
5 Econometric results

This section proceeds as follows. In Section 5.1, we consider the effect of pension contributions on dividend payouts by companies. In Section 5.2, we investigate whether pension contributions have any significant effect on company investment expenditures. In both cases, we use fairly general empirical specifications to guard against the possibility that our pension contributions variable is proxying for an omitted but relevant effect (as discussed in Section 3.3).

5.1 Dividends

Table A presents the estimation results for dividends. These are two-step results obtained using the GMM-System estimator. In column [1] we estimate the general model for dividends specified in equation (4), but without pension contributions. In [2] we add the pension contributions

Chart 2: Distribution of pension contributions as a percentage of sales^(a)



^(a) 90th, 75th, 50th, 25th and 10th percentiles shown.

variable, in [3] we remove the borrowing ratio, and in [4] we add controls for company size to specification [2] as a further robustness check. For the estimations in Table A we use all available instruments (dated $(t - 2)$ to $(t - 19)$) in the differenced equation and instruments from $(t - 2)$ in the levels equations. As discussed in Section 3.2, we exclude firms who have never paid a dividend from our dividend equations since there will be no variation in dividends for these firms and dividends cannot be adjusted in response to increases financial pressure. Our results are therefore conditional on firms having paid a dividend at some point in their life-span.⁽¹⁹⁾ Analysis of the characteristics of the firms who have never paid a dividend suggests that these are mainly companies who have entered the data since 1995 and they are concentrated among technology-based industries;⁽²⁰⁾ these are factors that will be controlled for by the firm-specific fixed effects in our estimations. Moreover, the general conclusions of our dividend analysis are unchanged if we do introduce firms who have never paid a dividend into the sample.

In all the specifications in Table A, we include the lagged dependent variable with two lags at $(t - 1)$ and $(t - 2)$. This ensures that the models are dynamically complete, and consequently we should expect to find evidence of first-order serial correlation in the differenced residuals. Further, there is no evidence of second-order serial correlation in the first-differenced residuals – which is

(19) Dividend omission was not very common in the UK until the early to mid-1990s (for example, see Bond *et al* (1996)). However, as Benito and Young (2003) show, the increase in companies paying zero dividends in the UK since 1994 can largely be accounted for by the increasing presence of companies that have never paid dividends. Excluding such companies from our sample reduces the proportion of companies paying zero dividends from about 15% to less than 10%.

(20) Such firms are also unlikely to have significant pension deficits.

the key requirement for our estimation strategy to be valid. Also note that, for all the estimated models, the null of the Sargan test that the overidentifying restrictions are valid cannot be rejected at the 5% level.

The lagged dependent variables are highly significant throughout, with a combined coefficient of around 0.55. This indicates a high degree of persistence – suggesting that *ceteris paribus* companies are slow to adjust their balance sheets through changes in dividends.⁽²¹⁾ The sum of the coefficients on the lagged dependent variable if the equation in column [1] is estimated by OLS is (an upward biased) 0.86; the WG estimate is (a downward biased) 0.43; and the GMM-difference estimate is 0.18. The fact that the GMM-difference estimate lies outside the OLS-WG interval and the GMM-System estimate within the interval suggests that the GMM first difference estimator faces the weak instrument problem discussed in Blundell and Bond (1998), and confirms that we should use the GMM-System methodology in our estimation.

The coefficient estimates associated with the explanatory variables in column [1] are consistent with our earlier discussion of the budget constraint and with results obtained by Benito and Young (2002). All coefficients other than that on the Q term are statistically significant at conventional levels. Dividends respond positively to cash flow, negatively to capital gearing or indebtedness, and negatively to financial pressure, as measured by the borrowing ratio. Firms who have higher levels of investment tend to pay lower dividends.

Pension contributions as a percentage of sales are added in column [2]. The coefficient on this term is negatively signed and is significant at the 5% level, this suggests that pension contributions have a statistically significant negative effect on the level of dividend payout for UK companies. The inclusion of this additional variable makes little difference to the other coefficients in the equation compared with [1].

In column [3] we remove the borrowing ratio since it is quite highly correlated with the cash-flow term. Since the financial pressure induced by pension contributions is like negative cash flow, we want to ensure that its effect is preserved even when standard cash flow is estimated precisely. As

(21) In their estimation of a dividends equation, Bond *et al* (1996) find coefficients on the lagged dependent variable ranging from 0.51 to 0.67, indicating a similar degree of persistence.

Table A

System-GMM estimation of dividend equations					
Dependent variable: dividends as percentage of sales (<i>ds</i>)					
Model		[1]	[2]	[3]	[4]
<i>ds</i>	(<i>t-1</i>)	0.399** (0.040)	0.412** (0.041)	0.446** (0.040)	0.390** (0.041)
<i>ds</i>	(<i>t-2</i>)	0.136** (0.022)	0.138** (0.022)	0.141** (0.022)	0.128** (0.022)
<i>cfk</i>	(<i>t-1</i>)	0.003** (0.001)	0.003** (0.001)	0.007** (0.001)	0.004** (0.001)
<i>ik</i>	(<i>t-1</i>)	-0.006** (0.001)	-0.006** (0.001)	-0.004** (0.001)	-0.005** (0.001)
<i>cgrk</i>	(<i>t-1</i>)	-0.003** (0.001)	-0.003** (0.001)	-0.004** (0.001)	-0.003** (0.001)
<i>br</i>	(<i>t-1</i>)	-0.007** (0.001)	-0.006** (0.001)		-0.005** (0.001)
<i>Q</i>	(<i>t-1</i>)	-0.005 (0.005)	-0.006 (0.005)	-0.011** (0.005)	-0.014** (0.005)
<i>ps</i>	(<i>t-1</i>)		-0.162** (0.068)	-0.164** (0.070)	-0.124* (0.065)
Size effects		No	No	No	Yes
Year effects		Yes	Yes	Yes	Yes
M_1	<i>p-value</i>	0.00	0.00	0.00	0.00
M_2	<i>p-value</i>	0.34	0.38	0.50	0.53
Sargan	<i>p-value</i>	0.06	0.29	0.06	0.27
Number of firms		1,438	1,438	1,438	1,438
Number of observations		14,105	14,105	14,105	14,105

Notes: Asymptotic robust standard errors are in parentheses. **significant at 5%; *significant at 10%. Reported estimates are the two-step System-GMM estimates computed for an equation with fixed effects in PcGive. M_j is a test of j th order serial correlation in the first-differenced residuals, asymptotically distributed $N(0,1)$. Sargan is a chi-square test of overidentifying restrictions. A constant is included in the regressions but is not reported in the table. Explanatory variable definitions: *cfk* is cash flow as a percentage of the capital stock, *ik* is investment as a percentage of the capital stock, *cgrk* is capital gearing at replacement cost, *br* is the borrowing ratio, *Q* is Tobin's Q, and *ps* is pension contributions as a percentage of sales. See appendix for further details on the definitions.

it turns out, dropping the borrowing ratio doubles the coefficient on cash flow and it also increases the coefficient on capital gearing. Moreover, this also allows us to estimate the coefficient on the Q term more precisely, which is now significant at the 5% level. Crucially, however, removing the borrowing ratio has no effect on the coefficient on the pensions variable, this remains significant at the 5% level at around 0.16 as in column [2].

Previous studies on dividends such as Bond *et al* (1996) and Benito and Young (2002) include continuous size variable such as real sales to pick up the effect of firm size on dividend payout. We tried including the log of real sales in our specification, but these turned out to be statistically insignificant and had little effect on other coefficients. This may be because the fixed effects in our specification may already be picking up part of the effect of company size. However, we do find that if firms are grouped into quartiles according to their market value in each year, including dummies for the group a firm is in are significant. This specification is reported in column [4]. The coefficients on the dummies (not reported for the sake of brevity) imply larger firms pay higher dividends in relation to sales. Including size effects also reduces the size of the coefficient on the pensions term from 0.16 to 0.12, but it is still significant at conventional levels with a *p*-value of 0.056. This reinforces our main conclusion that pension contributions have a negative and statistically significant relationship with dividends.

We have also investigated the sensitivity of our results to the choice of instrument set. Using successively fewer instruments in the differenced equation or using instruments lagged ($t - 1$) in the levels equation does not alter our results: the coefficient on the pensions term remains significant at around the 5% level and never falls below -0.1. However, the Sargan test is not passed for all these specifications.⁽²²⁾

In terms of the magnitude of parameter estimates, the overall negative effect of pension contributions on dividends is stable in specifications [2] and [3] at around -0.16. Evaluated at the means and holding other factors constant, this implies that a 0.1 percentage point increase in pension contributions as a percentage of sales⁽²³⁾ reduces dividends as a percentage of sales by 0.016 percentage points.⁽²⁴⁾ Given fixed sales, a £10 million increase in pension contributions will reduce dividends by £1.6 million in the following period. As the coefficient on the lagged

(22) See Bowsher (2002) on the size and power of the Sargan tests with GMM-System estimators.

(23) The mean of the variable is 0.85 and the standard deviation is 1.04.

(24) The mean of dividends as a percentage of sales is 2.3 and the standard deviation is 2.4.

dependent variable is approximately 0.5, this implies this effect is roughly double in the long run. It is also interesting that an increase in pension contributions is not fully passed through to lower dividends. This suggests there should be some further adjustment through other channels such as investment, debt or equity issuance given a binding budget constraint.

In percentage terms, a 0.1 percentage point increase in pension contributions relative to sales translates as roughly a 0.7% decline in dividends in response to a 12% increase in pension contributions, starting from their respective mean levels. This implies an impact elasticity of -0.058 for the coefficient on pension contributions as a percentage of sales (β_5), which lies between the two estimates of the elasticity of dividends with respect to cash flow taken from the specifications in [2] and [3].⁽²⁵⁾ The point estimates of the cash-flow coefficients (β_1) imply an impact elasticity of 0.036 with respect to dividends in [2] and 0.083 when the borrowing ratio is taken out in [3].⁽²⁶⁾ Therefore, in proportional terms, variations in pension contributions appear to have a similar impact on company dividends as changes in corporate cash flow. This is re-assuring, since increases in pension contributions are effectively reductions in cash flow, so we might expect them to have similar elasticities.

The result that dividends are reduced in response to increased financial pressure on account of higher pension contributions is consistent with most of the models discussed in Section 2 – all of which imply that adjustment should take place through financial channels. However, the fact that they are not reduced on a one-for-one basis in response to higher pension contributions is not strictly consistent with the ‘new view’ in which dividends are effectively a residual item, and which would have predicted a higher elasticity than our estimate. The fact also suggests that further financial adjustment may come from sources other than dividends, such as real investment.

It is also important to consider whether our empirical results could reflect alternative theoretical explanations, unrelated to financial adjustment. For example, in a recent paper Cocco and Volpin (2005) investigate a small cross-section of UK pension schemes, and find that the proportion of ‘corporate insiders’ (eg finance executives) within trustees of DB pension plans are related with both higher dividends and lower pension contributions.⁽²⁷⁾ However, to the extent that such

(25) The impact elasticities are calculated at the means of the respective variables in the standard way: $\frac{\partial y}{\partial x} \cdot \frac{\bar{x}}{\bar{y}}$.

(26) The mean of the cash-flow variable is 27.6, and the standard deviations is 30.4.

(27) By contrast, they find no evidence that such insiders are able to manipulate actuarial or rate of return assumptions that would affect the profile of pension contributions.

governance considerations do not change over time in a way that is related to idiosyncratic shocks to pension plan returns, their influence should be picked up by the firm-specific effects in our regressions.

5.2 *Investment*

The previous subsection of this paper found empirical evidence that there is a negative relationship between pension contributions and dividends payouts. In this section we test whether there is any effect on investment. The motivation for our investment specifications is discussed in Section 3.2, along with a discussion of the GMM-System estimator that is used. The dependent variable in all the equations is investment as a percentage of the capital stock. The equation reported in the first column of Table B is our baseline specification which is based on that reported by Benito and Young (2002). We then augment this with the pension contributions variable to test the hypothesis that there is a negative relationship between pension contributions and investment, holding other factors constant and perform the same robustness checks as in our dividends specifications by removing the borrowing ratio and adding in size effects.

We use instruments dated from $(t - 2)$ to $(t - 19)$ in the differenced equation and instruments from $(t - 2)$ in the levels equation in all investment specifications reported in Table B. For all equations, the Sargan test of overidentifying restrictions is not rejected. As with the dividends equations, this choice of instruments does not affect the general conclusions of our analysis, although the results on the Sargan test are less robust when we use alternative instrument sets. All of our investment specifications include two lags of the dependent variable, which ensures that there is no evidence of second-order serial correlation – a necessary for the estimation method to be valid. While the coefficient on the first lag of the dependent variable is always highly significant and the second lag is in some specifications, the sum of the coefficients (0.17 in equation [1]) is smaller than for dividends, indicating that whereas there is some persistence in investment there is less than in dividends. The sum of the coefficients on the lagged dependent variables from GMM-System estimation of specification [1] lies between the upward biased OLS estimator (0.31) and the downward biased WG estimator (0.07). In this case both the GMM-Difference and GMM-System estimators lie within the OLS-WG interval, indicating that weak instruments may not be as serious a problem here as in the dividend models. We choose to

report the GMM-System results for consistency with the dividends component of the paper.⁽²⁸⁾

The results presented in column [1] are consistent with those from Benito and Young (2002). As well as the positive coefficient on the lagged dependent variables, investment responds positively to Tobin's Q ratio (which is a proxy for investment opportunities). This is consistent with Q being a forward-looking measure of investment opportunities. Sales as a percentage of the capital stock is found to have a positive and significant coefficient.

In our initial specification cash flow has a positive coefficient although this effect is not significant, but we do find a negative relationship between investment and the borrowing ratio. When we remove the borrowing ratio in specification [3] the cash-flow coefficient increases substantially and becomes significant at the 1% level. This suggests the borrowing ratio is picking up much of the cash-flow effect in the initial equation. The finding of a positive and significant relationship between cash flow and investment is consistent with much of the empirical literature on investment. This would appear to support stories of costly external finance, which argue that firms are more likely to invest using internally generated funds because this is the cheapest source of finance available to them. However, to the extent that our measured Q is not a sufficient statistic for future prospects, cash flow could also simply reflect an improvement in such prospects if current cash flow is correlated with future profitability. Bond *et al* (2004) find that when future cash flow is accurately controlled for using analysts' earnings forecasts cash flow no longer has a significant effect on investment.

Column [2] augments our baseline specification for investment with pension contributions scaled by sales. This is negatively signed although it is only significant at the 10% level; it has a *p*-value of 0.08. However, when we drop the borrowing ratio in specification [3] the coefficient on the pension contributions term is no longer significant at the 10% level. We tried experimenting with alternative choices of instruments and alternative investment specifications, but could not establish a robust negative relationship between pension contributions and investment expenditure.

Including size dummies in column [4] makes little material difference, and overall we interpret the results in Table B as only weak evidence for a negative relationship between investment expenditures and financial pressure on account of pension contributions.

(28) The sum of the coefficients on the lagged dependent variable from GMM first-difference estimation of [1] is 0.18, compared to 0.17 for the GMM-System estimator.

Table B**System-GMM estimation of investment equations**Dependent variable: investment as percentage of capital stock (*ik*)

Model		[1]	[2]	[3]	[4]
<i>ik</i>	(<i>t-1</i>)	0.150** (0.014)	0.152** (0.013)	0.184** (0.013)	0.150** (0.013)
<i>ik</i>	(<i>t-2</i>)	0.022** (0.011)	0.020* (0.011)	0.024** (0.011)	0.018 (0.011)
<i>cfk</i>	(<i>t-1</i>)	0.009 (0.013)	0.013 (0.013)	0.063** (0.012)	0.010 (0.013)
<i>cgrk</i>	(<i>t-1</i>)	-0.039** (0.004)	-0.041** (0.004)	-0.048** (0.004)	-0.039** (0.004)
<i>br</i>	(<i>t-1</i>)	-0.082** (0.009)	-0.077** (0.008)		-0.072** (0.009)
<i>Q</i>	(<i>t-1</i>)	0.477** (0.043)	0.478** (0.042)	0.458** (0.041)	0.462** (0.042)
<i>sk</i>	(<i>t-1</i>)	0.004** (0.001)	0.004** (0.001)	0.002** (0.001)	0.004** (0.001)
<i>ps</i>	(<i>t-1</i>)		-0.508* (0.288)	-0.416 (0.279)	-0.509* (0.285)
Size effects		No	No	No	Yes
Year effects		Yes	Yes	Yes	Yes
M_1	<i>p-value</i>	0.00	0.00	0.00	0.00
M_2	<i>p-value</i>	0.92	0.83	0.70	0.76
Sargan	<i>p-value</i>	0.08	0.21	0.20	0.21
Number of firms		1,544	1,544	1,544	1,544
No. of observations		14,622	14,622	14,622	14,622

Notes: Asymptotic robust standard errors are in parentheses. **significant at 5%; *significant at 10%. Reported estimates are the two-step System-GMM estimates computed for an equation with fixed effects in PcGive. M_j is a test of j th order serial correlation in the first-differenced residuals, asymptotically distributed $N(0,1)$. Sargan is a chi-square test of overidentifying restrictions. A constant is included in the regressions but is not reported in the table. Explanatory variable definitions: *cfk* is cash flow as a percentage of the capital stock, *cgrk* is capital gearing at replacement cost, *br* is the borrowing ratio, *Q* is Tobin's Q, *sk* is sales as a percentage of the capital stock, and *ps* is pension contributions as a percentage of sales. See appendix for further details on the definitions.

Our results are weaker than evidence found for the United States in Rauh (2003), which establishes a strong negative correlation between capital expenditure and mandatory pension contributions for panel of US firms. His results rely on a simulated measure of mandatory contributions (rather than total pension contributions) which we cannot construct for the United Kingdom, and so setting aside the obvious differences in sample compositions and sizes, it is possible that part of the difference is on account of a cleaner measure of the financial pressure. We tried to address this possibility by considering a smaller sample of firms who do not pay dividends. This is consistent with the ‘pecking order’ model of financing constraints where we would only expect to see effects on investment for the sample of firms who face a binding dividend constraint, because these firms would be forced to adjust their investment in the face of increased pressure from higher pension contributions. This method drastically reduced the sample size (particularly in the early years), but we were still unable to discern a robust negative relationship between pension contributions and investment.

6 Conclusion

This paper has investigated the empirical relationship between company pension contributions and corporate expenditure on dividends and investment in the United Kingdom, which is an original contribution to the literature. The presence of the budget constraint, by which all corporate decisions are bound, implies that if a firm is financially constrained or if external finance is costly, increases in pension contributions may have to be financed by lower dividends and/or investment. Our analysis of a large panel of UK non-financial companies between 1983 and 2002 finds that firms do reduce their dividends relative to what they would otherwise have been in response to increases in pension contributions, although not on a one-for-one basis. The elasticity of dividends with respect to pension contributions is found to be similar to the elasticity with respect to cash flow. We find only weak evidence that firms reduce their investment in a statistically significant way when pension contributions are increased, implying that the adjustment to balance sheets is most likely to come through financial rather than real channels.

Our results imply that companies that seek to tackle underfunding of DB pension schemes by raising their contributions could pay lower dividends than they would have otherwise. There is no conclusive evidence of an impact on investment across all firms, although there may be an impact for some individual companies, particularly if they are unable to adjust their dividend payout. But,

pension contributions are only a particular example of financial pressure and our analysis sheds light on how corporates may respond to other financial pressures and vulnerabilities more generally.

7 Appendix

7.1 Variable definitions

All variables are taken from Thomson Financial Datastream, the x prefix indicates the Datastream item number for each variable considered.

Dividends as a percentage of sales (ds): ds

$$= 100 * \left(\frac{\text{Ordinary dividends net of advance corporation tax (x187)}}{\text{Total sales (x104)}} \right)$$

In each year observations in excess of the 99th percentile are recoded to that value.

Never pay dividend dummy ($neverpay$): $neverpay_i$

$$= \begin{cases} 1 & \text{if ordinary dividends net of advance corporation tax (x187) > 0 for firm } i \text{ in any year} \\ 0 & \text{if ordinary dividends net of advance corporation tax (x187) = 0 for firm } i \text{ in all years} \end{cases}$$

Total investment (i): A different method is used before and after 1991 owing to definitional changes.

1983-1991: $i = \text{Total new fixed assets (x435)} - \text{Sales of fixed assets (x423)}$

1992-2002: $i = \text{Total payments for fixed assets of the parent (x1026)} + \text{Total payments for fixed assets of subsidiaries (x479)}$

Capital stock (k): The capital stock is calculated on a replacement cost basis using the perpetual inventory method to convert the historic cost measure to replacement cost:

$$k_{t+1} = k_t(1 - \delta) + i_t$$

where δ is the depreciation rate (set to 0.08) and i is investment. For each firm's first observation the replacement cost is assumed to be equal to the net historic cost of total fixed assets (x339), adjusted for inflation.

Investment as a percentage of the capital stock (ik): $ik = 100 * \left(\frac{\text{Total investment (}i\text{)}}{\text{Capital stock (}k\text{)}} \right)$

In each year observations in excess of the 95th percentile and below the 5th percentile are recoded to those respective values.⁽²⁹⁾

(29) Outliers for ratios scaled by the capital stock are recoded to the 5th and 95th percentiles, whereas ratios scaled by sales are recoded to the 1st and 99th percentiles as appropriate. This is because there is more variation in the capital

Cash flow as a percentage of the capital stock (*cfk*): $cfk = 100 * \left(\frac{\text{Pre-tax profit (x157)} - \text{Total tax charge (x172)} + \text{Depreciation of fixed assets (x136)}}{\text{Capital stock (k)}} \right)$

In each year observations in excess of the 95th percentile and below the 5th percentile are recoded to those respective values.

Capital gearing at replacement cost (*cgrk*): $cgrk = 100 * \left\{ \frac{1}{\text{Capital stock (k)}} * \left(\begin{array}{l} \text{Borrowing repayable with one year (x309)} \\ + \text{Total loan capital (x321)} - \text{Total cash and equivalent (x375)} \end{array} \right) \right\}$

In each year observations in excess of the 95th percentile and below the 5th percentile are recoded to those respective values.

Borrowing ratio (*br*): $br = 100 * \left(\frac{\text{Total interest payments (x153)}}{\text{Pre-tax profit (x157)} + \text{Interest received (x143)}} \right)$

Negative values for the borrowing ratio (which all occur when pre-interest profits are negative) are recoded to 100, values in excess of 100 are also recoded to that level.

Tobin's Q (*Q*): $Q = 100 * \left\{ \frac{1}{\text{Capital stock (k)}} * \left(\begin{array}{l} \text{Market capitalisation at 31 December (Datastream item mv)} \\ + \text{Borrowing repayable with one year (x309)} \\ + \text{Total loan capital (x321)} - \text{Total cash and equivalent (x375)} \end{array} \right) \right\}$

In each year observations in excess of the 95th percentile and below the 5th percentile are recoded to those respective values.

Sales as a percentage of capital stock (*sk*): $sk = 100 * \left(\frac{\text{Total sales (x104)}}{\text{Capital stock (k)}} \right)$

In each year observations in excess of the 95th percentile and below the 5th percentile are recoded to those respective values.

Pension contributions as a percentage of sales (*ps*): $ps = 100 * \left(\frac{\text{Pension contributions put through the profit and loss account (x114)}}{\text{Total sales (x104)}} \right)$

In each year observations in excess of the 99th percentile are recoded to that value.

7.2 Pension costs and contributions

Our measure of pension contributions is the variable code x114 in Datastream company accounts. This refers to firm's pension cost charged in company accounts. According to Bacon and Woodrow (1998), until 1988 normal practice was to charge the amount of contributions paid as the pension cost. Since 1988, UK companies have had to account for their pension costs in accordance with SSAP 24 (Statement of Standard Accounting Practice No. 24: 'Accounting for stock than sales, owing to the perpetual inventory method used to calculate it, which produces more volatility in the ratios scaled by the capital stock.

Pension Costs’). For DB schemes, SSAP 24 specifies that pension cost is intended to be ‘a best estimate of the cost of pension benefits for the current employees’.⁽³⁰⁾ The standard expects that this estimate would be revised from time to time to take account both of actual past experience, where this differed from the basis of the estimate, and of changed expectations about the future. Such revisions would then be reflected in adjustments passed through current and future pension costs rather than changing past figures retrospectively. The fact that the standard allows companies to spread such changes into future pension costs means that companies have some ability to smooth out the cost of pension provision, and therefore the value reported in company accounts for pension costs (x114) may not correspond precisely to the actual amount of pension contributions that would cause the budget constraint to bind in each particular year.

The pertinent question from the perspective of this study is whether the smoothing of pension costs afforded by SSAP 24 is so severe, that there is no meaningful variation on either the cross-sectional or time-series dimensions. In the end, this is an empirical question, since the eventual pension cost that goes through the company accounts is determined by a complex set of factors acting within complex business circumstances. Perhaps the simplest way to proceed is to examine if the data on pension costs varies in some economically meaningful way across companies and over time. This would not rule out some degree of smoothing, but it may at least indicate whether or not we can obtain some traction from this measure. In fact, as we show below, it varies significantly both across companies and over time, in an economically sensible fashion. Pension contributions (as measured by (x114)) rise for all companies after a period in which they experience shortfalls on their schemes, and they are higher for companies with bigger plan deficits relative to the others who have smaller deficits.

Charts 3 and 4 depict our measure of pension contributions (x114) from Datastream for a sample of ten FTSE 100 companies with defined benefit pension schemes in 1998 and 2002 respectively. They also present a more direct measure of pension contributions – often referred to as ‘cash’ contributions and less likely to be smoothed for the sake of accounts – collected by hand from the disclosures on pensions in the notes to individual company accounts for this group of ten companies.⁽³¹⁾ We plot these contribution numbers (from the notes to company accounts)

(30) The standard stipulates that for defined contribution (DC) schemes, the cost should be the amount of contributions due in the accounting period. For more details, see Bacon and Woodrow (1998).

(31) The choice of companies was guided entirely by data availability considerations. While most FTSE 100 companies report some contributions data in the notes to accounts in 2002, the number rapidly diminished as we checked for earlier years. Since we wanted to compare changes over time as well, we picked ten companies for which

Chart 3: Pension contributions for a sample of FTSE 100 companies in 1998

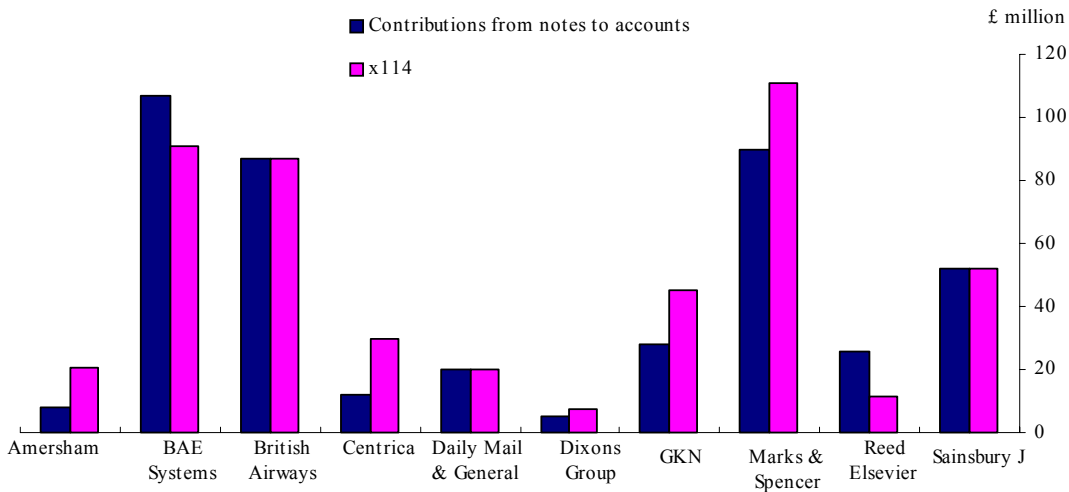
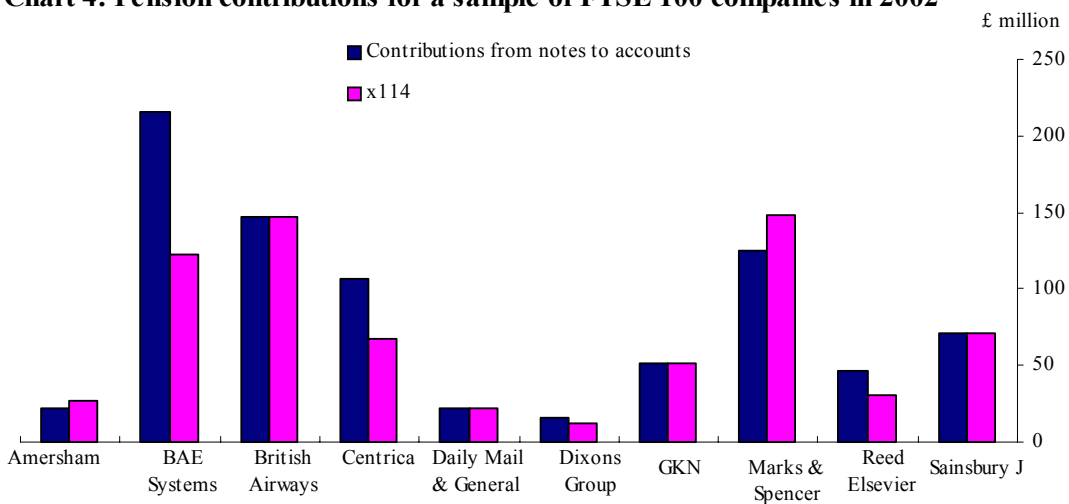


Chart 4: Pension contributions for a sample of FTSE 100 companies in 2002



alongside the x114 measure of pension costs to check if we can detect similar variation across companies and over time.

In both Charts 3 and 4, it is noticeable that for all companies, pension contributions from notes to company accounts and pension costs as measured by x114 follow a very similar pattern. For a couple of the companies the measures are identical, but even for the remainder the amounts are remarkably alike. Now consider Chart 4, which plots the two measures of contributions for the same companies but in 2002. Notice that the level of contributions has increased for all ten firms between 1998 and 2002, the vertical scale of Chart 4 now goes up to £250 million, double that of Chart 3. By 2002 company pension funds in the United Kingdom had been damaged by three years of falling equity prices, and moreover, the present value of their liabilities had also risen on account of falling interest rates. This would have forced companies to increase their contributions

we could find data on contributions in the notes to accounts for the five successive preceding years up to 1998.

for reasons discussed above, and it is reassuring that pension costs measured by x114 as well as the measure of contributions sourced from company accounts capture this increase. This suggests that while x114 is indeed a smoothed measure of pension contributions, it nevertheless captures much of the time-series variation that one would expect in a serious candidate measure.

We can also conduct a rudimentary check of whether x114 captures cross-sectional variation appropriately in our small sample of ten companies. Since 2001, companies registered in the United Kingdom have to make extensive disclosures about their pension schemes in accordance with FRS (Financial Reporting Standard) 17. FRS 17 is more of a ‘fair value’ standard and is meant to eventually replace SSAP 24, and it includes detailed information on scheme assets (valued at market prices) and scheme liabilities in present value terms, and any corresponding deficit or surplus. It is therefore possible to check if companies that reported bigger scheme deficits in 2002 in FRS 17 terms also made larger contributions to their pension schemes, or whether any such pattern was obscured by the smoothing of measured contributions. We collected data from the notes to the company accounts on the size of deficits reported under FRS 17 for the ten firms used in Charts 3 and 4, and it turns out that pension contributions, both x114 and from the notes to company accounts, correlate closely with the size of scheme deficits. The rank correlation coefficient between the size of scheme deficits and contributions sourced from company accounts is 0.88. It is marginally lower at 0.87 when contributions are measured by x114.⁽³²⁾

Overall, this suggests that x114 is a reasonable candidate for a measure of company pension contributions. While it may be smoothed to a limited extent, it nevertheless displays considerable time-series and cross-sectional variation in a manner that is economically sensible.

(32) The fact that the rank correlation coefficient is higher when contributions are measured from notes to company accounts relative to x114 is again consistent with some degree of smoothing, but the difference between the two is too small to read anything significant into it.

7.3 Descriptive statistics

Table C

Number of observations per firm			
Number of observations	Number of firms		
	Full sample	Excluding firms who never pay dividends	
5	196	168	
6	180	152	
7	141	119	
8	100	88	
9	81	74	
10	70	68	
11	59	57	
12	61	58	
13	85	85	
14	67	66	
15	73	73	
16	77	76	
17	58	58	
18	52	52	
19	119	119	
20	125	125	
Total	1,544	1,438	
Average number of observations per firm	11.47	11.81	

Table D

Number of observations per year		
Year	Number of observations	
	Full sample	Excluding firms who never pay dividends
1983	443	440
1984	720	716
1985	768	764
1986	813	810
1987	876	871
1988	903	897
1989	916	908
1990	909	897
1991	881	870
1992	890	877
1993	909	892
1994	945	919
1995	1012	973
1996	1060	998
1997	1098	1016
1998	1074	982
1999	995	902
2000	897	811
2001	837	753
2002	764	685
Total	17,710	16,981
Average number of observations per year	886	849

Table E**Variable descriptive statistics for full sample**

Variable	Number of observations	Mean	Median	Standard deviation		
				overall	between	within
<i>ds</i>	17,710	2.284	1.736	2.445	2.207	1.369
<i>neverpay</i>	17,710	0.041	0	0.199	0.253	0
<i>ik</i>	17,710	16.814	13.511	14.465	8.364	12.542
<i>cfk</i>	17,710	27.591	22.346	30.419	26.887	19.714
<i>cgrk</i>	17,710	16.915	20.470	73.322	60.632	49.655
<i>br</i>	17,710	31.818	16.915	34.798	24.981	25.794
<i>Q</i>	17,710	4.259	2.101	6.552	5.972	4.201
<i>sk</i>	17,710	479.693	326.865	460.145	449.345	201.346
<i>ps</i>	17,710	0.850	0.614	1.038	1.018	0.597

References

- Arellano, M and Bond, S (1991)**, ‘Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations’, *Review of Economic Studies*, Vol. 58, pages 277-97.
- Auerbach, A (1979)**, ‘Wealth maximization and the cost of capital’, *Quarterly Journal of Economics*, Vol. 94, pages 433-36.
- Auerbach, A (2002)**, ‘Taxation and corporate financial policy’, in Auerbach, A and Feldstien, M (eds), *Handbook of public economics*, Vol. 3, chapter 19, pages 1,251-92, North Holland.
- Auerbach, A and Hassett, K (2002)**, ‘On the marginal source of investment funds’, *Journal of Public Economics*, Vol. 87, pages 205-32.
- Bacon and Woodrow (1998)**, *Pensions Pocket Book 1998*, NTC Publications Limited.
- Benito, A (2004)**, ‘Financial pressure, monetary policy effects and inventories: firm level evidence from a market-based and bank-based financial system’, *Economica* (forthcoming).
- Benito, A and Young, G (2002)**, ‘Financial pressure and balance sheet adjustment by UK firms’, *Bank of England Working Paper no. 168*.
- Benito, A and Young, G (2003)**, ‘Hard Times or Great Expectations? Dividend omissions and dividend cuts by UK firms’, *Oxford Bulletin of Economics and Statistics*, Vol. 65, pages 531-55.
- Blundell, R W and Bond, S (1998)**, ‘Initial conditions and moment restrictions in dynamic panel data models’, *Journal of Econometrics*, Vol. 87, pages 115-43.
- Blundell, R W, Bond, S, Devereux, M P and Schiantarelli, F (1992)**, ‘Investment and Tobin’s Q: evidence from company panel data’, *Journal of Econometrics*, Vol. 51, pages 233-57.
- Bond, S, Chennells, L and Devereux, M P (1996)**, ‘Taxes and company dividends: a microeconomic investigation exploiting cross-section variation in taxes’, *Economic Journal*, Vol. 106, pages 320-33.
- Bond, S, Hoeffler, A and Temple, J (2001)**, ‘GMM estimation of empirical growth models’, *University of Bristol Discussion Paper no. 01/525*.
- Bond, S, Klemm, A, Newton-Smith, R, Syed, M and Vlieghe, G (2004)**, ‘The roles of expected profitability, Tobin’s Q and cash flow in econometric models of company investment’, *Bank of England Working Paper no. 222*.
- Bowsher, C (2002)**, ‘On testing overidentifying restrictions in dynamic panel data models’, *Economic Letters*, Vol. 77, pages 211-20.
- CBI (2003)**, ‘Focus on investment: the impact of pension deficits’, *Economic Brief*, July.

- Cocco, J and Volpin, P (2005)**, ‘The corporate governance of defined-benefit pension plans: evidence from the United Kingdom’, *CEPR Discussion Paper no. 4932*.
- Davis, E P (2000)**, ‘Regulation of private pensions - a case study of UK’, *Discussion Paper*, PI-0009, The Pensions Institute.
- Detragiache, E (2003)**, ‘Company pension plans, stock market returns, and labour demand’, *IMF Working Paper*, WP/03/222, November.
- GAD (2003)**, *Occupational pension schemes 2000: Eleventh survey by the Government Actuary*, April 2003, The Government Actuary’s Department, London.
- Hart, O (2001)**, ‘Financial contracting’, *NBER Working Paper no. 8285*.
- Hewitt, Bacon and Woodrow (2003)**, *Pensions Pocket Book 2003*, NTC Publications.
- Jensen, M and Meckling, W (1976)**, ‘Theory of the firm: managerial behaviour, agency costs and ownership structure’, *Journal of Financial Economics*, Vol. 3, pages 305-60.
- King, M (1977)**, *Public policy and the corporation*, Cambridge University Press.
- Lintner, J (1956)**, ‘Distribution of incomes of corporations among dividends, retained earnings and taxes’, *American Economic Review*, Vol. 46, pages 97-113.
- Modigliani, F and Miller, M (1958)**, ‘The cost of capital, corporation finance, and the theory of investment’, *American Economic Review*, Vol. 48, pages 261-97.
- Myers, S (2001)**, ‘Capital structure’, *Journal of Economic Perspectives*, Vol. 15, pages 81-102.
- Myers, S and Majluf, N (1984)**, ‘Corporate financing and investment decisions when firms have information that investors do not have’, *Journal of Financial Econometrics*, Vol. 13, pages 187-221.
- Nickell, S and Nicolitsas, D (1999)**, ‘How does financial pressure affect firms?’, *European Economic Review*, Vol. 43, pages 1,435-56.
- ONS (2004)**, *United Kingdom National Accounts: The Blue Book 2004*, The Office for National Statistics.
- Rauh, J (2003)**, ‘Investment and financing constraints: evidence from the funding of corporate pension plans’, *mimeo*, MIT.
- Shyam-Sunder, L and Myers, S (1999)**, ‘Testing static trade-off against pecking order models of capital structure’, *Journal of Financial Economics*, Vol. 51, pages 219-44.