Corporate Cross-holdings of Equity, Leverage and Pensions: Simulation and Empirical Evidence from the UK.

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This Paper

Investigates the role of defined benefit (DB) company pensions in amplifying the effect of common shocks to companies stock market valuations.

Considers 2 channels
- Cross-holdings of equities in pension scheme assets
- Leverage induced by pension liabilities

Simulation and Empirical Evidence

Motivation

This kind of contagion is relevant to systemic Financial Stability and Monetary Policy, since it can rapidly push corporate valuations up or down, with corresponding knock-on effects on the wider macro-economy especially through effects of changes in share prices on corporate behaviour (M&A, investment, incentives).

May also be costly for individual companies/shareholders.
- Cost of capital (Froot, Perold, and Stein, 1992)
- Stock-based compensation less effective (Baiman and Verrecchia, 1995)

Little formal academic literature on this specific issue, although commented on in financial press.
- Jin, Merton, Bodie, NBER WP 2004.
- Cardinale (2004)

Companies plagued by pension problems, such as Rolls-Royce, British Airways and BT Group, are the surprise stock market favourites of top investors. In a survey published in today's FTfm, seven of the 10 companies most exposed to the "pension crisis" have significantly outperformed the FTSE 100 index since March, when it hit its eight year low.

Financial Times, July 2003

Plan of Presentation

Why might pension schemes amplify shocks

Simulation Evidence

Empirical investigation of weekly stock price volatility

Channels of Amplification 1

Equity Cross-holdings

In Defined Benefit (DB) company pension schemes, shareholders are primarily responsible for ensuring solvency of the fund.

In the UK most DB pension scheme assets are heavily invested in equities: about 65-70% on average.

Together, these create a potential channel for contagion .

Equity Cross-holdings

Negative shock to A s equity price

↘

Reduces value of B s Pension Fund Assets

↘

Fall in B s equity price

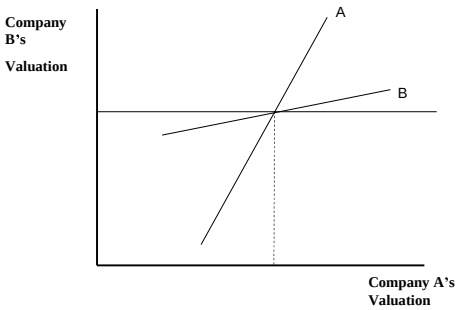
↘

Reduces pension equity assets of C or A again

↘

And so on until the spiral converges

The Effect of Cross-Holdings on Valuations



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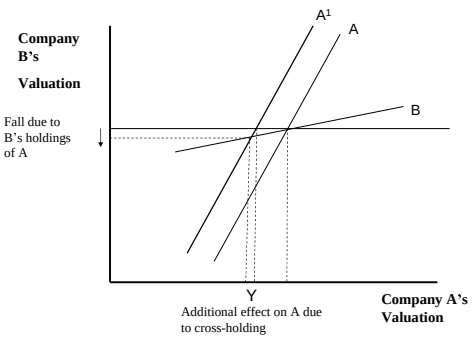

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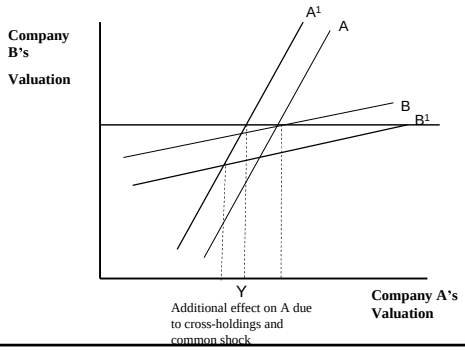


Channels of Amplification 2

Leverage effect

DB pension liabilities can be considered debt-like for the sponsoring firms.

For given asset risk, the volatility or equity returns should be amplified if companies are more highly leveraged (Modigliani and Miller, 1958)

Simulation Strategy I

We want to evaluate the size of the 2 effects holding other factors constant, and how it is distributed across heterogeneous companies.

Market Capitalisation (MV) is equal to business value (K) plus value of assets held in pension fund ($s \sum_j MV_j$) less book value of debt (D + L)

Simulation A

$$MV_i = K_i + s_i \sum_j MV_j \quad (D_i + L_i)$$

shock by 5% cross-holdings Economic leverage

Simulation B

$$MV_i = K_i + s_i \sum_j MV_j \quad (D_i + L_i)$$

shock by 5% fixed Economic leverage

Simulation Strategy II

The Equation is specified for each company using matched balance-sheet and FRS 17 data.

Sample of about 90 of the FTSE 100 companies.

Report the impact of this shock on the MV of each company in the same period relative to the base run (where capital grows by 2% per period).

Our Results

Our simulations suggest that a 5% common shock to companies capital, on average, causes a 10.5% reduction in its market value.

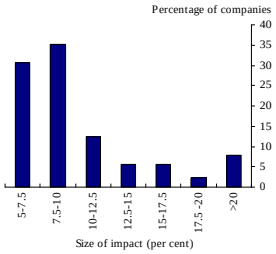
Of the additional 5.5% reduction, 1.4% was due to companies holding other companies equity in their pension funds. The remainder is due to the economic leverage effect

Simulation Results I

Table 1

	% Change from Base		Difference between A and B
	Simulation A	Simulation B	% points
Mean	-10.48	-9.07	-1.41
Standard Deviation	5.55	4.00	1.98
Minimum	-5.43	-5.21	0.00
Maximum	-37.26	-25.01	-12.25

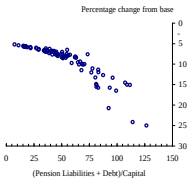
Simulation Results II



Sources: Individual annual reports, Thomson Financial Datastream and Bank calculations.

Simulation Results II

Economic Leverage



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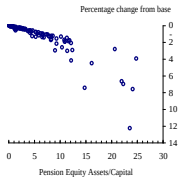
Equity Cross-holdings



Source: Individual annual reports, Thomson Financial Datastream, and Bank calculations.

Hypotheses:

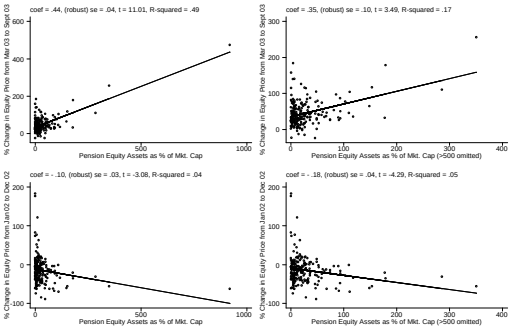
The sensitivity of the value of the stock market as a whole to shocks to fundamental business values is inflated by DB pension schemes.

The sensitivity depends on economic leverage (includes pension liabilities) and extent of cross-holdings.

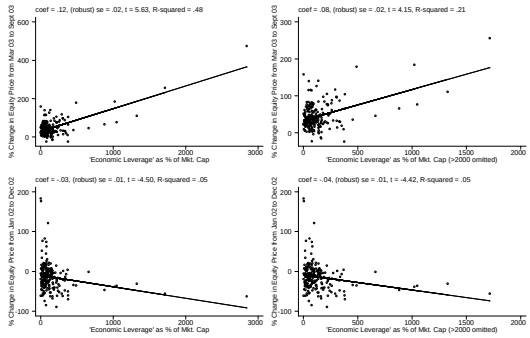
In principle, could test these hypotheses by comparing responses of national stock markets to global shocks.

Our strategy is to examine the response of valuations of UK companies to UK market shocks, testing for differences according to importance of leverage and cross holdings in individual companies.

Graphical Evidence I



Graphical Evidence II



Empirical Analysis I

But, a number of concerns remain with the graphs:
Omitted factors like industry-specific shocks
Endogeneity
robustness

Our econometric strategy is to investigate weekly stock return volatility for 56 weeks since April 2003 within the framework of a Capital Asset Pricing Model (CAPM).

Empirical Analysis II

CAPM relates the excess return on firm i s equity over the riskless rate of interest (R_{it}) to the excess return on the market (R_{mt}) and firm i s beta (β_i) so that:

$$R_{it} = \beta_i R_{mt} + \varepsilon_{it}$$

We estimate this model for about 220 of the FTSE 350 companies over a 56 week period to obtain estimates of $\hat{\beta}_i$ and the residuals.

Next, we investigate the relationship between company betas and their respective pension scheme characteristics in cross-sectional regressions.

This is because a company s pension scheme is likely to directly affect the contribution of its stock to portfolio risk, i.e. the betas.

First Stage Regressions

Dependent Variable:	Weekly Excess Total Return company *i*
RHS Variables:	Weekly Market Excess Total Return
Average R-squared	0.2357
Number of Observations	223 Companies, 56 weekly stock returns

Second Stage Regresssions

Dependent Variable:	Company Betas from first stage CAPM regressions					
	[1] OLS	*[2]* RWLS	*[3]* OLS	*[4]* RWLS	*[5]* OLS	*[6]* RWLS
pension equity assets as % of market capitalisation	0.2234** (0.1054)	0.1989* (0.1102)	0.2585** (0.1020)	0.2452** (0.1105)	0.1831* (0.1052)	0.1703* (0.1041)
pension liabilities + debt as % of market capitalisation	0.0534*** (0.0159)	0.0555** (0.0235)	0.0364** (0.0172)	0.0403* (0.0246)	0.0385** (0.0181)	0.0435** (0.0225)
market to book ratio			-0.4642 (2.0723)	0.9109 (2.9291)	0.9145 (2.2161)	2.3915 (2.6926)
log of total assets			5.0546** (1.9835)	5.1043** (2.0583)	9.8609*** (2.2253)	9.5656*** (2.1942)
Industry dummies	No	No	No	No	Yes	Yes
R-squared	0.129	n.a.	0.156	n.a.	0.355	n.a.
Number of Observations	216	216	216	216	216	216

Empirical Analysis III

If however, the betas did not capture all the effects from company pension schemes, then there would be some effect on the volatility of residuals from a CAPM model as well.

Hence, we also estimate cross-sectional regressions with the standard deviation of the estimated residuals as the dependent variable.

Analysis of Residual Volatility

Dependent Variable:	Standard Deviation of Company Residuals from first stage CAPM-style regression (in table 3)					
	[1] OLS	*[2]* RWLS	*[3]* OLS	*[4]* RWLS	*[5]* OLS	*[6]* RWLS
pension equity assets as % of market capitalisation	0.0022 (0.0045)	0.0070*** (0.0024)	0.0005 (0.0046)	0.0048** (0.0023)	0.00001 (0.0049)	0.0055*** (0.0022)
pension liabilities + debt as % of market capitalisation	0.0024** (0.0012)	0.0010* (0.0005)	0.0030** (0.0012)	0.0016*** (0.0005)	0.0031*** (0.0012)	0.0016*** (0.0005)
market to book ratio			-0.1283*** (0.0446)	-0.1015* (0.0561)	-0.1376*** (0.0490)	-0.1131** (0.0555)
log of total assets			-0.2691*** (0.0404)	-0.2268*** (0.0395)	-0.2244*** (0.0432)	-0.2223*** (0.0452)
Industry dummies	No	No	No	No	Yes	Yes
R-squared	0.204	n.a.	0.327	n.a.	0.432	n.a.
Number of Observations	216	215	216	215	216	216

Notes: *** Statistically significant at 1%; ** Statistically significant at 5%; * Statistically significant at 10%.
Coefficients and standard errors of second stage regressions are multiplied by 100.
Heteroscedasticity corrected estimates of standard errors reported in parentheses for OLS estimates

Concluding Remarks

The main finding is evidence of amplification on account DB pension schemes.

Simulation evidence suggests the magnitude of cross-holdings effect is not as large as that due to economic leverage , but nevertheless identified in data.

Results of the paper also related to a couple of separate issues which are also of relevance to Financial Stability:

- The stock market seems to process pension scheme information. Consistent with (Jin, Merton and Bodie, 2004, and Bulow, Morck and Summers, 1987)
- The importance of monitoring the whole economic balance sheet of companies in assessing riskiness of corporate sector.

Some implications for financial stability

Need to monitor the whole economic balance-sheet of companies in order to assess financial health and vulnerabilities.

From a systemic perspective, aggregate UK corporate sector is more highly leveraged than apparent from standard gearing measures & hence more responsive to shocks. This is clearly affected by size and investment policies of pension funds

Some implications for pension advisers

Pension fund investment policies, in tandem with corporate capital structure, affect the volatility of individual company s market capitalisation

Advice to individual companies has knock-on effects to others that could be internalised in advice to many.