Optimal payout policy under an integrated model of the financial decision calculus of the corporation – Part 2

by

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PREFACE TO PART II

Part I of this study developed a model of the growing corporation. The model involved maximising market value added (MVA) by choosing the values of two decision variables, the gearing ratio and the periodic amounts to be invested in capital employed. It turns out that the solution entails a well-defined retention ratio and, thus, an optimal payout ratio.

The model was then used to generate simulated balance sheets and profit and loss (P&L) accounts for ten corporations growing at rates varying between zero and 9% per annum. To ensure some degree of comparability, the simulations refer to those points in time when the cases start the year with capital employed of $100m. The results were set out in Table I-1, and this table is repeated here as the basis for the further analysis to be pursued in Part II of the study. The outstanding issues relate to the finding that faster growing corporations might logically have higher payout ratios than their slower growing counterparts, and to the valuation of corporations that fail to optimise their performance. The latter analysis provides a rationale for the decision to maximise MVA: in particular, the discussion demonstrates that maximising the size of the corporation, or alternatively, its price–earnings (P–E) ratio, will generally prove to be damaging in relation to shareholder value. These topics are tackled below in Sections I and II respectively.

The final section then offers an overall conclusion. As noted in Part I, the study assumes throughout that the corporation makes its distributions by repurchasing its own stock in the market: this is a matter of efficient tax planning in relation to the interests of those stock holders who are liable to the higher rate of income tax. This policy has the advantage that it clearly exposes the inherent circularity of the Dividend Irrelevancy Proposition. Once any contra-entries have been set aside, it immediately becomes apparent that there is a meaningful relationship between the rate at which the corporation grows and its optimal payout ratio. The downside of the repurchase plan approach is that it distorts the recorded growth of the corporation's earnings per share, and the conclusion thus also makes a recommendation on accounting reform. Finally, the study generates a number of suggestions for further research in the field of corporate finance.

Table I-1 P&L Accounts for Period One (Debt/Enterprise Value = 25%)

	Growth – per cent per annum									
	0	1	2	3	4	5	**6**	7	8	9
Balance sheet (beginning period) ($m)										
Capital employed	100.000	100.000	100.000	100.000	100.000	100.000	**100.000**	100.000	100.000	100.000
Financing										
Equity	72.996	72.754	72.447	72.042	71.485	70.669	**69.359**	66.915	60.731	14.329
Debt	27.004	27.246	27.553	27.958	28.515	29.331	**30.641**	33.085	39.269	85.671
Profit and loss account ($m)										
Operating profit	13.964	13.964	13.964	13.964	13.964	13.964	**13.964**	13.964	13.964	13.964
Interest	2.430	2.452	2.480	2.516	2.566	2.640	**2.758**	2.978	3.534	7.710
Profit before tax	11.533	11.511	11.484	11.447	11.397	11.324	**11.206**	10.986	10.429	6.253
Corporation tax	3.229	3.223	3.215	3.205	3.191	3.171	**3.138**	3.076	2.920	1.751
Net profit	8.304	8.288	8.268	8.242	8.206	8.153	**8.068**	7.910	7.509	4.502
Retained profit	0.000	0.728	1.449	2.161	2.859	3.533	**4.162**	4.684	4.859	1.290
Payout	8.304	7.561	6.819	6.081	5.347	4.620	**3.907**	3.226	2.651	3.213
Accounting ratios (%)										
ROCE	10.054	10.054	10.054	10.054	10.054	10.054	**10.054**	10.054	10.054	10.054
Return on equity (net)	11.376	11.392	11.413	11.441	11.479	11.537	**11.633**	11.821	12.365	31.420
Payout	100.000	91.222	82.476	73.778	65.155	56.661	**48.420**	40.782	35.299	71.356
Interest cover	574.537	569.449	563.098	554.945	544.100	528.962	**506.356**	468.944	395.100	181.101
Stock market statistics										
Equity capitalisation ($m)	81.013	81.737	82.659	83.873	85.545	87.993	**91.922**	99.255	117.806	257.012
Enterprise value ($m)	108.018	108.983	110.212	111.831	114.060	117.324	**122.562**	132.340	157.075	342.683
MVA ($m)	8.018	8.983	10.212	11.831	14.060	17.324	**22.562**	32.340	57.075	242.683
P–E ratio	9.756	9.862	9.997	10.176	10.425	10.793	**11.393**	12.548	15.688	57.085
Disbursement yield (%)	10.250	9.250	8.250	7.250	6.250	5.250	**4.250**	3.250	2.250	1.250
Overall tax rate (%)	23.127	22.935	22.696	22.385	21.969	21.380	**20.484**	18.956	15.760	4.890
PEG	Infinite	9.862	4.999	3.392	2.606	2.159	**1.899**	1.793	1.961	6.343
MEC function										
Intercept (*100)	NA	10.800	10.800	10.800	10.800	10.800	**10.800**	10.800	10.800	10.800
Gradient (*100)	NA	1.493	0.746	0.498	0.373	0.299	**0.249**	0.213	0.187	0.166

I. A CORPORATE FINANCE PICTURE GALLERY

The Payout Ratio Again

The table provides a reminder of the surprising shape of the relationship between growth and the optimal payout ratio. This was shown in Figure I-4 (in Part I) to be a power series in g, the rate of growth (a list of the variables used in the model is attached as Appendix II), with the characteristic that it would manifest a concave shape when viewed from above over the relevant range. It is the aim of the present section to explain, at least as far as is possible in an integrated model, the reasons for this tendency. This will be achieved by rationalising the graphs of the other relationships that emerge along the rows in the table.

In order to tie the graphs in to Table I-1, the data for the focal 6% growth case will be highlighted at the appropriate point in each.

Enterprise Value

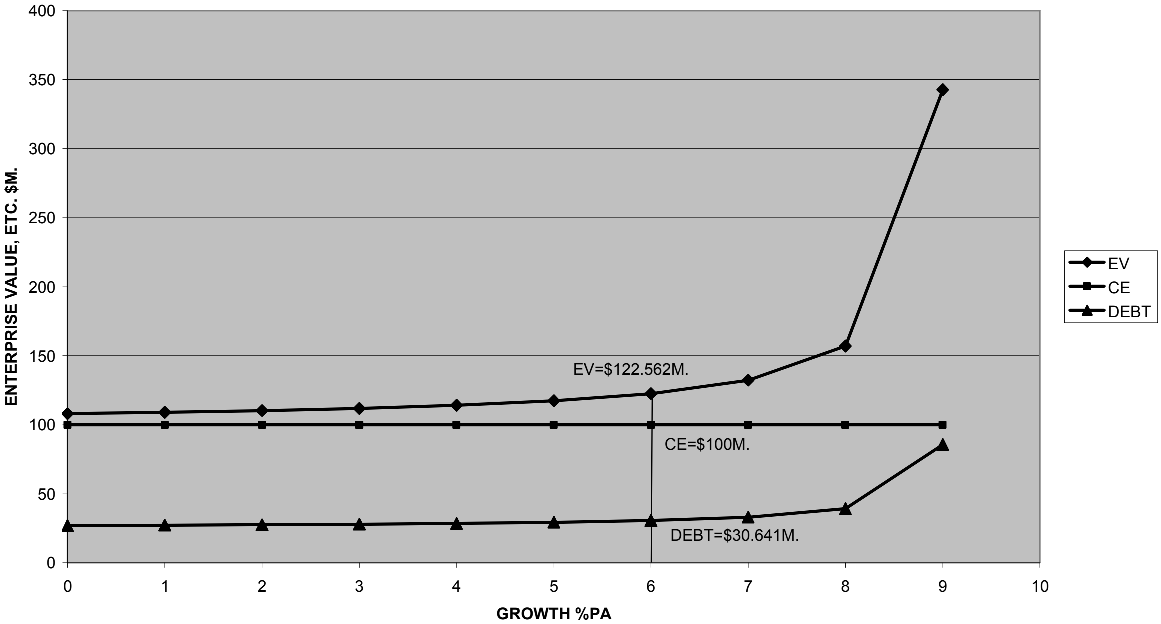
Figure II-1 traces out enterprise value and outstanding debt against the growth rate as at the end of Period Zero for the ten corporations simulated in Table I-1. Equity market capitalisation may be inferred in each case as the vertical distance between the two curves: balance sheet equity may be inferred as the line at $100m (this is the capital employed in each case) less the debt. As noted previously, debt is assumed always to trade at par value.

All ten corporations are priced by the stock market to offer a combination of disbursement yield and capital appreciation totalling 10.25% per annum, and it is thus important to understand why the simulations show such a significant escalation in enterprise value with the rise in the rate of growth – from $106.680m for the corporation in stasis, to $335.714m for 9% growth. The answer lies in Equation I-17 in Part I, which is repeated below as Equation II-1:

$$
\begin{aligned}
V_0 &= A_0(\text{ROCE} - g)/(\text{WACC} - g) \\
&= 100.0(0.1005375 - g)/(0.093075 - g) \qquad \text{(II-1)}
\end{aligned}
$$

where the computations for the solution values of the WACC and the ROCE were outlined in Sections III and IV of Part I. It is clear that the denominator in the formula approaches zero as the growth rate tends towards the WACC. This means that enterprise value will tend towards infinity as the growth rate approaches 9.3075%, notwithstanding that the bracket in the numerator also declines linearly with the growth rate.

FIGURE II-1



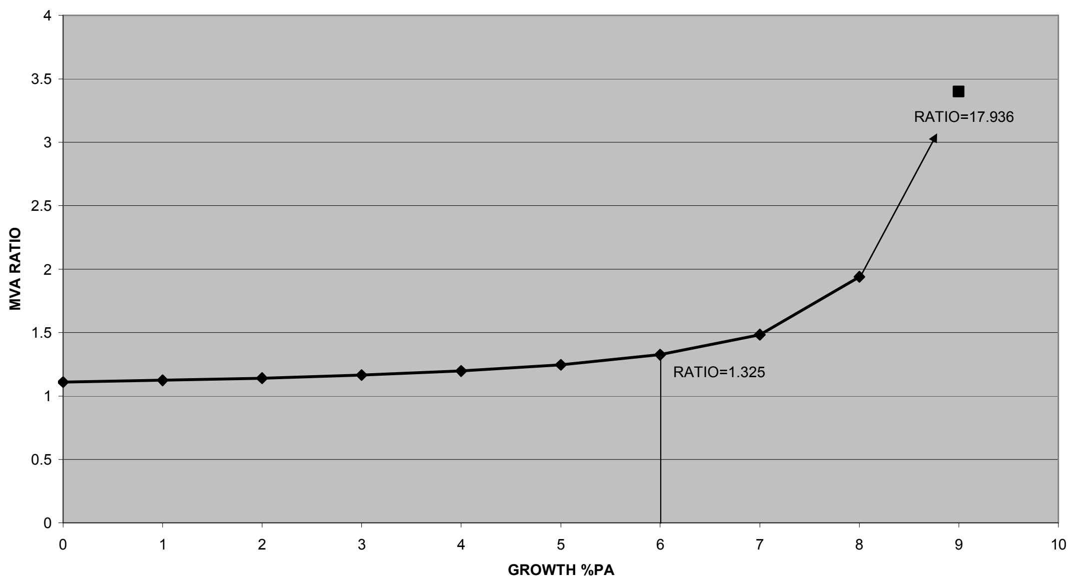
In practice the discount model does not break down in the way indicated by the formula. The investment analyst can always make sense of very fast-growing corporations by assuming that the growth rate will have to slow at some stage. Often she will devise a three-stage model to handle these cases: after the period of very rapid growth comes to an end, she assumes a phase of decelerating earnings growth which is then followed by an infinity characterised by a rate of growth below the cost of capital. Although the enterprise value may appear out of line for the 9% case in the figure, it is included, as a yield of 1.25%, and even a P–E ratio of 57 or so, is not outside the normal bounds of observation in the marketplace. Even now, nearly 20 years after the bursting of the Tokyo stock market bubble, the index there still manifests a lower yield than this: nor is it depressed by any meaningful level of stock repurchase activity

The associated sharp escalation in the balance-sheet debt ratio in the case of 9% growth raises the question of interest cover. While this looks healthy for the corporation growing at 8%, it is below two times for the 9% case. This could cause the rating agencies to rate the company's debt below investment grade. This tends to reflect a difference of approach between the agencies, which focus on balance-sheet gearing (in spite of the accounting distortions published accounts can harbour) and the logic of assessing debt capacity in relation to the economic – that is, the market – value of the corporation. In terms of market values, the gearing ratio is the same – 25% – for each of the corporations depicted in the table. This means that the present value of the future income to be generated by the corporation, including interest at 9%, is four times the present value of the interest on its own. In terms of the notation used in Part I, the ratio is equal to V_0/B_0.

MVA Ratio

As noted earlier, the amount of equity on the corporation's balance sheet may be inferred as the difference between the capital employed at $100.0m, and the debt: this shrinks along the growth spectrum as the increasing enterprise value supports a greater proportion of debt on the balance sheet. Also from Figure II-1, it is possible to perceive the equity market capitalisation as the difference between the enterprise value and the debt. The MVA ratio, the latter divided by the former, is graphed in Figure II-2.

FIGURE II-2



The ratio works out at 1.325 (= 91.922/(100.0 – 30.641)) in the case of 6% growth. The MVA ratio is the factor that converts a dollar of retained earnings into market capitalisation. It rises monotonically from 1.110 for the zero growth corporation, to 17.936 in the 9% growth case (note the point on the graph is not drawn to scale). In the case of 6% growth, by the end of Period One and post the stock repurchase operation, the equity market capitalisation will have increased by $5.515m (plus 6%) to $97.437m: this increase represents 1.325 times the amount of retained earnings of $4.162m in Period One. Again, there are many factors that come together to cause this effect, but it is easy to see how the shrinking equity investment translates into a higher return on equity, as shown in the table.

Market value added may seem a less obvious optimand than some other candidates, for instance, the enterprise value of the corporation or its P–E ratio. In due course – in the sensitivity analysis in the following section of the study – it will be shown that these alternatives may be in conflict with the maximisation of the MVA. In the meantime, it may be noted that the model results in ostensibly sensible decision rules – gearing up to minimise the WACC, and investing each period up to the limit in available positive net present value (NPV) projects.

The Price–Earnings Ratio

The P–E is the ratio of equity market capitalisation to net profit, otherwise referred to as earnings. In the data in Table I-1, the P–E rises by nearly six units between stasis and the corporation growing at 8%, before becoming highly unstable as the growth rate approaches the WACC. For 9% growth, the P–E rises to 57.085, as shown in Figure II-3.

Earnings for Period One are given by the first two terms in the expression for the distribution (D_1) given in Equation I-11. The P–E ratio may thus be written as:

$$P - E = Q_0/(A_0 f_1(X_1) - B_0 n(d)) \qquad \text{(II-2)}$$

where Q_0 represents equity market capitalisation at the end of Period Zero as usual. Equations I-5 and I-6 may then be used to obtain the P–E ratio in terms of the corporation's enterprise value:

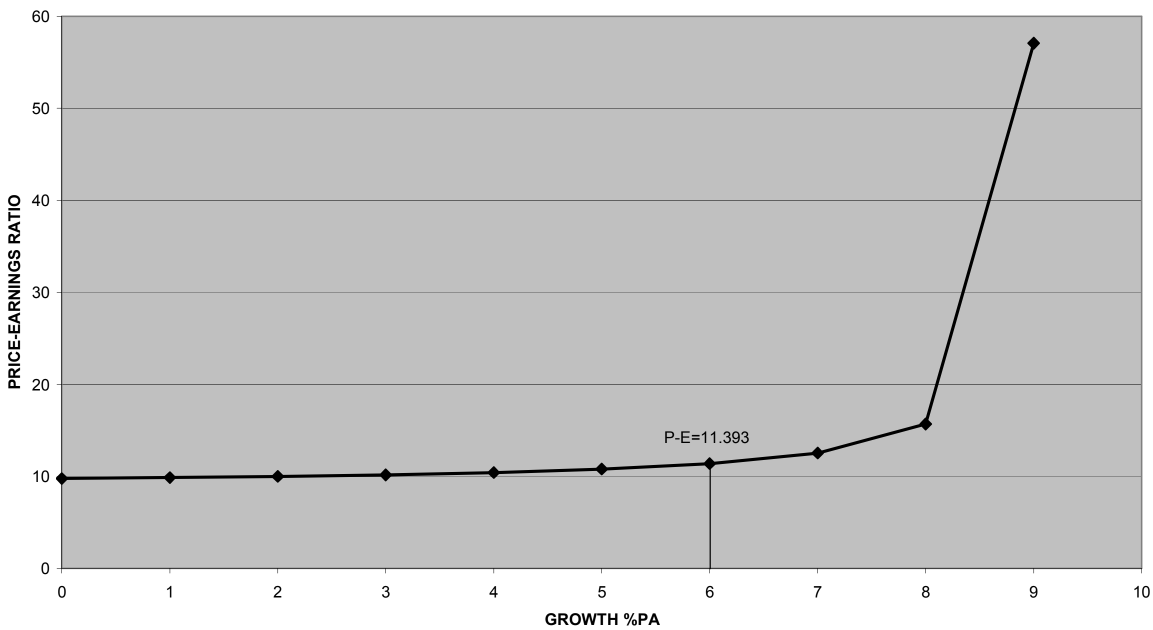
$$P - E = (1 - d)V_0/(A_0 * ROCE - dV_0 n(d)) \qquad \text{(II-3)}$$

Substituting in Equation II-1 for V_0 and simplifying results in:

$$P - E = [(1 - d)(R - g)]/[R(W - g) - dn(d)(R - g)] \qquad \text{(II-4)}$$

where R and W have again been used to signify ROCE and WACC. Upon entering the now familiar solution values for the case of 6% growth – d = 0.25, ROCE = 0.1005375, g = 0.06, WACC = 0.093075 and n(d) = 0.0648 – the P–E works out at the figure of 11.393 shown in Table I-1.

FIGURE II-3



The P–E ratio is used on a rule-of-thumb basis by financial analysts for valuing corporations directly, and as a check for assessing present value computations. The analyst is expected to be able to judge the extent to which the anticipated rate of growth of a corporation is reflected in its rating, and thus the extent to which a purchase or sale recommendation may be justified, on the expectation that the stock price will converge on its fair price. The complicated nature of Equation II-4 demonstrates just how hazardous such an enterprise might prove. Not only does the P–E depend in a complex way on the five variables appearing in the equation, but in practice they are not independent of one another. For instance, Figure I-3 shows that the corporation's ROCE will be influenced by its WACC, which in turn depends on the gearing ratio. There is also the added complication that managements cannot always be relied on to implement their optimal gearing and capital expenditure policies.

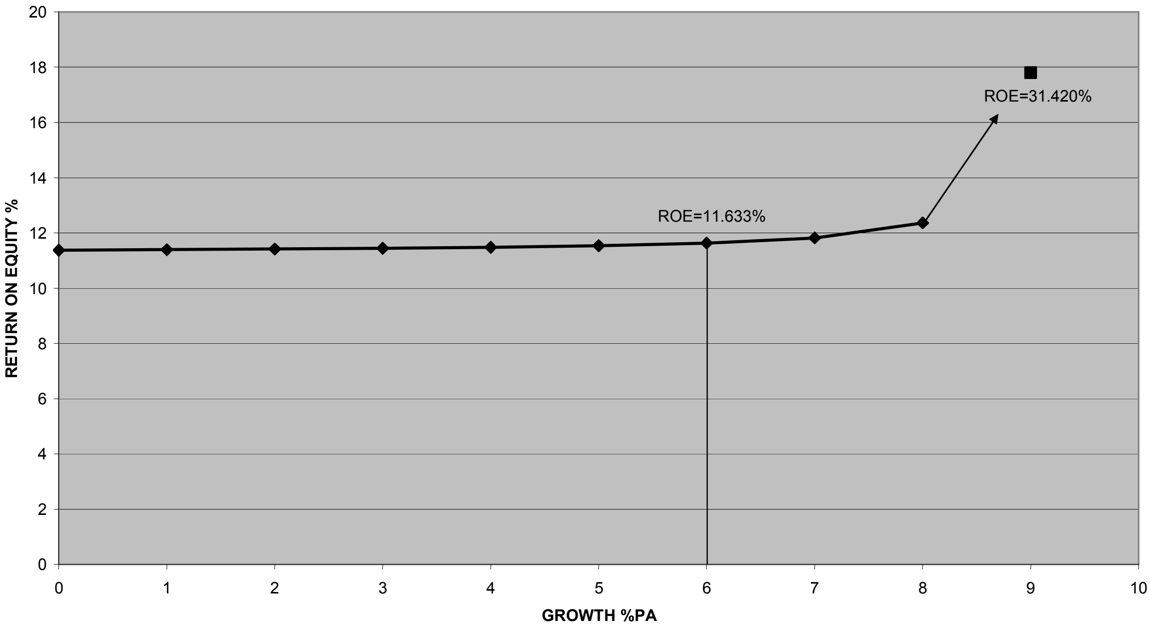
For instance, if the intercept for the corporation's MEC were 14.4%, instead of the 10.8% used in Equation I-35 in Part I, it would earn a net return of 11.854% on capital employed. Recomputing Equation II-4 to allow for this change results in a P–E ratio of 14.771, an increase of 3.378 over the value shown for the case of 6% growth in Table I-1. Comparisons of this type are demanded of investment analysts on a routine basis, but they are far too complicated to yield to intuition.

Table I-1 also states the PEG ratios for the ten simulated corporations. This is the ratio of the P–E to the growth rate in each case, and proves to be an even more fickle measure of value than the P–E ratio alone. The PEG falls and then rises again with growth, having begun its trajectory at infinity where the denominator takes the value zero. The corporation growing at 7% manifests the lowest PEG in the simulation – 1.793 – but it would be wrong to infer that it then offers better value than the other companies in the table. The no-arbitrage rule was used to price the stocks so that each would be expected to generate a total rate of return of 10.25% – the ECC.

Return on Equity

The return on equity, shown in Figure II-4, is calculated as the ratio of net profit, or earnings, to balance sheet equity, which in turn represents the accumulation of all previous retentions that have passed from the P&L account to the corporation's reserves (the point corresponding to growth of 9% is not drawn to scale).

FIGURE II-4

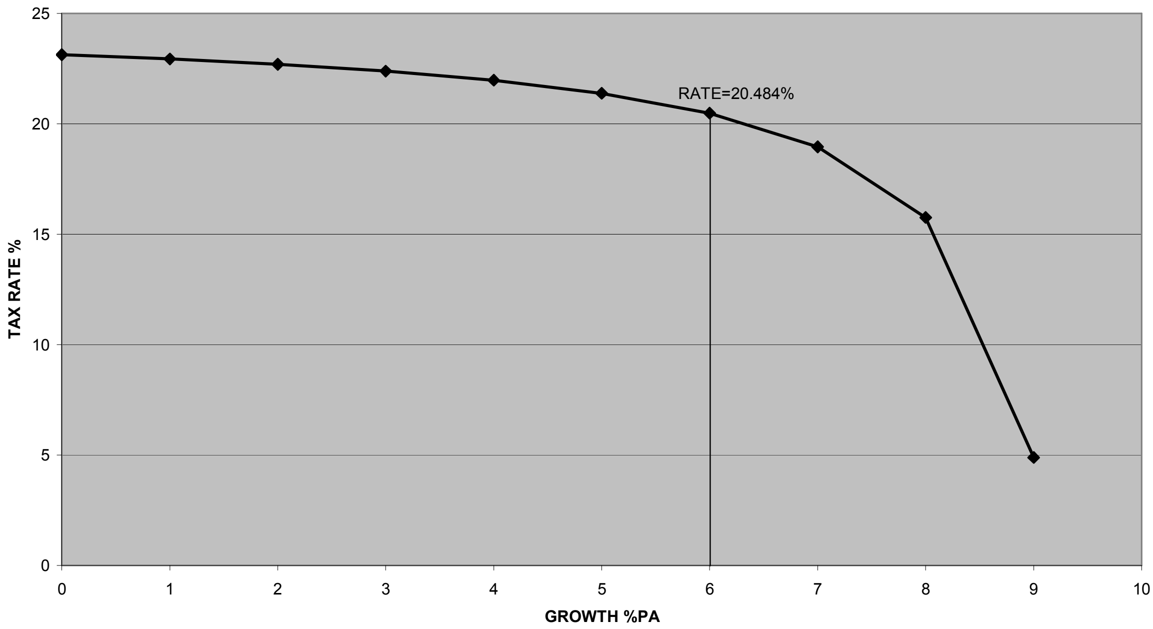


Although the earnings of the corporations tend to be depressed as the interest charge devours a greater proportion of operating profit as the growth rate increases, balance sheet equity falls even faster with the result that the return on equity increases monotonically across the growth spectrum. Its vital role in determining the optimal payout ratio is apparent when it is realised that the retention ratio will be equal to the ratio of the growth rate to the ROE: this is the point made by Miller and Modigliani (1961) in the statement quoted at the outset of the introduction to Part I of this study. Reorganising this equality shows the corporation growing at a rate equal to the product of its retention, or savings, ratio and its ROE. In the 6% case, the retention rate is 51.580% (= 100.0*6.0/11.821): Table I-1 quotes the payout ratio, its complement, standing at some 48.420%.

Overall Tax Rate

As noted earlier, the overall tax rate is computed as the ratio of the corporation tax paid to the sum of the returns received by the stakeholders in the corporation. These are taken to be the tax authorities, the bondholders and the stockholders, who receive respectively the corporation tax paid (the same amount as the numerator), the gross interest paid (that is, at 9%), and capital appreciation of 10.25% (the ECC) on the equity market capitalisation as at the beginning of Period One. The behaviour of this variable is illustrated in Figure II-5.

FIGURE II-5



The tax paid falls with growth due to the tax shield, but this effect is increasingly overwhelmed by the impact of the tax-free capital appreciation accruing to the stockholders. In the case of 9% growth, the tax shield amounts to $2.159m (= 0.28*7.710), the product of the corporation tax rate and the gross interest paid. But the stockholders enjoy capital appreciation of $23.131m (= 0.09*257.012), only $1.290m of which – retained profit – will have suffered corporation tax. Thus stockholders benefit from a tax-free gain of $21.841m. It is this that drives the effective tax rate down to only 4.890% in the 9% growth case.

The tax-free gain is the product of the growth rate and the MVA (0.09*242.683 – this relationship was noted in Part I), and the overall tax rate is thus largely the obverse of the MVA ratio: as shown in Figure II-2, this works out at 17.936 in the case of 9% growth.

A Virtuous Circle

It is easy to understand the emphasis on growth in the stock market. If the corporation can edge its prospective rate of growth upwards, it moves to the right in Table I-1, and there are then a number of beneficial effects. As the growth rate increases, the denominator in the valuation formula closes in on zero, and pushes up the value of the enterprise. As debt is a fixed proportion of this value, debt too increases, reducing the amount of equity on the balance sheet. Of course, the increase in debt increases the interest payable in proportion, but 28% of the increase if offset by a reduction in the corporation tax charge. Net profit falls, but by a lesser percentage than the fall in balance sheet equity, so that ROE rises along the growth spectrum. In due course, the amount available for distribution begins to rise again.

This of course reinforces the rise in the equity value of the portfolio, but the real driver is the increase in tax-free capital gains. This will be equal to the product of the growth rate and the MVA at the beginning of the period. This gain occurs on top of the gain generated by the equity component of the period's capital spend: however, this latter amount – $1.290m in the case of 9% growth – will have suffered corporation tax on its journey through the P&L account.

Dividend Policy in Practice

In terms of the model, dividend policy is redundant. The corporation's distribution is simply the residual that emerges as a result of implementing its optimal decisions on the gearing ratio and the capital spend. In practice, the chief financial officer (CFO) of a corporation has to make her recommendation on the corporation's payout one year at a time, and generally in an environment where earnings tend to manifest a considerable degree of volatility, and cash balances may be buffeted by a variety of influences. This raises the issue of how much force she should attach to any guidance she may derive by evaluating Equation I-52, the formula for the payout ratio.

Although it pre-dates by some decades the freedom corporations now have to effect their distributions via the repurchase route, the study by Lintner (1956) continues to offer the most telling insights into dividend policy. Corporations tend to have underlying long-term payout targets of the type predicted by the model, and to favour upwards-only revisions: a dividend cut is seen as a major admission of failure. Thus, averaging over a run of years, it should be possible to discern the predictions of Equation I-52 coming through. For the CFO then, the model potentially offers an important tool in relation to financial – and indeed strategic – planning. However, an already distorted picture – as forecasts for the growth rate of the corporation vary over time – is further confused by the ongoing transition from the payment of cash dividends to stock repurchases, and the failure of managers to offer sufficient guidance to stockholders on the extent to which repurchases reflect distributions out of current earnings, as opposed to those financed by capital transactions.

As noted previously, it is appropriate to adjust historic figures to get a true reflection of the rate at which a corporation's earnings are growing. The following section shows that no such adjustment will be necessary when the repurchase programme is financed by the disposal of assets or a balance sheet reorganisation to substitute debt for equity.

II. SENSITIVITY ANALYSIS

Maximising MVA: Second Order Conditions

First order conditions for the maximisation of MVA resulted in the derivation of Equations I-19 and I-20 in Part I. The partial derivatives of MVA (M_0) with respect to the gearing ratio, d, and the Period One level of capital expenditure, X_1, appear on the left-hand sides of these equations. In the following sections of the study, these equations were simplified and solved. Part of the solution process involved representing the ECC, the interest rate function (INTRTE) and MEC(1) by explicit straight lines. MEC(1) in Figure I-3 was shown as downward sloping, while the gradients of the ECC and the INTRTE in Figure I-1 were assumed positive, with the gradient of the latter being greater than that of the former.

The second order conditions for the maximisation of MVA involve taking the second order partial derivatives of M_0, and also its cross partial derivative, with respect to both d and X_1. These expressions may then be used to populate a two-by-two matrix with the two second order partial derivatives on its leading diagonal, and with the cross partial derivative appearing as each of its other two elements. Market value added will then be at a maximum if the determinant of this matrix proves to be negative when evaluated at the optimising values of the decision variables – d* and X_1* again – as already determined by solving the first order equations.

Rather than pursue this rather technical approach, it is more illuminating to carry out a sensitivity analysis to examine the contours of the MVA function in the vicinity of the indicated optimum. This is achieved by examining the characteristics of corporations that fail to implement the optimal values of the decision variables. In spite of the laboratory-like setting of the study, such exercises demonstrate the potential costs of such failures in terms of the MVA foregone by the stockholders. By solving the model for corporations that either over- or under-gear their operations, it is possible to demonstrate the derivation of the curve used by Brealey, Myers and Allen (2006) to illustrate their Trade-off Theory of Capital Structure. Thereafter, it will be the turn of corporations that over- or under-invest relative to the optimum level of capital expenditure. This demonstrates it is possible to expand the size of the company, and thereby also to increase its enterprise value, beyond the point where the stockholders' best interests are served.

Sensitivity of MVA to Gearing

Brealey, Myers and Allen (2006) demonstrate their Trade-off Theory of Capital Structure with a graph that shows enterprise value on the vertical axis first rising and then falling as the gearing ratio is increased on the horizontal axis. The optimal level of gearing is determined by balancing the advantage of the tax shield against the increasing costs of financial distress – the present value of bankruptcy costs and the commercial consequences of trading without the advantage of appearing financially sound to customers and suppliers. They contrast their curve with an interpretation of the Modigliani–Miller thesis, which shows enterprise value rising monotonically with the gearing ratio, reflecting only the advantage of the tax shield effect.

Later, Figure II-6 plots enterprise value against gearing for the case of 6% growth in Table I-1 above. The computations underlying the graph are illustrated in Table II-1.

Table II-1 Impact of Gearing on Market Value Added (Growth = 6% PA)

Corporate identity		B-Corp	A-Corp	C-Corp
Balance sheet ($m)				
Capital employed		100.000	100.000	100.000
Financing				
	Equity	75.691	69.359	63.537
	Debt	24.309	30.641	36.463
Profit and loss account ($m)				
Operating profit		13.964	13.964	13.964
Interest		1.984	2.758	3.588
Profit before tax		11.980	11.206	10.376
Corporation tax		3.354	3.138	2.905
Net profit		8.625	8.068	7.471
Retained profit		4.541	4.162	3.812
Payout		4.084	3.907	3.658
Accounting ratios (%)				
Roce		10.054	10.054	10.054
Return on equity (net)		11.395	11.633	11.758
Payout		47.348	48.420	48.971
Interest cover		703.852	506.356	389.218
Stock market statistics				
Equity capitalisation ($m)		97.236	91.922	85.081
Enterprise value ($m)		121.544	122.562	121.544
MVA ($m)		21.544	22.562	21.544
Debt/EV (%)		20.000	25.000	30.000
P–E ratio		11.273	11.393	11.113
Yield (distribution) (%)		4.200	4.250	4.300

The table duplicates, in its central column of figures, the accounts of the 6% growth case in Table I-1: this is now referred to as A-Corp. This is flanked by the corresponding data for delinquent companies, B-Corp and C-Corp, which adopt, respectively, a too cautious, and a too aggressive, stance on gearing. Gearing ratios are given in the table under the sub-heading ‘Stock market statistics’: against the optimum of 25%, B-Corp targets a ratio of 20% and C-Corp, a ratio of 30%. Figure I-1 earlier shows that these gearing ratios fail to minimise the WACC, but in spite of this both are assumed to make the same capital expenditure decisions as A-Corp (at least in terms of amounts invested) period by period: they thus earn the same rate of return, and these figures, net and gross, may be seen to take the same values in the table – 10.05375% and $13.964m respectively. But here the similarity ends. The description in the following paragraph details the accounts of C-Corp on the right of Table II-1, but an equivalent procedure applies in the case of B-Corp.

Based on the earlier interest rate and ECC relationships depicted in Figure I-1, a gearing ratio of 30% will involve C-Corp in paying interest at the rate of 7.084% (this is the net rate as explained earlier), while its stock will be priced to offer investors a total return of 10.3%. This latter figure will break down into the growth rate of 6%, and a residual net free cash flow (distribution) yield of 4.3%. The latter is the final figure of the C-Corp column. In this case the WACC works out at 9.3352% – that is:

$$\text{WACC} = 0.7 * 10.3 + 0.3 * 7.084 = 9.3352 \quad \text{(II-5)}$$

The next step in following through the data for C-Corp is to solve for the enterprise value. This is derived from Equation II-1 above, and incorporates the same ROCE as A-Corp:

$$V_0 = 100 * (0.1005375 - 0.06)/(0.093352 - 0.06) \quad \text{(II-6)}$$

which results in a figure of $121.544m, as shown in Table II-1. The accounts and related data for C-Corp follow in the usual way: debt is 30% of enterprise value, and interest is paid at 9.839% – the grossed up equivalent of the 7.084% used in the calculation of the WACC.

Targeting the higher gearing ratio – that is, 30% – has a modestly adverse effect on the corporation's enterprise value and MVA: the latter is a short 5% less than the corresponding figure for A-Corp. A rights issue to raise $5.822m (= 36.463 – 30.641), to be used in paying down debt, would result in an increase of $6.841m (= 91.922 – 85.081) in the equity market capitalisation of C-Corp – an instant gain of $1.019m, assuming the corporation can immediately negotiate its gross interest rate down to 9% on its remaining debt.

As soon as C-Corp announces its refinancing plan, its equity market capitalisation will rise to $86.100m (= 85.081 + 1.019): if the company has 100.0m shares in issue at the beginning of Period One (that is, immediately after the Period Zero repurchase exercise), each will now be priced at 86.100c. At this price C-Corp will need to issue 6.762m (= 5.822/0.86100) new shares to raise the $5.822m required to finance the planned debt repayment. It will then have 106.762m shares in issue. After the rights issue and debt repayment, C-Corp will be indistinguishable from A-Corp in economic terms, and will thus have an equity market capitalisation of $91.922m: this figure is equal to the product of the new number of shares in issue and the issue price (= 106.762*0.86100).

Of course, if the rights issue had been sold at a discount to the market price of the stock after the announcement, it would be necessary to apply an adjustment factor to the historic price record and to the historic earnings record so that meaningful comparisons could be made with the new characteristics of C-Corp. The refinancing would in fact give a small boost to earnings per share growth in Period One. C-Corp's total earnings in Period Zero would have been $7.048m (= 7.471/1.06), which works out at 7.048c per share. In Period One, total earnings rise to $8.068m: this represents 7.557c per share (= 8.068/106.762), where the denominator reflects the greater number of shares in issue after the rights issue. The forecast growth in earnings per share now works out at 7.22%: the main driver of the Period One advance remains the 6% increase in capital employed implemented at the end of Period Zero, of course.

Special Dividends and Repurchase Plans

Table II-1 shows that the result for B-Corp is symmetrical: it has the same, slightly raised WACC as C-Corp, which then results in the same enterprise value and MVA. Together with A-Corp, the three observations confirm the anticipated peaking of the surface along the dimension of the gearing ratio. The notable feature of the solutions is the tight clustering of the calculated payout ratios and P–E ratios. What appears a quite trivial difference in the payout ratio can cumulate to a significant change in the level of balance-sheet gearing.

Taking A-Corp as its role model, the arbitrage opportunity for B-Corp is to increase its borrowings in order to return cash to the stockholders: this may be achieved either through a repurchase operation or through the payment of a special dividend. Thus, the corporation decides to borrow an additional $6.332m (= 30.641 – 24.309): when this is paid out, the equity value of the corporation falls only by $5.316. (= 97.236 – 91.922), leaving stockholders better off in the amount of $1.016m. Initially, however, on the announcement of the planned refinancing, the market capitalisation of B-Corp will increase by this amount to $98.252m (= 1.016 + 97.236). If B-Corp has 100.0m shares in issue at the beginning of Period One (immediately after the Period Zero repurchase operation), these will now trade at 98.252c each. The additional borrowing will purchase 6.445m (= 6.332/0.98252) shares, leaving 93.555m in issue. At 98.252c each, these will have an equity market capitalisation of $91.922m, the same as A-Corp. As in the case of the rights issue by C-Corp, no further adjustments will be necessary to make the historic stock price record and the historic earnings figures comparable with those of the refinanced B-Corp. This is true as long as the rights issue and the repurchase operation are carried out at market prices. It is common for companies to issue shares at a discount by offering them as rights to existing holders: it is then appropriate to scale down prior year earnings and stock prices to allow for the associated bonus element. It is less common, but not unknown, for companies to carry out buybacks at a premium: but if they do so, it is equally important to issue rights – these will in fact be puts – to the existing stockholders, and thereafter to adjust historic earnings and stock prices by scaling them down accordingly. (The logic here is slightly more complicated. The corporation buys in fewer shares at the higher price – the dollar amount of the buyback is fixed by the additional debt raised – which leaves a greater number in issue, and this in turn has a depressing effect on future earnings per share. It will thus be necessary to scale down the historic earnings figures to make them comparable.)

If, on the other hand, the $6.332m raised were to be used to finance a special dividend, it would be appropriate to consolidate the shares at the rate of 93.555 per 100 held before the distribution. Failure to make this adjustment would result in a discontinuity in the stock price and earnings records. Of course, paying a special dividend will have the usual adverse consequences for those stockholders subject to the higher rate of income tax.

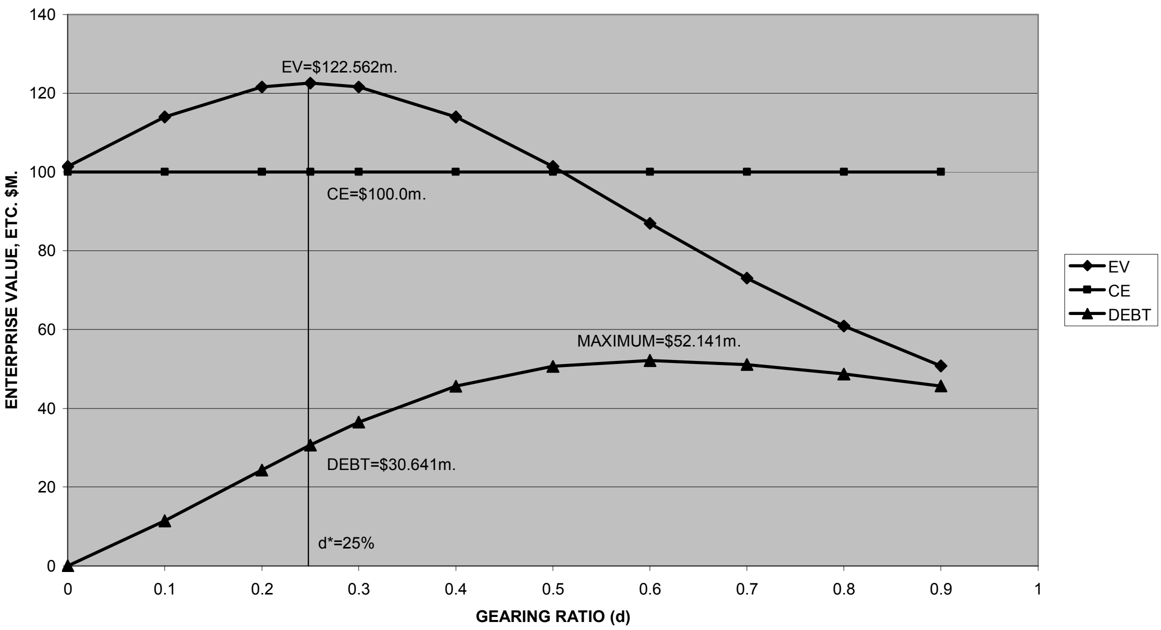
This analysis demonstrates the need for different treatments as between repurchases financed from current operations, and repurchases financed out of capital transactions. In the former case, as discussed in Sections I and V of Part I, historic stock prices and earnings should be scaled up – by the ratio of the old number of shares in issue to the new – to make them comparable with the new situation.

As a result of the altered capital structure of B-Corp, its Period One distribution will fall by $0.177m (= 4.084 – 3.907): this represents 2.80% of the amount paid out to stockholders (= 100*0.177/6.332). As the distribution shortfall would be assumed to be on course to increase at 6% per annum (the growth rate), it may be seen that the $6.322m returned to the stockholders was effectively earning a return of only 8.80% in total previously. In the stockholders' hands, this money may then be redeployed back into the stock market to earn the equity cost of capital – 10% or more, depending on the risk stance adopted.

The Trade-off Theory of Capital Structure: Denouement

As anticipated above, Figure II-6 below provides an elaboration of the Brealey, Myers and Allen (2006) Trade-off Theory of Capital Structure.

FIGURE II-6



The graph presents the same variables as Figure II-1, and highlights the optimal values of the variables as they apply in the case of A-Corp in Tables I-1 and II-1. Now, all the corporations depicted are growing at 6%, as in Table II-1: the data for the cases of 20% and 30% gearing are of course as detailed as in the table. The diamonds show enterprise value first rising and then falling, compared firstly with the $100m of capital employed, and secondly with the debt, as the gearing ratio increases from 0% to 90%. If the corporation decides to adopt a zero debt stance, it will be bid onto a total return of 10% and a disbursement yield of 4%, according to the relationship in Figure I-1. The ECC of 10% – now also the WACC – is barely less than the ROCE (= 10.05375%), so that the MVA in this case is more or less zero.

In the other direction, the corporation that targets equal amounts of debt and equity will also fall close to zero MVA, and the situation deteriorates thereafter for corporations that adopt even more aggressive gearing ratios. In fact, the corporation's ability to raise debt declines beyond the 60% gearing level, as the enterprise value begins to collapse: the corporation pays higher and higher interest rates, and is thus forced at the same time to finance more of its capital expenditure from retained earnings. Of course, the shape of the curve is determined to a large extent by the arbitrary values assigned to the intercept and gradient of the interest rate function as depicted in Figure I-1.

In spite of the laboratory-like setting of the study, it is then possible to sympathise with the position adopted by Koller, Goedhart and Wessels (2005), when they warn managers against attempting to be too precise in optimising the corporation's gearing ratio. The curve of the enterprise value is in fact relatively flat in the vicinity of the maximum, as already noted in relation to B-Corp and C-Corp in Table II-1. Beyond this, the graph shows that any gearing ratio between 10% and 40% captures more than 60% of the potential MVA. Obviously, uncertainties surrounding the shapes and parameters of the underlying relationships – for instance, the interest rate function – make it impossible to be too definitive concerning the optimal gearing ratio in practice. On the other hand, it would be dangerous for managements to be too complacent about their levels of gearing, when the stock market is patrolled by private equity operators that specialise in negotiating better borrowing terms than may be available to incumbent managers, and that are prepared to push the level of borrowing to the limit.

Sensitivity of MVA to Capital Expenditure

An exercise similar to that above may be conducted in the dimension of the capital expenditure variable: the results are shown in Table II-2, which again confirms a maximum in the optimand. Here A-Corp is contrasted with delinquent corporations D-Corp and E-Corp which respectively under- and over-invest in each period, even though they each target the optimal 25% gearing ratio, and thus have the same WACC. The exposition follows the case of E-Corp, but a comparable solution process applies to D-Corp.

Both delinquents are assumed to be faced with the same MEC curve as A-Corp, period by period: it is, however, taken to be the case that their MECs are independent of one another – that is, there is no suggestion that these companies are in any sense operating in competition with one another. But E-Corp invests 10% more than A-Corp at each point in time, thus running on beyond the point where the return on the marginal project covers the cost of capital: in spite of its error, it ranks its potential projects correctly in terms of their internal rates of return. By the time A-Corp has accumulated $100.0m of capital employed, E-Corp will have a balance sheet totalling $110.0m. While A-Corp decides to invest $6.0m at the end of Period One, E-Corp goes for $6.6m: this has the effect, according to the ROCE(1) curve in Figure I-1 in Part I, of depressing its rate of return to 9.979%, compared to 10.054% for the optimum:

$$f_1(X_1) = 0.105 - 0.5 * 0.0024875 * 6.60 = 0.09979125 \quad \text{(II-7)}$$

where the parameters of the MEC have been taken from the 6% case in Table I-1 above (subject to the halving of the gradient to convert to the ROCE function). The ROCE is listed in the third column of Table II-2: it grosses up to 13.860%, but this figure in fact fails to make an appearance in the table.

Table II-2 Impact of CAPEX on Market Value Added (Growth = 6% PA)

Corporate identity	D-Corp	A-Corp	E-Corp
Balance sheet ($m)			
Capital employed	90.000	100.000	110.000
Financing			
Equity	61.916	69.359	76.916
Debt	28.084	30.641	33.084
Profit and loss account ($m)			
Operating profit	12.660	13.964	15.246
Interest	2.528	2.758	2.978
Profit before tax	10.133	11.206	12.268
Corporation tax	2.837	3.138	3.435
Net profit	7.296	8.068	8.833
Retained profit	3.715	4.162	4.615
Payout	3.581	3.907	4.218
Accounting ratios (%)			
ROCE	10.128	10.054	9.979
Return on equity (net)	11.783	11.633	11.484
Payout	49.080	48.420	47.754
Interest cover	500.894	506.356	512.023
Debt:capital employed	31.205	30.641	30.077
Stock market statistics			
Equity capitalisation ($m)	84.253	91.922	99.253
Enterprise value ($m)	112.337	122.562	132.337
MVA ($m)	22.337	22.562	22.337
P–E ratio	11.548	11.393	11.236
Yield (distribution) %	4.250	4.250	4.250

This is because capital employed in this case is $110.0m, so that the operating profit works out at $15.246m (= 110.0*0.13860) as shown. The formula for the enterprise value is then:

$$V_0 = 110.0 * (0.09979125 - 0.06)/(0.093075 - 0.06) = 132.337 \quad \text{(II-8)}$$

Debt is one quarter of this amount as usual, and the interest rate is 9% as before. After corporation tax, net profit of $8.833m remains for the account of the stockholders. Debt works out at 30.076% (= 100.0*33.084/110.0) of capital employed, so that $1.985m will be the amount borrowed to help finance the $6.6m capital spend. This leaves $4.615m (= 6.600 – 1.985) to be financed internally, resulting in residual net free cash flow of $4.218m as shown. This is the amount available for the repurchase programme at the end of Period One.

The accounts for D-Corp – which consistently under-invests by 10% – are also shown, and again indicate a symmetrical effect. In spite of what seems a fairly substantial error in the scale of operations in each case, the MVA is only just over 1% less than that of A-Corp. Of course, this result could be higher, depending on the parameters chosen for the various relationships, but the main conclusion holds. The penalty for getting it wrong is likely to be modest and often imperceptible when the degree of general uncertainty faced by managers is factored in. The differences in the payout ratios for the three corporations are barely meaningful when other influences on the payout decision from period to period are considered – most obviously, the volatility of earnings over the economic cycle and the vagaries of the companies' cash balances at payout points.

Both corporations could make a start on rectifying their failures by investing the optimal amount in Period One and thereafter: their accounts would then converge with those of A-Corp over time. But there is no easy route to recovery this time, especially for D-Corp, which has no way of revisiting its earlier missed investment opportunities. E-Corp could sell its lowest rate of return assets and distribute the proceeds to stockholders. But the sale of $10m of surplus assets would raise only $9.775m (= 132.227 –122.562), thus crystallising a loss of $0.225m. Repaying debt would then absorb $2.443m (= 33.084 – 30.641), leaving some $7.332m to be returned to the stockholders, either through a repurchase operation or through the payment of a special dividend. That the whole exercise is neutral in relation to the interests of the stockholders is shown by the fact that its Period One residual net free cash flow (payout in the table) would diminish by $0.311m (= 4.218 – 3.907), which represents 4.25% of the $7.332m returned to the stockholders. As this difference would be expected to grow at 6% per annum after the disposal, it may be seen that the amount withdrawn from the market was earning a return equal to the ECC. Of course, there could be an advantage to a disposal if a buyer could be found to pay a premium over the cost of the assets, presumably because they could be made to earn a higher return by a more competent management.

Obviously, a special dividend would have the aforesaid adverse income tax consequences. It would also be necessary to consolidate the shares at the rate of 92.614 units for every 100 held before the distribution in order to make the historic stock price and earnings per share comparable with those of E-Corp in its new form. As there is no profit on the transaction in this case, the scaling factor is given directly by the ratio of the equity market capitalisation of A-Corp to that of E-Corp (= 100*91.922/99.253)

Corporate Financial Objectives

The case of E-Corp brings into focus the difference between the objectives of maximising MVA and maximising enterprise value. At a comparable point in its life (in terms of the history of its investment opportunities), E-Corp has invested $10m more than A-Corp, but its enterprise value exceeds that of A-Corp only by $9.775m, a loss of value to the stockholders of $0.225m. This is because E-Corp is taking on projects which fail to cover its WACC. This is evident from computing the MEC at its chosen level of capital expenditure in Period One:

$$\mathrm{MEC}(1) = 0.108 - .0024875 * 6.6 = 0.0915825 \qquad \text{(II-9)}$$

that is, 9.15825%. This compares with the critical cut-off value of 9.3075% for the WACC.

There is also an interesting comparison to be made between D-Corp and A-Corp, with the former being valued in the market on a higher P–E ratio, albeit the premium is small in this case. D-Corp earns – again based on the ROCE(1) curve in Figure I-3 in Part I – a rate of return of 10.128% (compared with 10.054% for A-Corp), which grosses up to 14.067%, which, when applied to assets of $90.0m, generates the Period One operating profit of $12.660m shown in Table II-2. Working the simulation through shows that D-Corp enjoys a higher return on equity than A-Corp – 11.783% versus 11.633% – but evidently other effects mean that restricting the scale of D-Corp's operations results in it being priced in the market to manifest a lower MVA at the end of Period Zero. Of course the market sees through this failure, with both companies being priced to offer a total rate of return of 10.25% – the ECC as before.

In general, restricting the level of investment in order to boost return on equity may result in a higher P–E valuation for the corporation, but such a policy need not necessarily be in the best interests of the stockholders, as Table II-2 shows. In particular, selling relatively low return assets to enhance overall return on capital employed and the P–E ratio can be treacherous. A disposal at a knock-down price will be detrimental to the interests of the stockholders: such assets have to be sold at a price high enough to ensure that their prospective rate of return is below the seller's WACC. The conclusion below argues this policy would benefit from further modelling.

If neither the enterprise value of the corporation nor its P–E ratio can serve adequately as the optimand, this seems to justify the approach taken in Section II of Part I, which was to maximise market value added. This certainly appears to be confirmed by the intuitive appeal of the decision rules derived from Equations I-19 and I-20 for the debt ratio and the periodic amounts to be laid down in capital expenditure.

This is not quite the end of the issue of objectives. Koller, Goedhart and Wessels (2005) recommend putting the strategic emphasis on ratcheting up the corporation's growth rate. And a glance along the rows of Table I-1 above certainly indicates that faster growing corporations enjoy superior stock market ratings and MVA ratios: as noted earlier, increasing debt depresses the corporation tax liability, while escalating tax-free capital gains accrue to the stockholders. However, the most obvious means of improving the corporation's growth prospects is by spending on research and development (R&D). Extending the model to treat the R&D budget as an additional decision variable is considered to be outside the scope of the present paper, but there can be an optimal rate of growth where the escalation in the P–E ratio with the corporation's rate of growth is offset by the depressing effect of the extra spending on its ROCE. Again, it is intended to explore this topic in a subsequent study.

III. CONCLUSION

Resolving the Dividend Puzzle

'This case has little empirical significance, but it is convenient for illustrative purposes and has received much attention in the literature.' Again, the authors are Miller and Modigliani (1961), and their topic, 'the convenient case of constant growth rates'. In due course they continue: 'We suspect that, in the last analysis, the popularity of the internal financing model will be found to reflect little more than its ease of manipulation combined with the failure to push the analysis far enough to disclose how special and how treacherous a case it really is.' Thus Miller and Modigliani attempt to downplay the significance of their admission, in the statement quoted at the outset of the introduction in Part I of this study, of the possibility of an optimal payout ratio for the corporation. The main culprit as far as they are concerned is Myron Gordon (1962), but Benjamin Graham and David Dodd (1951), among others, are also cited as meriting criticism. But it is not easy to imagine how the investment analyst should proceed in attacking the valuation problem, if not by 'illustrating' the infinite life of the corporation by essaying, under varying assumptions, a few instances of the constant growth, internal financing model. She may be sufficiently informed to make detailed forecasts of its cash flows for the immediate two or three years, or even more, and these may indeed manifest differing growth rates, but these early years will typically account for only the tip of the iceberg. The weight of the corporation's value will generally be obtained as a residual to be estimated only by making a bold stab at its underlying long-term rate of growth, and plugging it into the dividend – or, in this case, residual net free cash flow – discount model. The stock market may indeed constitute a 'treacherous' theatre in which to hazard such predictions, but the problem is unlikely to be made any more tractable by roundly condemning what seems to many analysts to be the most logical approach.

But at the same time, the concept of optimality can prove slippery when considered in relation to payout policy. For one thing, there is no call for a variable to represent the payout ratio (nor, of course, its complement, the retention ratio) in the model developed in Section II of Part I of the study. The MVA of the corporation is maximised, and its future fully determined, by choosing that debt ratio that minimises its WACC, and then investing from period to period up to that amount where the MEC falls to equality with the WACC. This process generates the optimal payout policy – Equation I-52 of Part I – but only in the passive sense of providing a target or benchmark against which to measure the competence of the corporation's management. The fact that the payout ratio is not a decision variable is made more confusing because in practice the management has to determine from year to year what the corporation's dividend or repurchase spend should be. The optimal payout ratio may then appear to play only a minor role in the decision process, when earnings and cash balances can suffer significant volatility through the economic cycle.

There is a further reason why the existence of an optimal payout ratio appears problematic, and this relates to the dichotomy between the corporation and its stockholders. Rational stockholders will not be concerned with the means by which they receive their returns – cash dividends or capital appreciation – since they can make their own individual adjustments concerning how much spending money they wish to withdraw from their portfolios from period to period, and how much they wish to remain invested for the future. But it would be wrong to infer from this that there is no optimal payout ratio for the corporation itself. Modigliani and Miller demonstrate that the corporation can set its payout at a level above the ideal, but that this aberration must then be compensated for by implementing regular equity issues if it is to remain on track to fulfil its full economic potential. However, the inherent circularity of this process cannot be avoided when it is assumed, as in the present study, that the corporation makes its distributions wholly in the form of a series of stock repurchase programmes. For then the Dividend Irrelevancy Proposition would seem to countenance a process whereby the corporation not only buys in stock to a greater value than its residual net free cash flow each period, but simultaneously sells new shares – at exactly the same price (in effect, the 'cum dividend' price) – to finance the resulting shortfall on its capital expenditure account also. Stockholders, who can no doubt recognise a contra-entry when they see one, would surely baulk at such behaviour, but the puzzle can be resolved by recognising that the stock market arrives at its value for the corporation by discounting at the ECC the growing cash disbursements it makes as the yearly repurchase programmes unfold. The stockholder effectively buys a capital share – what might be termed a 'zero-dividend equity'. But the discounted cash flow analysis is entirely consistent between the two cases, each having an internal rate of return equal to this same ECC. In particular, the one-year rate of return is exactly the same for both the investor who responds to the buyback, and the investor who decides to stay with the company for a further period. The former sells at the implied cum dividend price, while the latter continues to hold a stock that sustains this same price, as it never actually goes ex that dividend: the value remaining within the company after the buyback is just spread over fewer shares.

Accounting Reform

Of course, the stock repurchase plan was adopted throughout this study to circumvent the complications that arise as a result of the incidence of income tax on dividends, but this approach then has the unfortunate consequence that it opens up a difference between the growth of total earnings (net profit in the tables) and the growth of earnings per share (and the rate of increase in the stock price). In the extreme case, where the corporation uses the whole of its residual net free cash flow for the buyback, earnings per share will appear to increase at a rate equal to the ECC: recorded earnings per share will be independent of the underlying rate of profits growth, as argued previously in relation to the simulations in Table I-1. This phenomenon has been the subject from time to time of adverse comment in the financial press, where executive performance bonuses have been inflated by being tied to a corporation's reported (thus, unadjusted) growth in earnings per share. As discussed in Section V of Part I of the study, it will be necessary to scale up the historic earnings figure by the ratio of the old number of shares in issue to the new, in order to compute the underlying rate of earnings growth in any period. In addition, the historic record of the price of the stock needs to be similarly adjusted.

In practice the problem is more insidious because most corporations, at least in the UK, favour a hybrid approach, continuing to pay a cash dividend at some level, but undertaking repurchases from time to time to siphon off excess cash generated by exceptionally favourable trading conditions. These complications inevitably lead to the conclusion that conventional annual financial statements are inadequate, and should be supplemented by an appropriation account, so that the investment analyst may more clearly perceive what amounts the corporation is planning to distribute – both by way of cash dividends and of stock repurchases – and the sources of the funds to be used to finance such distributions. This would provide useful additional information for the analyst in her attempt to compute and assess the corporation's payout ratio, and to estimate a meaningful historical rate of earnings growth. Any such appropriation account should also make it possible to track disbursements financed by the disposal of assets, or from additional borrowings raised to restore the gearing ratio where the managers judge it to be too low relative to its optimal level. As noted in Section II of Part II, this distinction is important, as it is not necessary to adjust past stock price and earnings data in relation to repurchases financed by capital transactions.

Further Studies

Mention of the optimal gearing ratio in the previous paragraph serves as a reminder that the present paper comes into conflict on a second front with the teachings of Modigliani and Miller, when they argue that, if interest on debt may be expensed before striking taxable profits, then the corporation should finance its capital expenditure as far as possible by borrowing. This could result in a 100% payout ratio – and a dearth of equity on the balance sheet. The Trade-off Theory of Capital Structure proposed by Brealey, Myers and Allen (2006) implies the corporation faces a rising interest rate as it gears up, and Figure I-1 then shows the minimum for the WACC occurs where the MCD (marginal cost of debt) intersects with the MCE- (adjusted marginal cost of equity). But what happens if the gradients are such that this intersection occurs at a significantly higher debt ratio than the 25% level determined in Figure I-1 earlier? This is the subject to be tackled in a subsequent paper. For it then transpires that, by solving the model developed in Section II of Part I, subject to the constraint that balance sheet equity must be non-negative, a Modigliani–Miller type solution is arrived at. The faster the corporation grows – as determined by the time shift in its MEC curves, of course – the greater its enterprise value relative to its capital employed. But capital employed is financed entirely by issuing debt, so that faster growing companies have lower optimal gearing ratios (debt upon enterprise value). Together, these effects drive lower interest rates, and higher ROCEs. This combination results in the escalation of the P–E ratio with growth becoming even more explosive than that shown in Figure II-3. And of course, the optimal payout ratio is uniformly 100% across all rates of growth.

A number of other potential studies were noted as the discourse progressed. If the analysis shows anything looking along the rows of Table I-1, it must be that there will be a significant payoff to ratcheting up the rate of growth of the corporation: this is the point emphasised by Koller, Goedhart and Wessels (2005) when they consider the objectives of the corporation. This means introducing a third decision variable, the level of R&D expenditure, which then offers the prospect of some degree of management control over the rate at which the MECs shift to the right over time. The optimal level of the R&D budget is then determined where there is a balance between its depressing effect on the ROCE, and the enhanced rating put on the corporation's shares as the MVA ratio escalates with the faster rate of growth. It was also noted, in relation to Table II-2 in Section II above, that the targeting of an increase in the corporation's P–E ratio, as is often done to justify acquisitions and disposals, could prove counter-productive in relation to maximising shareholder value. This too would benefit from detailed modelling. Other projects relate to the exploration of the source of the corporation's PVGO, the present value of its growth opportunities, and the impact on the WACC when personal taxes cannot be avoided – and thus ignored – as readily as they may be now under the UK's existing tax regime.

This last analysis should then make it possible to begin to gauge the impact on the MVAs of UK companies, where managers persist with the payment of cash dividends, instead of switching to the tax-efficient stock repurchase alternative. This seems a wasted opportunity, but the effect may in fact not be all that significant, given the high proportion of their equity market capitalisations in the hands of tax-free funds, and the flexibility higher rate tax-payers have to concentrate their portfolios in lower yielding growth stocks. Of course, this is only one of a number of possible empirical studies that suggest themselves in the light of the model.

APPENDIX I. KEY POINTS FROM THE STUDY

Dividend Irrelevancy

The Dividend Irrelevancy Proposition of Franco Modigliani and Merton Miller demonstrates that the value of the corporation will be independent of the dividend payout ratio adopted by its managers, so long as this does not affect their implementation of its optimal level of capital expenditure each period. The higher the ratio, the higher the yield the stock will trade on, but this is of no consequence to the rational stockholder. By buying and selling in the market, she can make her own determination as to how much spending money she wants to realise year by year, and how much of her portfolio she wants to remain invested for the future. The proposition has then been interpreted to mean that the search for an optimal payout ratio for the corporation is futile.

Market Value Added

But the proposition rules nothing out either. In particular, the managers can hardly be faulted if their payout ratio is consistent with the optimal stewardship of the corporation's resources. In the present study, the managers' decisions are determined with the objective of maximising the market value added (MVA) of the corporation: this is the excess of its enterprise value over the book cost of its capital employed. Enterprise value is the total market capitalisation of the corporation's debt and equity, with the latter determined as the present value of the residual net free cash flow to be distributed year by year in the future.

Decision Variables

Under fairly straightforward assumptions concerning the expansion in the corporation's investment opportunity over time – this is modelled as a steady rightward progression in its marginal efficiency of capital expenditure curve (MEC) – and the stability of its borrowing arrangements, there are two rules to be followed. Firstly, the corporation should adopt that gearing ratio (debt to enterprise value) that minimises its market value weighted average cost of capital (WACC). Secondly, its capital expenditure should be set at that amount each year such that the MEC (for that year) falls to that level where it is equal to the WACC, now treated as a perennial constant. It should thus undertake only those projects with positive net present value (NPV).

Steady State Growth

The picture that emerges is then of the corporation moving along a steady state growth path. Each of its accounting and stock market magnitudes grows at a common constant rate. Each of its accounting and stock market ratios, including its payout ratio, remains constant through time. The assumption of stable borrowing costs implies that the corporation's debt will trade at face value: coupons will be discounted at the interest rate it pays. The further assumption necessary to generate this result is that the corporation distributes to its stockholders its residual net free cash flow – that is, the cash it has available after implementing its optimal capital expenditure plan each period, as determined above.

Optimal Payout Ratio

While the payout ratio thus arrived at is not a decision variable of the model – for instance, in the way described above for the optimal gearing ratio – it does have the following attributes:

1. it results from an optimisation process
2. it provides a valid prediction of how the well-managed corporation may be expected to behave in relation to its distribution policy: the corporation simply pays out the portion of its earnings it can afford after prioritising its investment spend each period.

It is important to stress that neither the payout ratio nor its complement, the retention ratio, appear explicitly in the model.

Personal Taxes

The analysis described above is satisfactory to the extent that all investors are subject to the same taxes. This is not the same as being subject to the same tax regimes. In the UK and the US, pension funds (and some other institutions) pay no tax. The main contrast is then with those private individuals who are subject both to the higher rate of income tax on the dividends they receive, and to capital gains tax if and when they realise investment profits. This means that a corporation that wishes to maximise its MVA should distribute its residual net free cash flow by implementing a series stock repurchase programmes. In this way, all stockholders will be able to avoid paying income tax. Further, those stockholders who retain their shares will, other things being equal, benefit from an equivalent appreciation in the value of their investment in the corporation. Again, they will be able to avoid any liability to capital gains tax. Ironically, it is the Dividend Irrelevancy Proposition that indicates that it would be illogical for the gross funds to object to the repurchase procedure, even though it will only be those individual stockholders subject to the higher rate of income tax who stand to benefit from it directly.

Distributions from Year to Year

Part of the problem of implementing the insights from the model in practice arises because corporations have to decide their payouts from year to year in the light of earnings and cash balances that fluctuate with the economic cycle and other commercial pressures. This means that any assessment of the consistency of the corporation's payout ratio with its optimal level has to be averaged over a reasonable period of time. The model then shows that its retention ratio – the complement of its payout ratio – should be equal to the ratio of its underlying growth rate to its return on equity. However, for this test to be meaningful, return on equity has to be evaluated on the assumption that the corporation is pursuing its optimal financing and investment policies as stated above. Thus, the model represents an important planning tool for chief financial officers when they are faced with making recommendations on distributions to their boardroom colleagues, and indeed, more generally, when they are plotting their financial strategy.

P–E Ratio versus Growth

The central simulation demonstrates how the characteristics of the corporation vary with the growth rate. Corporations growing at rates between 0% and 9% are portrayed, and the dividend discount model indicates that the residual net free cash flow yields on their shares will decline linearly over this range. This drives a significant escalation in their respective price–earnings (P–E) ratios, which in turn, is reflected in very high equity market capitalisations for the fastest growing cases, and thereafter, correspondingly high enterprise values. Investment analysts and other financial practitioners concerned with valuing companies will find the new insights offered by the study into the trade-off between P–E and growth to be of major significance for their craft.

Payout versus Growth

The zero growth corporation makes no investments, and its payout ratio will therefore be 100%. Surprisingly, possibly, the corporation growing at 9% also manifests a high payout ratio – more than two thirds. In between – at 8% growth – the ratio dips to only about one third. The faster the corporation grows, the more it will need to spend on capital expenditure, and therefore the greater the percentage of earnings it will, in general, retain to finance the saving and investment process. However, as the growth rate increases, so equity market capitalisation escalates and an increasing proportion of the capital expenditure is thus capable of being financed with debt. Eventually the payout ratio starts to increase again, and ultimately reverts back to the higher levels – indeed, even possibly reaching 100%.

Corporation Tax versus Growth

Ignoring personal taxes as argued above, the model shows that the escalation of enterprise value with the rate at which the corporation grows is supported by a dramatic decline in the overall effective tax rate. Firstly, increasing reliance on debt finance reduces the corporation tax liability – the tax shield effect. Secondly, stockholders receive an increasing proportion of their return in the form of tax-free capital appreciation – assuming always that no potentially taxable gains are realised. Earnings used to finance the repurchase programme and the equity component of capital expenditure will have suffered corporation tax, of course – in the simulations, at the forthcoming UK rate of 28% – but for the fastest growing company tax-free capital appreciation from year to year becomes substantial. Retentions fall away dramatically, and the effective corporation tax levy works out at less than 5% in the case of 9% growth.

Arbitrage Pricing

Obviously such effects are not lost on the stock market. All the corporations in the simulation are priced to generate the same total rate of return – the equity cost of capital (ECC) – which eventuates at 10.25%: this too is determined within the model. There are thus no arbitrage opportunities between the companies in the simulations, even though they manifest highly contrasting optimal payout ratios, with correspondingly contrasting yields.

APPENDIX II. LIST OF VARIABLES USED IN PART I

A_0	capital employed, end Period Zero
B_0	debt outstanding, end Period Zero
d	gearing ratio: ratio of debt to enterprise value (argument of points 7 & 9)
f(,)	return (net) on capital employed (ROCE)
g	growth rate
M_0	market value added (MVA), end Period Zero
n(.)	interest rate function (INTRTE)
Q_0	equity market capitalisation, end Period Zero
r(.)	equity cost of capital function (ECC)
R	return on capital employed (ROCE)
s	corporate retention (saving) ratio
V_0	enterprise value, end Period Zero
W	weighted average cost of capital (WACC)
X_1	Period One capital expenditure (argument of point 4)
y	dividend (more generally, disbursement) yield
z	difference between the WACC and the growth rate, which is then the capitalisation rate to be applied to the excess of total net income over capital expenditure in Period One to generate enterprise value.

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The author retired in 2006 from the position of Chief Investment Officer with the London Office of the Abu Dhabi Investment Authority, the role he performed for the last 18 of a 40-year City career. Previously he held senior appointments in investment management with the BP Pension Trust and with a quoted life insurance company.

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