The book value of current assets were read from BFA 38: Net current assets. This figure represents the balance of the total current assets after the total current liabilities have been deducted, and could be negative if the current liabilities were more than the current assets.

6.3.1.2 Depreciable assets

The book value of depreciable assets were calculated from two ratios, BFA 12: Cost of other fixed assets and BFA 13: Total depreciation other fixed assets. Other fixed assets refer to all fixed assets apart from land and buildings and include machinery and plant, vehicles, office equipment, furniture and fittings.

6.3.1.3 Non-depreciable assets

Non-depreciable assets were taken from BFA 10: Land and buildings at cost or valuation. Buildings do depreciate and should therefore not be included under non-depreciating assets. The value of land and buildings are not usually reported separately and it is therefore not possible to exclude the value of buildings from this figure working from published information.

6.3.1.4 Project duration

The project duration is not reported in the financial statements of firms and is estimated for the present study from BFA 13: Total depreciation other fixed assets and BFA 65: Depreciation for the year - other fixed assets. The method used to estimate the project duration from these figures has been discussed in section 6.2.1.4.

6.3.1.5 Earnings

The earnings figures used in this study are BFA 73: Profit before interest and taxation (which includes profits and losses of an extraordinary nature) minus BFA 63: Total profit of an extraordinary nature.

6.3.1.6 Value of ordinary shareholders funds

The value of the ordinary shareholders funds is calculated from BFA 150: Year-end price per share and BFA 101: Number of ordinary shares issued.

6.3.1.7 Value of minority shareholders funds

The value of the minority shareholders funds is estimated from the value of the majority shareholders funds through scaling according to BFA 78: Minority interest in profit and BFA 77: Profit before taxation.

6.3.1.8 Value of loans and preferred shares

The value of loans and preferred shares is assumed to be equal to their book value. This is read from BFA 24: Total long term loan capital and BFA 8: Preference shares.

6.3.2 Sample of firms

The sample of firms considered in the present study was selected by the BFA and included all firms for which a ten year history exists. A total of 218 firms are included in the sample, and the names of the firms can be read from any appendices 11, 12 and 13 of the thesis, where the interiary results of the calculations are presented.

6.3.3 Changes in accounting period

The financial period for which firms report does not always extend to 12 months, but could cover a longer or shorter period when a firm's financial year-end is changed. This creates two practical problems. The first problem is that the income statement figures do not reflect annual amounts any longer. The second practical problem is that no data exist for some firms in some calender years because the firms did not have a financial year-end in that year.

The first problem is already partially solved by the BFA because the income statement items are adjusted on a pro rata basis to a 12 month period. This does not eliminate the problem entirely because some businesses may show seasonal fluctuations. Incomes and expenditures need therefore not be time related. Another aspect of this problem is that the theory relates activity over a twelve month period starting from the balance sheet date to value on that date. The adjusted figures, even though they are annualised, relate to activity that takes place closer to the balance sheet date. Inflation will have had less effect over the shorter period, and the annualised figures will therefore not correspond to the actual 12 month figures, even if no seasonality exists in the business. This problem can therefore not be entirely overcome with the data set. The BFA adjusted figures do present a better reflection of the position than before the adjustment and will therefore be used.

The second practical problem surfaces during the running of the computer program used for data manipulation. The program tests whether data exist before the calculations are undertaken. If no data exist for a given firm for a given calendar year the program will not undertake the price-earnings calculations for that firm for that year and the year preceding it and also not for that year and the year following it. One year's data being unavailable (as a result of the change of year-end or any other reason) therefore causes the loss of two pairs of data from the analysis. The problem fortunately occurs sufficiently infrequently so that the loss of data points does not pose a serious problem.

6.3.4 Inflation rate

The data used in the analysis covers financial years 1977 to 1986. This means that the first financial year of a firm can start anywhere between February 1976 and January 1977 and the last financial year end between January and December 1986. To allow for the fact that firms will be included in the analysis for part of the year 1976 and part of 1986 the inflation rate used in the present study was calculated from the middle of 1976 to the middle of 1986. The change in the South African consumer price index as reported in the International Monetary Fund publication International Financial Statistics (various issues) was used. The geometric average inflation rate over the period was 13,75 percent per year.

6.4 DATA MANIPULATION

The data was manipulated by means of the Fortran program shown in appendix 10 of the thesis. This program performs the following functions:

6.4.1 Reading in data

The data to be used can be accessed by the program because the BFA reports have been converted to computer files (referred to as "CMS files" in the program documentation).

6.4.2 Calculating theoretical project characteristics

The program must calculate the characteristics of the theoretical projects that each firm is made up of. It firstly calculates the average theoretical project length for each firm using the method outlined in section 6.2.1.4. The program also calculates the book asset structure for each firm for each year and determines the average for each firm.

Using the average book asset structure and average theoretical project length for each firm, the program calculates the theoretical project asset structure for each firm.

6.4.3 Calculating the actual price-earnings ratios

The actual price earnings ratio (earnings divided by beginning-of-year assets) are calculated for each firm for each of the pairs of years for which data are available. The average actual price-earning ratio is calculated for each firm.

6.4.4 Calculating the theoretical price-earnings ratio

The program calculates theoretical price-earnings ratios for more than one discount rate.

The project characteristics determined previously are used to calculate the share of each of the types of assets in a firm's total value. The mathematical expression for the price-earnings ratio that is presented in appendix 7 of the thesis is then used to calculate a theoretical price-earnings ratio for each firm.

6.4.5 Calculating the discrepancy

The theoretical price-earnings ratio of each firm is compared to the actual ratio calculated previously. The absolute difference is calculated for each firm and the average across firms is used to determine which discount rate causes the theoretical ratios to best approximate the actual ratios.

6.4.6 Printing results

Results of the calculations are printed to files. This can be used to produce printouts of the intermediary or final results. This facility was used to produce the tables of results presented in appendices 11, 12, 13 and 14 of the thesis. The files can also be used in further data manipulation. This facility was used to regress the actual ratios against the theoretical ratios (see section 6.5 below). The program also has the facility to print progress messages or the intermediary results of any specific firm to the screen.

The results obtained from this program are discussed in the next section.

6.5 RESULTS

6.5.1 Book asset structure

The book asset structure calculated for each firm is shown in appendix 11 of the thesis and have been plotted on the asset structure diagram presented in figure 6.1. From the total of 218 firms thirteen showed negative net current assets. Their asset structures could therefore not be plotted on the asset structure diagram since it is restricted to positive values. The firms are:

BON KOR	PIKNPAY
CROOKES	PLACOR
D & H	PUTCO
GOLDSTEIN	SUTHSUN
HIVELD	TURF HLD
L T A	UNIEWYN
LUCEM	

From figure 6.1 it is clear that the firms show a large variation in book asset structure. The points seem to be concentrated to some extent to the bottom right of the diagram which means that firms with a high proportion of current assets in their book structures predominate.

6.5.2 Project asset structure

The asset structure of the theoretical project that make up each firm is shown in appendix 12 and has been plotted on

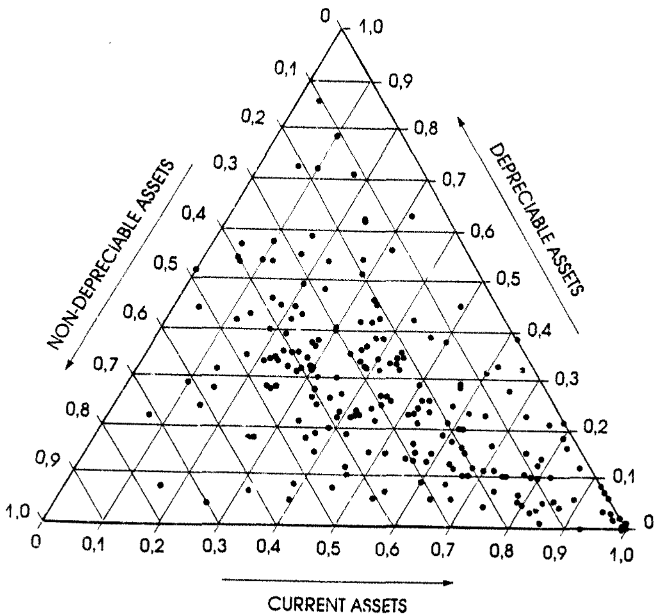

Figure 6.1 Book asst structures of Industrial Firms on the Johannesburg Stock Exchange.

the diagram presented in figure 6.2. The thirteen firms showing a negative asset structure have again not been plotted on the diagram.

If figure 6.2 is compared to figure 6.1 it is clear that the distribution of asset structures has shifted to the left and the top of the diagram. This means that the distribution has shifted away from current assets and towards depreciable assets. This change in the pattern can be explained by comparing the asset requirements of the projects that make up a firm to the asset values that appear in the firm's accounts. Current assets are replaced at inflated costs over the life of a project and are shown in the accounts at these higher values. Current assets therefore represent a larger portion of a firm's book assets (figure 6.1) than of the original project investment (figure 6.2). The reverse happens with depreciable assets. These assets are depreciated in the firm's accourts and therefore represent a smaller portion of the firm's book assets (figure 6.1) than of the original project investment (figure 6.2).

Figure 6.2 further shows that there is a wide distribution in the asset structure of the theoretical projects that make up firms. Current and depreciable assets are well represented but there are few firms that have a large portion of non-depreciable assets in their project asset structure. For only 16 of the 203 firms in figure 6.2 do non-depreciable assets represent more than 50 percent of the project asset requirement.

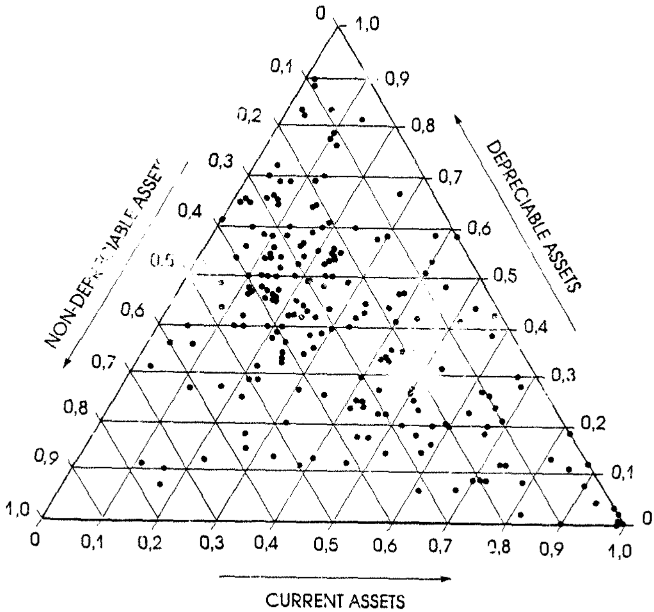

Figure 6.2 Theoretical project asset structure of industrial firms on the Johannesburg Stock Exchange.

Appendix 12 also presents the estimates of the project duration for each firm. This also shows a wide variation. The average estimated project duration of all the firms was 12 years.

6.5.3 Price-earnings ratios

The theoretical price-earnings ratios of the firms were calculated for different discount rates. The absolute difference between the theoretical and actual ratios was determined and the average across firms was used to determine the appropriateness of the discount rate. The average absolute differences obtained in this way for each discount rate are presented in appendix 13. The discrepancy shows a minimum at 36,25 percent.

The discount rate of 36,25 percent was then used to calculate theoretical price-earnings ratios for each firm. These are presented together with the actual ratios in appendix 14 of the thesis.

6.5.4 Verification of procedures

To verify the program and the procedure the calculation of the theoretical and actual price-earnings ratios of one firm (SA Breweries) was also carried out separately, showing the intermediary results. This is presented in appendix 15 of the thesis.

By comparing the book asset structure, project characteristics and price-earnings ratios of S A Breweries in appendix 15 with those reported in appendices 11, 12 and 14 it is clear that the two procedures yield the same answers. The only difference is that the numbers in the earlier appendices have been rounded off to fewer digits than those in appendix 15. By using the facility to print the intermediary results of the Fortran program (used for appendices 11, 12 and 14) it has however been confirmed that the correspondence between the two sets of answers extends to more digits than those shown in the appendices.

Appendix 15 does not only serve to verify the procedures but can also be used to follow the logic of the Fortran program in appendix 10 because the calculations in both instances proceed along the same lines.

6.5.6 Regression

The aim of this chapter of the thesis is to determine whether the price-earnings ratios of the firms do vary according to asset structure as the theory predicts.

In order to test this the actual price-earnings ratios of the firms were regressed on the theoretical ratios. If the market ratios do reflect the asset structure effect the coefficient of the theoretical ratio in this regression will be positive.

The method of ordinary least squares was used. The coefficient of the theoretical ratio was negative (-0,8204) and not statistically different from ze[illegible] = -1,09). The coefficient of deter[illegible]ination (R [illegible] The null hypothesis therefore has to be acce[illegible] [illegible]e theoretical ratios do not explain the variation in the act[illegible] ratios. Price-earnings ratios on the market do not vary according to asset structure as the theory predicts.

6.5.7 Conclusion

In section 6.5.6 it was established that the price-earnings ratios of industrial shares on the Johannesburg Stock Exchange do not vary according to theoretical ratios which are based on asset structure. Two arguments can be advanced to explain this:

- As a result of its simplifying assumptions the theory does not resemble the real situation and therefore the theoretical ratios cannot be used to predict the actual ratios.

- The market is inefficient and does not take the effect of asset structure into account in determining the value of shares.

It can safely be assumed that the many simplifying assumptions of the theory will cause the actual ratios to differ from those predicted by the theory. This does not necessarily mean that the differences would be sufficient to eliminate any apparent relationship between the two variables. Intuitively this would seem to be unlikely. The ratios considered in the present study are ten year averages and the effect of short-term variations should therefore have been removed from the data. It seems improbable that the remaining long-term differences would completely eclipse the relationship between asset structure and price-earning ratios, if such a relationship exists. From the available evidence it would therefore seem as if a relationship of this nature does not exist in practice, and that the market fails to reflect the effect of asset structure in the prices of shares.

The data used in the present analysis were obtained from published sources. If the market fails to reflect the effect of asset structure in the prices of shares, this means that market fails to discount all the available published information. This would mean that the market does not exhibit the semi-strong form of market efficiency.

The conclusion to be drawn from the regression analysis in the present study is that the market does seem to be inefficient in that it appears not to take the effect of asset structure into account in pricing industrial shares.

6.6 CONCLUSIONS

The main conclusions to be drawn from the analyses presented in this chapter are:

(i) Industrial firms on the JSE have a wide range of asset structures. The actual structures seem to cover the range of asset structures except that firms consisting of mainly non-depreciable assets may be under-represented.

(ii) From the different asset structures a theoretical price-earnings ratio can be calculated for each firm that takes the asset structure into account but assumes that the present value of the growth opportunities for each firm is equal to zero.

(iii) No significant relationship is found between the theoretical ratios that take the asset structure of the firms into account and the actual price-earnings ratios of firms on the JSE.

(iv) The market seems to be inefficient in that it fails to reflect the effect of asset structure in the pricing of industrial shares.

6.6 CONCLUSIONS

The main conclusions to be drawn from the analyses presented in this chapter are:

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(iii) No significant relationship is found between the theoretical ratios that take the asset structure of the firms into account and the actual price-earnings ratios of firms on the JSE.

(iv) The market seems to be inefficient in that it fails to reflect the effect of asset structure in the pricing of industrial shares.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

7.1 CONCLUSIONS

This section presents the conclusions of the literature review, the theory and the empirical investigations in turn below.

7.1.1 Literature

The literature review (chapter 2) showed that the basic method used in the theoretical analyses (chapters 3 and 4) is well established in the financial literature. The literature accepts that the internal rate of return (IRR) equals the true rate of return. The review establishes the standard method used to determine the discrepancy between the true rate of return (IRR) and the accounting rate of return (ARR). This consists of constructing a theoretical firm made up from a number of parallel projects of known IRR. To determine the discrepancy the method calculates the ARR of the firm and compares it to the IRR.

There is a general agreement in the literature that a discrepancy exists between ARR and IRR. Authors disagree on the extent and significance of the discrepancy. They agree that inflation increases the extent of the discrepancy between ARR and IRR.

The survey found that the literature does not investigate the interaction between inflation and asset structure in their impact on the discrepancy between ARR and IRR. This forms the subject of the theoretical and empirical investigations of this thesis.

7.1.2 Theoretical

The theory found that the conventional *accounting rate of return* (ROI) is not a good indicator of true return (IRR) under inflation. It considered another variant of the ARR, the accounting profit divided by the true value of the firm (POV). POV is also not a good indicator, but the discrepancy between POV and IRR shows a more consistent pattern than that between ROI and IRR. This is because the POV focuses only on the *deficiencies* in the accounting profit figure. ROI at the same time reflects *deficiencies* in both the profit and the asset figures.

The analysis established the following pattern for the discrepancy between the POV and IRR. For a constant IRR, POV can vary between two points. POV is the highest for the all current asset firm, where it equals the IRR. It is the lowest for the all non-depreciable asset firm. For this firm it equals the IRR minus the inflation rate. This pattern holds for all project durations, IRR's, inflation rates, tax rates and growth rates.

The model predicts a decline in price-earnings ratios with increasing inflation (and vice versa). The model also shows that the price-earnings ratios of firms under inflation will vary depending on the type of assets they employ. Firms with non-depreciable assets (or depreciable assets with a long life) will show higher price-earnings ratios. Firms with current assets (or depreciable assets with a short life) will have lower price-earnings ratios.

7.1.3 Empirical

The empirical part of the thesis focused on two of the relationships established by the theory. The first is the effect of inflation on the general level of price-earnings ratios. The second is the combined influence of inflation and asset structure on price-earnings differences between firms.

The first investigation found that inflation had a statistically significant effect on price-earnings ratios in the UK (1965 to 1986). This agrees with the prediction of the model.

In South Africa inflation does not seem to have had a statistically significant effect on price-earnings ratios (1969 to 1986). This contradicts the model. The finding could result from insufficient variation in the RSA inflation rate during the period of the study. Alternatively this could show the effect of sporadic political developments in South Africa.

The study found that industrial firms on the JSE have a wide range of asset structures. From the different asset structures the study calculated a theoretical price-earnings ratio for each firm.

The study found no statistically significant relationship between the theoretical ratios and the actual price-earnings ratios of firms on the JSE. The market seems inefficient in that it fails to reflect the effect of asset structure in the pricing of industrial shares.

7.2 RECOMMENDATIONS FOR FURTHER STUDY

The results suggest a number of areas for further study, both theoretical and empirical.

7.2.1 Theoretical

7.2.1.1 Relaxing simplifying assumptions

The theory can be expanded by relaxing some of the simplifying assumptions of the present analysis. The present analysis assumes a firm financed in full by equity. The effect of financial leverage is an obvious candidate for inclusion in an expanded theory. One of the effects of inflation is that loans are repaid with depreciated money. As a result the real value of the outstanding capital value of a loan continually decreases. According to Fisher (1938), the nominal interest rate adjusts to compensate for this. One could consider the nominal interest being paid under inflation to consist of an interest portion and the repayment of capital. The calculation of accounting profits employs the nominal interest figure. An expanded theory could study the effect that this has on reported returns. If this does have an effect, the duration of the loans taken up by a firm could influence the size of this effect. An expanded model could include this parameter. This model can show whether the Modigliani and Miller relationship between leverage and the return on equity holds under inflation.

Another perhaps more interesting aspect to include in the analysis is the effect of leased assets.

In the present analysis, the appreciation of depreciable assets (in nominal terms) counters the effect of the depreciation of these assets. This appreciation accrues to the firm and its shareholders but accounts drawn to historical cost conventions do not show this. For a leased asset this benefit does not normally accrue to the lessee. He on the other hand has the advantage of lease payments that are being made with deflated money.

An expanded model can investigate the net effect of leasing on the discrepancy between ARR and IRR. This can include the effect of taxes and the model can show whether inflation influences the desirability of leasing.

The rectangular time profile of project activity could perhaps be the most difficult simplifying assumption to relax. Stauffer (1980) has shown that different industries have different project time profiles. To include the effect of Stauffer's time profiles into the present model could be a very challenging research project.

7.2.1.2 Continuous analysis

The present analysis uses a discrete analysis which requires summing along and across projects. A continuous analysis would involve integrating instead of summing. Repeating the analysis using a continuous analysis should not yield a different outcome. It could yield more elegant derivations. It may also be easier to accommodate non-rectangular project patterns more easily in a continuous than in a discrete analysis.

7.2.1.3 Transition effects

The present analysis assumes steady state. Key variables such as the inflation rate, the firm's asset structure and the growth rate remain constant. To determine some of the transition effects could be an interesting and challenging project. It could be extremely difficult to include these transition effects in a model that describes actual inflation rate variations. Failing this, the analysis would still be useful because it will show the direction and persistence of the transition effects.

7.2.1.4 Evaluation of accounting methods

The present study assumes accounting according to historical cost conventions. It does not consider the various methods of inflation accounting at all. One of the important applications of the model could be its use in evaluating inflation accounting procedures.

The basis for the profit calculations in inflation accounting is the income definition of Hicks. This defines income as the maximum consumption in a defined period that will not impair "welloffness" as it existed at the beginning of the period (Lee, 1974, p.7). To calculate this one needs a method of evaluating and comparing the beginning and the end states. The different methods of inflation accounting only differ in that they assume different evaluation rules for these states.

This concept of profits is useful for dividend decisions or cash planning. The profit figure provides an indication of the cash available for distribution or investment. Profits are however also used as an indication of productivity. The model of the present study can show how good an indication of productivity an accounting method provides.

To determine this a researcher would identify the different accounting methods. He would then construct t ɘoretical firms of known IRR and use diffcrent methods to determine the firms' ARR. The researcher would compare the ARR's to the IRR of the firm. This will show which of the methods provide the best estimate of true profitability.

7.2.2 Empirical

7.2.2.1 Profitability of Industries

In considering the differences in the price-earnings ratios of firms the present research focused on individual industrial shares. One could repeat this study focussing on industries rather than the individual firms. This will remove some of the random noise from the data because differences in the prospects of different firms may cancel out. It may of course also introduce new noise into the data. Industries are even more different from each other than the individual firms. It may introduce some industries employing mostly non-depreciable assets into the sample. These were under-represented in the sample used in the present study.

From casual observation it appears that farmland in South Africa sells at a very much lower earnings yield (higher price-earnings ratio) than shares in industrial or commercial undertakings. The assets of a farming operation is dominated by the value of the land. A farm is therefore an example of an operation consisting of mainly non-depreciable assets. The theory of this thesis therefore explains the low earnings yield.

7.2.2.2 Test for market inefficiency

From the present study of the price-earnings ratios of industrial shares the market appears inefficient. It fails to reflect the effect of asset structure in the pricing of industrial shares. If this is true, the theory provides a decision rule for share selection. Under this assumption one would expect the shares with a high theoretical price-earnings ratio to outperform the market. Even if the market remains ignorant of the effect of asset structure, it will still re-value the shares as the advantages of their asset structures become visible from other indicators.

This provides a further test of the theory. The researcher should test whether portfolios consisting of shares with high theoretical price-earnings ratios can outperform others.

APPENDIX 1

DERIVATION OF RELATIONSHIPS FOR STATIONARY STATE WITHOUT TAX

This appendix presents the derivation of relationships for the model outlined in chapter 3 of the thesis. It applies to a firm in stationary state in the absence of company income tax. Further assumptions of the model are outlined in section 3.2 of the thesis.

NOTATION USED

The following symbols are used to define the variables in the appendix:

A = total assets at the end of the year

C = creditors at the end of the year

C^A = creditors added during the year

C^P = creditors that paid during the year

CA = current assets at the end of the year

CA^A = current assets acquired during the year

D = debtors at the end of the year

D^A = debtors added during the year

D^P = debtors that paid during the year

DA = depreciable assets at the end of the year

DA^A = depreciable assets acquired during the year

DA^D = depreciation of depreciable assets during the year

E = accounting profit for the year

F = cash flow for the year

I = inventory at the end of the year

I^A = inventory added during the year

I^P = inventory processed during the year

i = inflation rate

NA = non-depreciable assets at the end of the year

NA^A = non-depreciable acquired during the year

POV = *accounting profit as a proportion of the true value of the firm*

ROI = accounting profit as a proportion of the book value of the firm

r = internal rate of return (true rate of return)

S = total sales during the year

TS = trading surplus (sales minus cash expenses minus inventory processed)

V = true value of the firm at the end of the year

X = cash expenses incurred during the year

Subscripts are used to distinguish between variables relating to individual projects and variables relating to the firm as a whole. Double subscripts indicate a project variable; the first indicating the year of the project and the second the year in which the project was initiated. A single subscript refers to a variable relating to the firm as a wholeand indicates activity *during a year or balance* at the end of the year as applicable.

PROJECT CASH FLOWS

The annual cash flow associated with a project can be expressed as:

$$F_{n,k} = \text{(cash received during year n of the project)}$$

$$\text{minus (cash paid out during year n of the project)}$$

$$= (S_{n,k} - D^A_{n,k} + D^P_{n,k}) - (I^A_{n,k} - C^A_{n,k}) - C^P_{n,k} - X_{n,k}$$

$$- DA^A_{n,k} - NA^A_{n,k} \qquad \ldots(1)$$

During any year of the project we also have that:

$$D_{n,k} = D_{n-1,k} + D^A_{n,k} - D^P_{n,k}$$

$$C_{n,k} = C_{n-1,k} + C^A_{n,k} - C^P_{n,k}$$

$$I_{n,k} = I_{n-1,k} + I^A_{n,k} - I^P_{n,k} \qquad \ldots(2)$$

For year 0 of the project (the year in which the project is initiated):

$$D_{-1,k} = C_{-1,k} = I_{-1,k} = 0$$

Substituting into (2), rearranging and substituting into (1):

$$F_{0,k} = -CA_{0,k} - DA^{A}_{0,k} - NA^{A}_{0,k} \quad \ldots(3)$$

During any year j of the project (where j is greater than 0 and smaller than d):

$$DA^{A}_{j,k} = NA^{A}_{j,k} = 0 \quad \ldots(4)$$

and

$$D_{j,k} = (1+i)D_{j-1,k}$$

so that, by substituting into (2):

$$D^{A}_{j,k} = iD_{j-1,k} - D^{P}_{j,k} \quad \ldots(5)$$

Because of a trading pattern that stays constant in real terms we have that:

$$D_{j-1,k} = (1+i)^{j-1}D_{0,k}$$

Substituting into (5):

$$D^{A}_{j,k} = i(1+i)^{j-1}D_{0,k} - D^{P}_{j,k}$$

Similarly for creditors and inventory:

$$C^{A}_{j,k} = i(1+i)^{j-1}C_{0,k} - C^{P}_{j,k}$$

$$I^{A}_{j,k} = i(1+i)^{j-1}I_{C,k} - I^{P}_{j,k}$$

Substituting this as well as (4) into (1) and rearranging:

$$F_{j,k} = S_{j,k} - X_{j,k} - I^{P}_{j,k} - i(1+i)^{j-1}CA_{0,k} \qquad \ldots(6)$$

From the regular project trading pattern we also have that:

$$S_{j,k} = (1+i)^{j-1}S_{1,k}$$

$$X_{j,k} = (1+i)^{j-1}X_{1,k}$$

$$I^{P}_{j,k} = (1+i)_{j-1}I^{P}_{1,k}$$

If we further define the trading surplus to be:

$$TS_{j,k} = S_{j,k} - X_{j,k} - I^{P}_{j,k}$$

Then, substituting into (6) and rearranging:

$$F_{j,k} = (1+i)^{j-1}TS_{1,k} - i(1+i)^{j-1}CA_{0,k} \qquad \ldots(7)$$

In the last year of the project (year d), the wound-up value of non-depreciable and current assets has to be taken into account in addition to the trading cash flow. Adding this to the expression derived in equation (7), we obtain:

$$\begin{aligned} F_{d,k} = \; & (1+i)^{d-1}TS_{1,k} - i(1+i)^{d-1}CA_{0,k} \\ & + (1+i)^{d}(CA_{0,k} + NA^{A}_{0,k}) \qquad \ldots(8) \end{aligned}$$

The cash flow in any year of the project can therefore be determined from equations (3), (7) and (8) and are summarised below:

Table A.1.1

Project cash flows

Cash flow item	Year o (initial year)	Year j	Year d (last year)
Initial investment	$-CA_{0,k}$ $-DA^{A}_{0,k}$ $-NA^{A}_{0,k}$	0	0
Trading surplus	0	$(1+i)^{j-1}TS_{1,k}$	$(1+i)^{d-1}TS_{1,k}$
Additional current assets	0	$-i(1+i)^{j-1}CA_{0,k}$	$-i(1+i)^{d-1}CA_{0,k}$
Wound-up	0	0	$(1+i)^{d}(CA_{0,k})$ $(1+i)^{d}(NA^{A}_{0,k})$

TRADING SURPLUS REQUIRED

It is assumed that every individual project shows an internal rate of return of r, or that:

$$\sum_{j=0}^{d} \frac{F_{j,k}}{(1+r)^{j}} = 0 \qquad \ldots(9)$$

Substituting for the annual cash flows from equations (3), (7) and (8):

$$\sum_{j=0}^{d} \frac{F_{j,k}}{(1+r)^j}$$

$$= (-CA_{0,k} - DA^A_{0,k} - NA^A_{0,k})(\frac{1}{1+r})^0$$

$$+ \sum_{j=1}^{d-1} ((1+i)^{j-1}TS_{1,k} - i(1+i)^{j-1}CA_{0,k})(\frac{1}{1+r})^j$$

$$+ \quad ((1+i)^{d-1}TS_{1,k} - i(1+i)^{d-1}CA_{0,k})(\frac{1}{1+r})^d$$

$$+ (1+i)^d(CA_{0,k} + NA^A_{0,k})(\frac{1}{1+r})^d$$

$$= 0$$

And therefore:

$$- CA_{0,k} - DA^A_{0,k} - NA^A_{0,k}$$

$$+ \sum_{j=1}^{d} (\frac{1+i}{1+r})^j(\frac{TS_{1,k}}{(1+i)} - \frac{iCA_{0,k}}{(1+i)})$$

$$+ (CA_{0,k} + NA^A_{0,k})(\frac{1+i}{1+r})^d$$

$$= \quad 0$$

Solving for $TS_{1,k}$ gives:

$$TS_{1,k} = CA_{0,k}(1+i)\left(\frac{1 + \left(\frac{i}{1+i}\right) \sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^{j} \cdot \left(\frac{1+i}{1+r}\right)^{d}}{\sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^{j}}\right)$$

$$+ DA^{A}_{0,k}(1+i)\left(\frac{1}{\sum \left(\frac{1+i}{1+r}\right)^{j}}\right)$$

$$+ NA^{A}_{0,k}(1+i)\left(\frac{1 - \left(\frac{1+i}{1+r}\right)^{d}}{\sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^{j}}\right)$$

But:

$$\sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^{j} = \frac{\frac{1+i}{1+r} - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \frac{1+i}{1+r}}$$

Substituting and rearranging:

$$TS_{1,k} = rCA_{0,k} + \left(\frac{r - i}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right) DA^{A}_{0,k} + (r-i)NA^{A}_{0,k} \qquad \ldots(10)$$

ACCOUNTING PROFIT OF THE FIRM

The accounting profit of the firm equals the turnover minus cost of sales, cash expenses and depreciation, or:

$$E_k = S_k - X_k - I_k^P - DA_k^A$$

Seperating this into the contributions from each of the current projects of the firm:

$$E_k = S_{1,k-1} - X_{1,k-1} - I_{1,k-1}^P - \left(\frac{DA_{0,k-1}^A}{d}\right)$$

$$+ S_{2,k-2} - X_{2,k-2} - I_{2,k-2}^P - \left(\frac{DA_{0,k-2}^A}{d}\right)$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ S_{d,k-d} - X_{d,k-d} - I_{d,k-d}^P - \left(\frac{DA_{0,k-d}^A}{d}\right)$$

But:

$$S_{1,k-1} = S_{2,k-2} = \ldots\ldots\ldots\ldots = S_{d,k-d}$$

$$X_{1,k-1} = X_{1,k-1} = \ldots\ldots\ldots\ldots = X_{d,k-d}$$

$$I_{1,k-1}^P = I_{2,k-2}^P = \ldots\ldots\ldots\ldots = I_{d,k-d}^P$$

And:

$$DA_{0,k-1}^A = (1+i)DA_{0,k-2}^A = (1+i)^2 DA_{0,k-3}^A = \ldots$$
$$\ldots = (1+i)^{d-1} DA_{0,k-d}^A$$

And therefore, after substituting and rearranging:

$$E_k = dS_{1,k-1} - dX_{1,k-1} - dI^P_{1,k-1} - \frac{DA^A_{0,k-1}}{d} \sum_{m=1}^{d} \left(\frac{1}{(1+i)^{m-1}}\right)$$

But:

$$S_{1,k-1} - X_{1,k-1} - I^P_{1,k-1} = TS_{1,k-1}$$

And:

$$\sum_{m=1}^{d} \left(\frac{1}{(1+i)^{m-1}}\right) = \frac{1 - \left(\frac{1}{1+i}\right)^d}{1 - \frac{1}{1+i}}$$

Therefore, after simplifying:

$$E_k = dTS_{1,k-1} - DA^A_{0,k-1}\left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right)$$

This equation gives the accounting profit in year k in terms of the characteristics of the project that was initiated in year (k-1). Similarly one could express the accounting profit in year (k+1) in terms of the characteristics of the project that was initiated in year k:

$$E_{k+1} = dTS_{1,k} - DA^A_{0,k}\left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right) \qquad \ldots(11)$$

Where:

$$TS_{1,k} = rCA_{0,k} + \left(\frac{r - i}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)DA^A_{0,k} + (r-i)NA^A_{0,k}$$

So that, after substituting and rearranging:

$$E_{k+i} = d.r.CA_{0,k}$$

$$+ d.DA^A_{0,k}\left(\frac{r-i}{1-\left(\frac{1+i}{1+r}\right)^d} + \left(\frac{1+i}{d.i}\right)\left(1-\left(\frac{1}{1+i}\right)^d\right)\right)$$

$$+ d.(r-i).NA^A_{0,k} \qquad \ldots(12)$$

BOOK VALUE OF THE FIRM

The book value of the firm is equal to the book values of the current assets, non-depreciable assets and the depreciated value of the depreciable assets of all the current projects of the firm.

Straight-line depreciation over the the total life of the assets is employed to calculate the book value of depreciable assets. Current and non-depreciable assets are valued at cost.

The book value of the firm is equal to the book value of the current, depreciable and non-depreciable assets of the firm, or:

$$A_k = CA_k + DA_k + NA^A_k$$

So that, after substituting and rearranging:

$$E_{k+1} = d.r.CA_{0,k}$$

$$+ d.DA^A_{0,k}\left(\frac{r-i}{1-\left(\frac{1+i}{1+r}\right)^d} + \left(\frac{1+i}{d.i}\right)\left(1-\left(\frac{1}{1+i}\right)^d\right)\right)$$

$$+ d.(r-i).NA^A_{0,k} \qquad \ldots(12)$$

BOOK VALUE OF THE FIRM

The book value of the firm is equal to the book values of the current assets, non-depreciable assets and the depreciated value of the depreciable assets of all the current projects of the firm.

Straight-line depreciation over the the total life of the assets is employed to calculate the book value of depreciable assets. Current and non-depreciable assets are valued at cost.

The book value of the firm is equal to the book value of the current, depreciable and non-depreciable assets of the firm, or:

$$A_k = CA_k + DA_k + NA^A_k$$

Seperating this into the contributions of each of the current projects of the firm:

$$A_k = CA_{0,k} + DA^A_{0,k} + NA^A_{0,k}$$

$$+ CA_{1,k-1} + (\frac{d-1}{d}) DA^A_{0,k-1} + NA^A_{0,k-1}$$

$$+ CA_{2,k-2} + (\frac{d-2}{d}) DA^A_{0,k-2} + NA^A_{0,k-2}$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ CA_{d-1,k-(d-1)} + (\frac{1}{d}) DA^A_{0,k-(d-1)} + NA^A_{0,k-(d-1)}$$

But:

$$CA_{1,k-1} = (1+i)CA_{0,k-1}$$

$$CA_{2,k-2} = (1+i)^2 CA_{0,k-2}$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$CA_{d-1,k-(d-1)} = (1+i)^{d-1} CA_{0,k-(d-1)}$$

And:

$$CA_{0,k} = (1+i)CA_{0,k-1}$$

$$= (1+i)^2 CA_{0,k-2}$$

$$= \ldots\ldots\ldots\ldots\ldots$$

$$= (1+i)^{d-1} CA_{0,k-(d-1)}$$

Therefore:

$$\begin{aligned} CA_{0,k} &= CA_{1,k-1} \\ &= CA_{2,k-2} \\ &= \ldots\ldots\ldots\ldots \\ &= CA_{d-1,k-(d-1)} \end{aligned}$$

Furthermore:

$$\begin{aligned} DA^{A}_{0,k} &= (1+i)DA^{A}_{0,k-1} \\ &= (1+i)^{2}DA^{A}_{0,k-2} \\ &= \ldots\ldots\ldots\ldots\ldots\ldots \\ &= (1+i)^{d-1}DA^{A}_{0,k-(d-1)} \end{aligned}$$

And:

$$\begin{aligned} NA^{A}_{0,k} &= (1+i)NA^{A}_{0,k-1} \\ &= (1+i)^{2}NA^{A}_{0,k-2} \\ &= \ldots\ldots\ldots\ldots\ldots\ldots \\ &= (1+i)^{d-1}NA^{A}_{0,k-(d-1)} \end{aligned}$$

Substitute and simplify:

$$A_k = dCA_{0,k} + DA^{A}_{0,k}\sum_{n=0}^{d-1}\left(\left(\frac{d-n}{d}\right).\left(\frac{1}{1+i}\right)^{n}\right) + NA^{A}_{0,k}\sum_{n=0}^{d-1}\left(\frac{1}{1+i}\right)^{n}$$

But:

$$\sum_{n=0}^{d-1} \left(\frac{1}{(1+i)^n}\right) = \frac{1 - \left(\frac{1}{1+i}\right)^d}{1 - \frac{1}{1+i}}$$

And:

$$\sum_{n=0}^{d-1} \left(\left(\frac{d-n}{d}\right) \cdot \left(\frac{1}{1+i}\right)^n\right) = \left(\frac{1}{d}\right) \sum_{n=0}^{d-1} \left(\frac{(d-n)}{(1+i)^n}\right)$$

$$= \left(\frac{1}{d}\right) \Bigg(\left(\frac{1}{1+i}\right)^0 + \left(\frac{1}{1+i}\right)^1 + \left(\frac{1}{1+i}\right)^2 + \ldots\ldots\ldots + \left(\frac{1}{1+i}\right)^{d-2} + \left(\frac{1}{1+i}\right)^{d-1}$$

$$+ \left(\frac{1}{1+i}\right)^0 + \left(\frac{1}{1+i}\right)^1 + \left(\frac{1}{1+i}\right)^2 + \ldots\ldots\ldots + \left(\frac{1}{1+i}\right)^{d-2}$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ \left(\frac{1}{1+i}\right)^0 + \left(\frac{1}{1+i}\right)^1 + \left(\frac{1}{1+i}\right)^2$$

$$+ \left(\frac{1}{1+i}\right)^0 + \left(\frac{1}{1+i}\right)^1$$

$$+ \left(\frac{1}{1+i}\right)^0$$

$$= \left(\frac{1}{d}\right) \sum_{m=0}^{d-1} \sum_{n=0}^{m} \left(\frac{1}{1+i}\right)^n$$

$$= \left(\frac{1}{d}\right) \sum_{m=0}^{d-1} \left(\frac{1 - \left(\frac{1}{1+i}\right)^{m+1}}{1 - \left(\frac{1}{1+i}\right)} \right)$$

$$= \left(\frac{1+i}{d.i}\right) . \left(d - \sum_{n=1}^{d} \left(\frac{1}{1+i}\right)^{n} \right)$$

$$= \left(\frac{1+i}{d.i}\right) . \left(d - \frac{\left(\frac{1}{1+i}\right) - \left(\frac{1}{1+i}\right)^{d+1}}{1 - \left(\frac{1}{1+i}\right)} \right)$$

$$= \left(\frac{1+i}{i}\right) - \left(\frac{1+i}{d.i^2}\right) + \frac{1}{d.i^2.(1+i)^{d-1}}$$

Substitute:

$$A_k = dCA_{0,k}$$

$$+ DA^{A}_{0,k} \left(\left(\frac{1+i}{i}\right) - \left(\frac{1+i}{d.i^2}\right) + \frac{1}{d.i^2.(1+i)^{d-1}} \right)$$

$$+ NA^{A}_{0,k} \left(\frac{1+i}{i}\right) . \left(1 - \left(\frac{1}{1+i}\right)^{d}\right) \qquad ...(13)$$

TRUE VALUE OF THE FIRM

The true value of the marginal firm is the present value of the remaining cash flows of its current projects (the present value of other future projects being zero).

The value of the remaining cash flows of an individual project at the end of year j of the project is:

$$V_{j,k} = \sum_{m=j+1}^{d} \frac{(1+i)^{m-1}TS_{1,k} - i.(1+i)^{m-1}CA_{0,k}}{(1+i)^{m-j}}$$

$$+ \frac{(1+i)^{d}(CA_{0,k} + NA^{A}_{0,k})}{(1+i)^{d-j}}$$

where:

$$TS_{1,k} = rCA_{0,k} + \left(\frac{r - i}{1 - (\frac{1+i}{1+r})^{d}}\right) DA^{A}_{0,k} + (r-i)NA^{A}_{0,k}$$

And therefore:

$$V_{j,k} = CA_{0,k}\left((r-i) \sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}} + \frac{(1+i)^{d}}{(1+r)^{d-j}}\right)$$

$$+ DA^{A}_{0,k} \frac{r-i}{1 - (\frac{1+i}{1+r})^{d}} \sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}}$$

$$+ NA^{A}_{0,k}\left((r-i) \sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}} + \frac{(1+i)^{d}}{(1+r)^{d-j}}\right)$$

But:

$$\sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}} = \frac{(1+i)^{j}}{r-i} \left(1 - (\frac{1+i}{1+r})^{d-j}\right)$$

So that, after substituting and simplifying:

$$V_{j,k} = (1+i)^j CA_{0,k}$$

$$+(1+i)^j DA^A_{0,k}\left(\frac{1 - (\frac{1+i}{1+r})^{d-j}}{1 - (\frac{1+i}{1+r})^d}\right)$$

$$+ (1+i)^j NA^A_{0,k}$$

The value of the firm is the value of its current projects, or:

$$V_k = V_{0,k} + V_{1,k-1} + V_{2,k-2} + \cdots\cdots + V_{d-1,k-(d-1)}$$

Substitute:

$$V_k = (1+i)^0 CA_{0,k} + (1+i)^0 DA^A_{0,k}\left(\frac{1 - (\frac{1+i}{1+r})^d}{1 - (\frac{1+i}{1+r})^d}\right) + (1+i)^0 NA^A_{0,k}$$

$$+ (1+i)^1 CA_{0,k-1} + (1+i)^1 DA^A_{0,k-1}\left(\frac{1 - (\frac{1+i}{1+r})^{d-1}}{1 - (\frac{1+i}{1+r})^d}\right) + (1+i)^1 NA^A_{0,k-1}$$

$$+ (1+i)^2 CA_{0,k-2} + (1+i)^2 DA^A_{0,k-2}\left(\frac{1 - (\frac{1+i}{1+r})^{d-2}}{1 - (\frac{1+i}{1+r})^d}\right) + (1+i)^2 NA^A_{0,k-2}$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ (1+i)^{d-1} CA_{0,k-1}$$

$$+ (1+i)^{d-1} DA^A_{0,k-(d-1)}\left(\frac{1 - (\frac{1+i}{1+r})}{1 - (\frac{1+i}{1+r})^d}\right)$$

$$+ (1+i)^{d-1} NA^A_{0,k-(d-1)}$$

But:

$$CA_{0,k} = (1+i)CA_{0,k-1}$$

$$= (1+i)^2 CA_{0,k-2}$$

$$= \cdots\cdots\cdots\cdots\cdots\cdots$$

$$= (1+i)^{d-1} CA_{0,k-(d-1)}$$

And:

$$DA^A_{0,k} = (1+i)DA^A_{0,k-1}$$

$$= (1+i)^2 DA^A_{0,k-2}$$

$$= \cdots\cdots\cdots\cdots\cdots\cdots$$

$$= (1+i)^{d-1} DA^A_{0,k-(d-1)}$$

Also:

$$NA^A_{0,k} = (1+i)NA^A_{0,k-1}$$

$$= (1+i)^2 NA^A_{0,k-2}$$

$$= \cdots\cdots\cdots\cdots\cdots\cdots$$

$$= (1+i)^{d-1} NA^A_{0,k-(d-1)}$$

Therefore, after substituting and simplifying:

$$V_k = dCA_{0,k}$$

$$+ DA^A_{0,k} \sum_{n=1}^{d} \frac{1 - \left(\frac{1+i}{1+r}\right)^n}{1 - \left(\frac{1+i}{1+r}\right)^d}$$

$$+ dNA^A_{0,k}$$

But:

$$\sum_{n=1}^{d} \frac{1 - \left(\frac{1+i}{1+r}\right)^n}{1 - \left(\frac{1+i}{1+r}\right)^d} = \frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i}$$

And therefore:

$$V_k = dCA_{0,k}$$

$$+ DA^A_{0,k}\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i}\right)$$

$$+ dNA^A_{0,k} \qquad \ldots(14)$$

ACCOUNTING *RATE OF RETURN*

To calculate the conventional accounting rate of return, the accounting profit (12) is divided by the book value of assets (13), or:

$$ROI = \frac{E_{k+1}}{A_k} \qquad \ldots(15)$$

PROFIT ON VALUE

An alternative measure of accounting rate of return is the profit (12) divided by the true value of the firm (14), or:

$$POV = \frac{E_{k+1}}{V_k} \qquad \ldots(16)$$

SUMMARY

The conventional accounting rate of return of the theoretical firm is given by:

$$ROI = \frac{E_{k+1}}{A_k} \qquad \ldots(15)$$

An alternative measure of accounting rate of return for the theoretical marginal firm is given by:

$$POV = \frac{E_{k+1}}{V_k} \qquad \ldots(16)$$

where:

$$E_{k+1} = d.r.CA_{0,k}$$

$$+ d.DA^{A}_{0,k}(\frac{r - i}{1 - (\frac{1+i}{1+r})^{d}} + (\frac{1+i}{d.i})(1 - (\frac{1}{1+i})^{d}))$$

$$+ d.(r-i).NA^{A}_{0,k} \qquad \ldots(12)$$

and:

$$A_k = dCA_{0,k} + DA^A_{0,k}\left(\left(\frac{1+i}{i}\right) - \left(\frac{1+i}{d.i^2}\right) + \frac{1}{d.i^2.(1+i)^{d-1}} \right) + NA^A_{0,k}\left(\frac{1+i}{i}\right).\left(1 - \left(\frac{1}{1+i}\right)^d\right) \quad \ldots(13)$$

and:

$$V_k = dCA_{0,k} + DA^A_{0,k}\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i}\right) + dNA^A_{0,k} \quad \ldots(14)$$

APPENDIX 2

PROGRAM TO CALCULATE THE ROI, A/V AND POV OF FIRMS WITH VARYING ASSET STRUCTURES IN THE ABSENCE OF GROWTH OR TAXES

This appendix presents a "basic" program to calculate the *accounting rate of return*, the extent to which the accounting book value understates the true asset value and the accounting profit as a percentage of the true value of theoretical firms.

The program uses equations (12), (13) and (14) from appendix 1 to calculate accounting *profit*, *book* value and true value. The user supplies the IRR (discount rate), inflation rate and project length to be used in the calculations. The program generates positive-value project asset structures in increments of 10 percent and calculates the ROI, A/V and POV for each of these structures.

This program was used to generate the data for figures 3.2 to 3.14 presented in chapter 3 of the thesis.

A listing of the program and a sample output (for a discount rate of 20 percent, an inflation rate of 10 percent and a project duration of 4 years) are presented below.

PROGRAM LISTING

```
10 REM
20 REM        PROGRAM TO CALCULATE ROI, A/V AND POV
30 REM        ************************************
40 REM
50 LPRINT "            ROI, A/V AND POV"
60 LPRINT "            ----------------
70 LPRINT
80 LPRINT
90 SCREEN
92 PRINT
94 PRINT
95 PRINT
96 PRINT "    Please enter the following:
97 PRINT
98 PRINT
100 INPUT "Discount rate % =", RPERS
101 PRINT
102 PRINT
105 LPRINT "     Discount rate (%) =", RPERS
106 LPRINT
110 INPUT "Inflation rate % =", IPERS
111 PRINT
112 PRINT
115 LPRINT "     Inflation rate (%) =", IPERS
116 LPRINT
130 INPUT "Project length (years) =" , D
131 PRINT
132 PRINT
135 LPRINT "     Project length (y) =", D
136 LPRINT
140 R = RPERS / 100
150 I = IPERS / 100
155 LPRINT
160 LPRINT "          ASSET STRUCTURE                           RATIOS
165 LPRINT "          ---------------                           ------
170 LPRINT "CURRENT    DEPRECIABLE    NON-DEP         ROI, A/V AND POV
180 LPRINT "-------    -----------    -------         ----------------
190 LPRINT
1000 REM
1020 REM GENERATING ASSET STRUCTURES
1030 REM ***************************
1040 REM
1100 FOR CA = 0 TO 100.001 STEP 10
1120 FOR DA = 0 TO 100.001 - CA STEP 10
1130 NA = 100 - CA - DA
```

```
1630 GOSUB 3000
1640 GOSUB 4000
1650 GOSUB 5000
1700 ROI = 100*EKP1/AK
1710 AOV = 100*AK/VK
1720 POV = 100*EKP1/VK
1810 LPRINT CA, DA, NA, "ROI(%) =", ROI
1820 LPRINT "                                            A/V(%) =", AOV
1830 LPRINT "                                            POV(%) =", POV
1840 LPRINT
1900 NEXT DA
1910 NEXT CA
2000 END
3000 REM
3010 REM CALCULATING ACCOUNTING PROFIT
3020 REM ****************************
3030 REM
3050 F1 = R - I
3060 F2 = 1 - ((1+I)/(1+R))^D
3070 F3 = (1+I)/(D*I)
3080 F4 = 1 - (1/(1+I)^D)
3090 FAC = R*D
3100 FAD = D*F1/F2 - F3*F4
3110 FAN = (R-I)*D
3120 EKP1 = FAC*CA + FAD*DA + FAN*NA
3200 RETURN
4000 REM
4010 REM CALCULATING BOOK VALUE
4020 REM *********************
4030 REM
4040 FA1 = (1+I)/I
4050 FA2 = (1+I)/(D*(I^2))
4060 FA3 = 1/(D*(I^2)*((1+I)^(D-1)))
4070 FA4 = 1 - (1/(1+I)^D)
4080 FAC = D
4090 FAD = FA1 - FA2 + FA3
4100 FAN = FA1*FA4
4110 AK = FAC*CA + FAD*DA + FAN*NA
4200 RETURN
5000 REM
5010 REM CALCULATING TRUE VALUE
5020 REM *********************
5030 REM
5040 FV1 = 1 - ((1+I)/(1+R))^D
5045 FV2 = (1+I)/(R-I)
5050 FVC = D
5060 FVD = D/FV1 - FV2
5070 FVN = D
5080 VK = FVC*CA + FVD*DA + FVN*NA
5200 RETURN
```

SAMPLE OUTPUT

ROI, A/V AND POV

Discount rate (%) = 20

Inflation rate (%) = 10

Project length (y) = 4

ASSET STRUCTURE			RATIOS	
CURRENT	DEPRECIABLE	NON-DEP	ROI, A/V AND POV	
0	0	100	ROI(%) =	11.47166
			A/V(%) =	87.17132
			POV(%) =	10
0	10	90	ROI(%) =	12.14672
			A/V(%) =	87.19459
			POV(%) =	10.59129
0	20	80	ROI(%) =	12.87186
			A/V(%) =	87.21961
			POV(%) =	11.22679
0	30	70	ROI(%) =	13.65286
			A/V(%) =	87.24656
			POV(%) =	11.91165
0	40	60	ROI(%) =	14.49644
			A/V(%) =	87.27569
			POV(%) =	12.65187
0	50	50	ROI(%) =	15.41044
			A/V(%) =	87.30727
			POV(%) =	13.45443
0	60	40	ROI(%) =	16.40404
			A/V(%) =	87.34163
			POV(%) =	14.32756
0	70	30	ROI(%) =	17.48814
			A/V(%) =	87.37915
			POV(%) =	15.28098
0	80	20	ROI(%) =	18.67567
			A/V(%) =	87.42029
			POV(%) =	16.32632
0	90	10	ROI(%) =	19.98219
			A/V(%) =	87.46559
			POV(%) =	17.47754

0	100	0	ROI(%) =	21.42652
			A/V(%) =	87.51573
			POV(%) =	18.75158
10	0	90	ROI(%) =	12.43582
			A/V(%) =	88.45419
			POV(%) =	11
10	10	80	ROI(%) =	13.13471
			A/V(%) =	88.52371
			POV(%) =	11.62733
10	20	70	ROI(%) =	13.88463
			A/V(%) =	88.59841
			POV(%) =	12.30156
10	30	60	ROI(%) =	14.6914
			A/V(%) =	88.6789
			POV(%) =	13.02817
10	40	50	ROI(%) =	15.56173
			A/V(%) =	88.76591
			POV(%) =	13.81351
10	50	40	ROI(%) =	16.50343
			A/V(%) =	88.86026
			POV(%) =	14.66499
10	60	30	ROI(%) =	17.52566
			A/V(%) =	88.96289
			POV(%) =	15.59134
10	70	20	ROI(%) =	18.63922
			A/V(%) =	89.07497
			POV(%) =	16.60288
10	80	10	ROI(%) =	19.85691
			A/V(%) =	89.19784
			POV(%) =	17.71193
10	90	0	ROI(%) =	21.19405
			A/V(%) =	89.33316
			POV(%) =	18.93332
20	0	80	ROI(%) =	13.3724
			A/V(%) =	89.73706
			POV(%) =	12
20	10	70	ROI(%) =	14.09346
			A/V(%) =	89.85281
			POV(%) =	12.66337
20	20	60	ROI(%) =	14.86637
			A/V(%) =	89.97719
			POV(%) =	13.37634

20	30	50	ROI(%) =	15.69692
			A/V(%) =	90.11125
			POV(%) =	14.14469
20	40	40	ROI(%) =	16.59183
			A/V(%) =	90.25615
			POV(%) =	14.9751[illegible]
20	50	30	ROI(%) =	17.55887
			A/V(%) =	90.41374
			POV(%) =	15.87555
20	60	20	ROI(%) =	18.60713
			A/V(%) =	90.58414
			POV(%) =	16.85511
20	70	10	ROI(%) =	19.74729
			A/V(%) =	90.77078
			POV(%) =	17.92477
20	80	0	ROI(%) =	20.99199
			A/V(%) =	90.97539
			POV(%) =	19.09754
30	0	70	ROI(%) =	14.28259
			A/V(%) =	91.01992
			POV(%) =	13
30	10	60	ROI(%) =	15.02426
			A/V(%) =	91.18191
			POV(%) =	13.69941
30	20	50	ROI(%) =	15.81846
			A/V(%) =	91.35599
			POV(%) =	14.45112
30	30	40	ROI(%) =	16.67098
			A/V(%) =	91.5436
			POV(%) =	15.26122
30	40	30	ROI(%) =	17.58847
			A/V(%) =	91.74638
			POV(%) =	16.13679
30	50	20	ROI(%) =	18.57867
			A/V(%) =	91.96622
			POV(%) =	17.08611
30	60	10	ROI(%) =	19.65057
			A/V(%) =	92.20541
			POV(%) =	18.11889
30	70	0	ROI(%) =	20.81472
			A/V(%) =	92.46659
			POV(%) =	19.24666

40	0	60	ROI(%) =	15.16747
			A/V(%) =	92.30279
			POV(%) =	14
40	10	50	ROI(%) =	15.92832
			A/V(%) =	92.51101
			POV(%) =	14.73545
40	20	40	ROI(%) =	16.74225
			A/V(%) =	92.73479
			POV(%) =	15.52589
40	30	30	ROI(%) =	17.61503
			A/V(%) =	92.97594
			POV(%) =	16.37774
40	40	20	ROI(%) =	18.55326
			A/V(%) =	93.23661
			POV(%) =	17.29843
40	50	10	ROI(%) =	19.5646
			A/V(%) =	93.51921
			POV(%) =	18.29666
40	60	0	ROI(%) =	20.65795
			A/V(%) =	93.82667
			POV(%) =	19.38267
50	0	50	ROI(%) =	16.0281
			A/V(%) =	93.58566
			POV(%) =	15
50	10	40	ROI(%) =	16.80677
			A/V(%) =	93.84012
			POV(%) =	15.77149
50	20	30	ROI(%) =	17.63897
			A/V(%) =	94.11358
			POV(%) =	16.60067
50	30	20	ROI(%) =	18.53042
			A/V(%) =	94.40829
			POV(%) =	17.49426
50	40	10	ROI(%) =	19.48768
			A/V(%) =	94.72684
			POV(%) =	18.46007
50	50	0	ROI(%) =	20.51832
			A/V(%) =	95.0722
			POV(%) =	19.50722
60	0	40	ROI(%) =	16.86545
			A/V(%) =	94.86854
			POV(%) =	16

60	10	30	ROI(%) =	17.66068
			A/V(%) =	95.16921
			POV(%) =	16.80753
60	20	20	ROI(%) =	18.50979
			A/V(%) =	95.49238
			POV(%) =	17.67544
60	30	10	ROI(%) =	19.41846
			A/V(%) =	95.84064
			POV(%) =	18.61078
60	40	0	ROI(%) =	20.39317
			A/V(%) =	96.21706
			POV(%) =	19.62171
70	0	30	ROI(%) =	17.68045
			A/V(%) =	96.1514
			POV(%) =	17
70	10	20	ROI(%) =	18.49107
			A/V(%) =	96.49831
			POV(%) =	17.84357
70	20	10	ROI(%) =	19.35583
			A/V(%) =	96.87117
			POV(%) =	18.75022
70	30	0	ROI(%) =	20.28035
			A/V(%) =	97.27299
			POV(%) =	19.7273
80	0	20	ROI(%) =	18.47399
			A/V(%) =	97.43426
			POV(%) =	18
80	10	10	ROI(%) =	19.2989
			A/V(%) =	97.82741
			POV(%) =	18.87961
80	20	0	ROI(%) =	20.17812
			A/V(%) =	98.24997
			POV(%) =	19.825
90	0	10	ROI(%) =	19.24691
			A/V(%) =	98.71713
			POV(%) =	19
90	10	0	ROI(%) =	20.08506
			A/V(%) =	99.15652
			POV(%) =	19.91565
100	0	0	ROI(%) =	20
			A/V(%) =	100
			POV(%) =	20

APPENDIX 3

NUMERICAL EXAMPLE SHOWING THE CALCULATION OF ROI, A/V AND POV IN THE ABSENCE OF GROWTH OR TAXES.

This appendix presents a numerical example showing the calculation of ROI, A/V, and PoV for a firm with a specific asset structure, project duration, IRR and under a specific inflation rate.

The calculation follows the same lines as the mathematical derivation presented in appendix 2 and can therefore serve as both an aid to the understanding of the mathematical derivation and as a procedure to validate its results.

The numerical example also serves to validate the results of the computer program presented in appendix 3. Because this example was produced on a computer "spread-sheet" it is possible to repeat the calculation for different asset structures, IRR's and inflation rates. This therefore provides an alternative method of generating the data to construct figures 3.2 to 3.14. The procedure has been set up specifically for firms with four-year projects and has to be repeated for each asset structure. It is therefore not a very convenient method to use for this purpose, especially when firms with varying project lives are considered.

The numerical example presented below applies to a firm with a project asset structure of 50 percent current assets, 30 percent depreciable assets and 20 percent non-depreciable assets. The firm has a project life of four years, has an IRR of 20 percent per year and is operating under 10 percent per year inflation.

NUMERICAL EXAMPLE

INFLATION AND DISCOUNT RATES

Inflation rate:	10 percent
Discount rate:	20 percent

PROJECT ANALYSIS

The project has a duration of four years and consists of:

- a 50 percent investment in current assets
- a 30 percent investment in depreciable assets
- a 20 percent investment in non-depreciable assets

Project cash flows:

	year 0	year 1	year 2	year 3	year 4
Investment:					
current	-500				
depreciable	-300				
non-depreciable	-200				
Additional investment in current assets		-50	-55	-60.5	-66.55
Wound-up value:					
current					732.05
non-depreciable					292.82
Sub total	-1000	-50	-55	-60.5	958.32
Present value:					
year(-1):-543.933					
year 0: -652.719					
Trading surplus:		222.0639	244.2703	268.6974	295.5671
TOTAL CASH FLOW:	-1000	172.0639	189.2703	208.1974	1253.887

Present value,
total: 1.1E-13 (This figure should be equal to 0)

CALCULATING ACCOUNTING PROFIT

The acco[illegible]nting profit of year 1 is calculated. The firm then has four current projects. These are the projects initiated in years (-3), (-2), (-1), and (0) respectively.

The trading surplus associated with the project in[illegible]ated in year 0 is equal to: 222.0639 The pro[illegible]initiated in year (-1) is smaller than the project initi[illegible] year 0 by a factor of: 0.909090 Year 1 represe[illegible] second year of this project, and the trading surplus [illegible]fore 0.909090 times 244.2703 or 222.0639

Similarly for the other two projects, so that:

Trading surplus:

Project initiated in year (0):	222.0639
Project initiated in year (-1):	222.0639
Project initiated in year (-2):	222.0639
Project initiated in year (-3):	222.0639
Total trading surplus:	888.2559

Depreciation from project initiated in:

year (0),	0.25 of	300	is	[illegible]
year (-1),	0.25 of	272.7272	is	68.18181
year (-2),	0.25 of	247.9338	is	61.98347
year (-3),	0.25 of	225.3944	is	56.34861
Total depreciation:				261.5138

Accounting profit:

Total trading surplus:	888.2559
Minus total depreciation:	-261.513
PROFIT:	626.7420

CALCULATING BOOK VALUE

The book value of the firm is calculated at the end of year 0, when there are four projects contributing to the book assets. These are the projects initiated in years (-3), (-2), (-1) and (0) respectively.

The project initiated in year (-1) is smaller than the project initiated in year 0 by a factor of 0.909090 . The initial investment associated with the project initiated in year (-1) can therefore be determined by multiplying the amounts invested in year 0 by 0.909090 .

Similarly for the other projects, so that:

Project initiated		Initial investment	
	current	depreciable	non-depreciable
year (0)	500	300	200
year (-1)	454.5454	272.7272	181.8181
year (-2)	413.2231	247.9338	165.2892
year (-3)	375.6574	225.3944	150.2629

Project initiated		Book value	
	current	depreciable	non-depreciable
year (0)	500	300	200
year (-1)	500	204.5454	181.8181
year (-2)	500	123 9669	165.2892
year (-3)	500	56.34861	150.2629
Sub totals	2000	684.8610	697.3703

TOTAL BOOK VALUE: 3382.2[illegible]1

CALCULATING TRUE VALUE

The true value of the firm is calculated in year 0. The true value is the present value of the remaining cash flows of the firm's current projects.

The relevant projects are those initiated in year (-3), year (-2), year (-1) and year (0) respectively. The project initiated in year (-1) is smaller than the project initiated in year 0 by a factor of 0.909090 The cash flows can therefore be determined by multiplying those of the project initiated in year 0 by this factor.

Similarly for the other projects, so that:

Project initiated in:	Remaining cash flows			
	year 1	year 2	year 3	year 4
year (0)	172.0639	189.2703	208.1974	1253.887
year (-1)	172.0639	189.2703	1139.897	
year (-2)	172.0639	1036.270		
year (-3)	942.0639			
TOTAL CASH FLOW	1458.255	1414.811	1348.094	1253.887

The value of the firm is the present value of these cash flows:

TRUE VALUE OF FIRM 3582.559

CALCULATING RATIOS

ROI(%) = 18.53043

A/V(%) = 94.40824

POV(%) = 17.49425

APPENDIX 4

DERIVATION OF RELATIONSHIPS FOR STATIONARY STATE WITH INCOME TAX

This appendix presents the derivation of the relationships for the model discussed in section 4.2 of the thesis. It applies to a theoretical firm in stationary state paying company income tax. The derivation proceeds along similar lines as the one presented in appendix 1. (The derivation in appendix 1 refers to a firm not paying income tax.) This appendix uses the same notation as appendix 1.

The theoretical firm pays income tax based on its accounting profits at a rate of t. Taxable income is calculated according to historical cost conventions, and the income tax is payable immediately. No capital gains tax applies.

PROJECT CASH FLOWS

The annual cash flow associated with the project can be expressed as:

$$F_{n,k} = \text{(cash received during the year n of the project)}$$

$$\text{minus (cash paid out during year n of the project)}$$

$$= (S_{n,k} - D^A_{n,k} + D^P_{n,k}) - (I^A_{n,k} - C^A_{n,k})$$

$$- C^P_{n,k} - X^P_{n,k} - DA^A_{n,k} - NA^A_{n,k} - T_{n,k} \qquad \ldots(1)$$

where:

T = tax payable

and:

$$T_{n,k} = t.(S_{n,k} - I^P_{n,k} - X_{n,k} - DA^A_{n,k}) \qquad \ldots(2)$$

During any year of the project we also have that:

$$D_{n,k} = D_{n-1,k} + D^{A}_{n,k} - D^{P}_{n,k}$$

$$C_{n,k} = C_{n-1,k} + C^{A}_{n,k} - C^{P}_{n,k}$$

$$I_{n,k} = I_{n-1,k} + I^{A}_{n,k} - I^{P}_{n,k} \qquad \ldots(3)$$

In year 0 of the project (the year in which the project is initiated) no trading takes place, and therefore:

$$S_{0,k} = D^{P}_{0,k} = C^{P}_{0,k} = X_{0,k} = I^{P}_{0,k} = DA^{D}_{0,k} = 0 \qquad \ldots(4)$$

Furthermore:

$$D_{-1,k} = C_{-1,k} = I_{-1,k} = 0 \qquad \ldots(5)$$

Substituting (5) into (3), and (3) and (4) into (2) leaves:

$$F_{0,k} = - D_{0,k} - I_{0,k} + C_{0,k} - DA^{A}_{0,k} - NA^{A}_{0,k}$$

But:

$$D_{0,k} + I_{0,k} - C_{0,k} = CA_{0,k}$$

And therefore:

$$F_{0,k} = - CA_{0,k} - DA^{A}_{0,k} - NA^{A}_{0,k} \qquad \ldots(6)$$

For any year j of the project (where j is greater than 0 but smaller than d):

$$DA^{A}_{j,k} = NA^{A}_{j,k} = 0 \qquad \ldots(7)$$

and:

$$D_{j,k} = (1+i)D_{j-1,k}$$

so that, substituting into (3):

$$(1+i)D_{j-1,k} = D_{j-1,k} + D^{A}_{j,k} - D^{P}_{j,k}$$

and therefore:

$$D^{A}_{j,k} = iD_{j-1,k} + D^{P}_{j,k}$$

Because the project activity stays constant in real terms we also have that:

$$D_{j-1,k} = (1+i)^{j-1}D_{0,k}$$

so that:

$$D^{A}_{j,k} = i(1+i)^{j-1}D_{0,k} + D^{P}_{j,k} \qquad \ldots(8)$$

Similarly:

$$C^{A}_{j,k} = i(1+i)^{j-1}C_{0,k} + C^{P}_{j,k} \qquad \ldots(9)$$

$$I^{A}_{j,k} = i(1+i)^{j-1}I_{0,k} + I^{P}_{j,k} \qquad \ldots(10)$$

Substituting (7), (8), (9) and (10) into (1):

$$\begin{aligned} F_{j,k} = \; & S_{j,k} - i(1+i)^{j-1}D_{0,k} - i(1+i)^{j-1}I_{0,k} \\ & - I^{P}_{j,k} + i(1+i)^{j-1}C_{0,k} - X_{j,k} \\ & - t(S_{j,k} - I^{P}_{j,k} - X_{j,k} - DA^{D}_{j,k}) \qquad \ldots(11) \end{aligned}$$

From the regular pattern of project activity we further have that:

$$S_{j,k} = (1+i)^{j-1}S_{1,k}$$

$$X_{j,k} = (1+i)^{j-1}X_{1,k}$$

$$I^{P}_{j,k} = (1+i)^{j-1}I^{P}_{1,k}$$

We also have that:

$$TS_{j,k} = S_{j,k} - X_{j,k} - I^{P}_{j,k}$$

This is also the case for the first year of the project so that:

$$TS_{1,k} = S_{1,k} - X_{1,k} - I^{P}_{1,k}$$

Substituting into (11):

$$F_{j,k} = (1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)CA_{0,k} + tDA^{D}_{j,k} \quad \ldots(12)$$

But:

$$DA^{D}_{j,k} = (DA^{A}_{0,k})/d$$

Substituting into (12) leaves:

$$F_{j,k} = (1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)CA_{0,k} + \left(\frac{t}{d}\right)DA^{A}_{0,k} \quad \ldots(13)$$

In the last year (year d) of the project, the wound-up value of non-depreciable and current assets has to be taken into account in addition to the other cash flows. In the absence of a tax on capital gains this will not be taxable and can be added to the annual cash flows, so that:

$$F_{j,k} = (1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)CA_{0,k}$$

$$+ \left(\frac{t}{d}\right)DA^{A}_{0,k} + (1+i)^{d}(CA_{0,k} + NA^{A}_{0,k}) \quad \ldots(14)$$

The cash flows associated with a project can therefore be summarised from (6), (13) and (14) in Table A.4.1 as follows:

Table A.4.1

Project cash flows

Cash flow item	year 0 (initial year)	year j	year d (last year)
Initial investment	$-CA_{0,k}$ $-DA^A_{0,k}$ $-NA^A_{0,k}$	0	0
Trading surplus	0	$(1-t)(1+i)^{j-1}TS_{1,k}$	$(1-t)(1+i)^{d-1}TS_{1,k}$
Additional current assets	0	$-i(1+i)^{j-1}CA_{0,k}$	$-i(1+i)^{d-1}CA_{0,k}$
Depreciation tax shield	0	$(\frac{t}{d})DA^A_{0,k}$	$(\frac{t}{d})DA^A_{0,k}$
Wound-up	0	0	$(1+i)^{d}CA_{0,k}$ $+ (1+i)^{d}NA^A_{0,k}$

TRADING SURPLUS REQUIRED

It is assumed that every individual project has an internal rate of return of r, or that:

$$\sum_{j=0}^{d} \frac{F_{j,k}}{(1+r)^j}$$

$$= \quad (-CA_{0,k} - DA^A_{0,k} - NA^A_{0,k})\left(\frac{1}{1+r}\right)^0$$

$$+ \sum_{j=1}^{d-1} \left((1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)^{j-1}CA_{0,k} + \left(\frac{t}{d}\right) DA^A_{0,k}\left(\frac{1}{1+r}\right)^j\right)$$

$$+ \quad \left((1-t)(1+i)^{d-1}TS_{1,k} - i(1+i)^{d-1}CA_{0,k} - \left(\frac{t}{d}\right) DA^A_{0,k}\left(\frac{1}{1+r}\right)^d\right)$$

$$+ \quad (1+i)^d (CA_{0,k} + NA^A_{0,k})\left(\frac{1}{1+r}\right)^d$$

$$= 0$$

And therefore:

$$
\begin{aligned}
&- CA_{0,k} - DA^A_{0,k} - NA^A_{0,k} \\
&+ \sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^j \left(\frac{(1-t)}{(1+i)} TS_{1,k} - \frac{iCA_{0,k}}{(1+i)}\right) \\
&+ \sum_{j=1}^{d} \left(\frac{1}{1+r}\right)^j \left(\frac{t}{d}\right) DA^A_{0,k} \\
&+ \left(CA_{0,k} + NA^A_{0,k}\right) \left(\frac{1+i}{1+r}\right)^d \\
&= 0
\end{aligned}
$$

Solving for $TS_{1,k}$ gives:

$$
\begin{aligned}
TS_{1,k} = {} & CA_{0,k}\left(\frac{(1+i)}{(1-t)}\right)\left(\frac{1 + \left(\frac{i}{1+i}\right)\sum_{j=1}^{d}\left(\frac{1+i}{1+r}\right)^j - \left(\frac{1+i}{1+r}\right)^d}{\sum_{j=1}^{d}\left(\frac{1+i}{1+r}\right)^j}\right) \\
& + DA^A_{0,k}\left(\frac{(1+i)}{(1-t)}\right)\left(\frac{1 - \left(\frac{t}{d}\right)\sum_{j=1}^{d}\left(\frac{1}{1+r}\right)^j}{\sum_{j=1}^{d}\left(\frac{1+i}{1+r}\right)^j}\right) \\
& + NA^A_{0,k}\left(\frac{(1+i)}{(1-t)}\right)\left(\frac{1 - \left(\frac{1+i}{1+r}\right)^d}{\sum_{j=1}^{d}\left(\frac{1+i}{1+r}\right)^j}\right) \qquad \ldots(16)
\end{aligned}
$$

But:

$$\sum_{j=1}^{d} \left(\frac{1+i}{1+r}\right)^{j} = \frac{\frac{1+i}{1+r} - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \frac{1+i}{1+r}}$$

and:

$$\sum_{j=1}^{d} \left(\frac{1}{1+r}\right)^{j} = \left(\frac{1}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)$$

Substituting into (16):

$$TS_{1,k} = CA_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{1 + \left(\frac{i}{1+i}\right)\left(\frac{\frac{1+i}{1+r} - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \frac{1+i}{1+r}}\right) - \left(\frac{1+i}{1+r}\right)^{d}}{\frac{\left(\frac{1+i}{1+r}\right) - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \left(\frac{1+i}{1+r}\right)}}\right)$$

$$+ \; DA^{A}_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{\frac{\left(\frac{1+i}{1+r}\right) - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \left(\frac{1+i}{1+r}\right)}}\right)$$

$$+ \; NA^{A}_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{1 - \left(\frac{1+i}{1+r}\right)^{d}}{\frac{\left(\frac{1+i}{1+r}\right) - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \left(\frac{1+i}{1+r}\right)}}\right) \qquad \ldots(17)$$

But:

$$\frac{1 + \left(\frac{i}{1+i}\right)\left(\frac{\frac{1+i}{1+r} - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \frac{1+i}{1+r}}\right) - \left(\frac{1+i}{1+r}\right)^{d}}{\frac{\left(\frac{1+i}{1+r}\right) - \left(\frac{1+i}{1+r}\right)^{d+1}}{1 - \left(\frac{1+i}{1+r}\right)}}$$

$$= \left(\frac{\left(1 - \left(\frac{1+i}{1+r}\right)^{d}\right)\left(1 - \left(\frac{1+i}{1+r}\right)\right) - \left(\frac{i}{1+i}\right)\left(\frac{1+i}{1+r}\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d}\right)}{\left(\frac{1+i}{1+r}\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d}\right)}\right)$$

$$= \left(\frac{1 - \frac{1+i}{1+r} - \left(\frac{i}{1+i}\right)\left(\frac{1+i}{1+r}\right)}{\frac{1+i}{1+r}}\right)$$

$$= \frac{1 + r - 1 + i - i}{1 + i}$$

$$= \frac{r}{1+i} \qquad \ldots(18)$$

and:

$$\left(\frac{1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})}{\dfrac{(\frac{1+i}{1+r}) - (\frac{1+i}{1+r})^{d+1}}{1 - (\frac{1+i}{1+r})}}\right)$$

$$= \frac{(\frac{r-i}{1+r})(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})}{(\frac{1+i}{1+r})(1 - (\frac{1+i}{1+r})^{d})}$$

$$= (\frac{r-i}{1+i})\left(\frac{1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}}\right) \qquad ...(19)$$

and:

$$\left(\frac{1 - (\frac{1+i}{1+r})^{d}}{\dfrac{(\frac{1+i}{1+r}) - (\frac{1+i}{1+r})^{d+1}}{1 - (\frac{1+i}{1+r})}}\right)$$

$$= \frac{(\frac{r-i}{1+r})(1 - (\frac{1+i}{1+r})^{d})}{(\frac{1+i}{1+r})(1 - (\frac{1+i}{1+r})^{d})} = \frac{r-i}{1+i} \qquad ...(20)$$

And therefore, substituting (18), (19) and (20) into (17) gives:

$$TS_{1,k} = CA_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{r}{1+i}\right)$$

$$+ \; DA^{A}_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{r-i}{1+i}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ \; NA^{A}_{0,k}\left(\frac{1+i}{1-t}\right)\left(\frac{r-i}{1+i}\right)$$

so that, after simplifying:

$$TS_{1,k} = \left(\frac{r}{1-t}\right)CA_{0,k}$$

$$+ \; \left(\frac{r-i}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)DA^{A}_{0,k}$$

$$+ \; \left(\frac{r-i}{1-t}\right)NA^{A}_{0,k} \qquad \ldots(21)$$

ACCOUNTING PROFIT OF THE FIRM

The accounting profit of the firm equals the turnover minus cost of sales, cash expenses [illegible]iation, or:

$$E_k = S_k - X_k - I_k^P - DA_k^A$$

Separating this into the contributions from each of the current projects of the firm:

$$E_k = S_{1,k-1} - X_{1,k-1} - I_{1,k-1}^P - \left(\frac{DA_{0,k-1}^A}{d}\right)$$

$$+ S_{2,k-2} - X_{2,k-2} - I_{2,k-2}^P - \left(\frac{DA_{0,k-2}^A}{d}\right)$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ S_{d,k-d} - X_{d,k-d} - I_{d,k-d}^P - \left(\frac{DA_{0,k-d}^A}{d}\right)$$

But:

$$S_{1,k-1} = S_{2,k-2} = \ldots\ldots\ldots\ldots = S_{d,k-d}$$

$$X_{1,k-1} = X_{1,k-1} = \ldots\ldots\ldots\ldots = X_{d,k-d}$$

$$I_{1,k-1}^P = I_{2,k-2}^P = \ldots\ldots\ldots\ldots = I_{d,k-d}^P$$

And:

$$\begin{aligned} & DA_{0,k-1}^A \\ &= (1+i)\,DA_{0,k-2}^A \\ &= (1+i)^2 DA_{0,k-3}^A \\ &= \ldots\ldots\ldots\ldots \\ &= (1+i)^{d-1} DA_{0,k-d}^A \end{aligned}$$

And therefore, after substituting and rearranging:

$$E_k = dS_{1,k-1} - dX_{1,k-1} - dI^P_{1,k-1} - \frac{DA^A_{0,k-1}}{d} \sum_{m=1}^{d} \left(\frac{1}{(1+i)^{m-1}}\right)$$

But:

$$S_{1,k-1} - X_{1,k-1} - I^P_{1,k-1} = TS_{1,k-1}$$

And:

$$\sum_{m=1}^{d} \left(\frac{1}{(1+i)^{m-1}}\right) = \frac{1 - \left(\frac{1}{1+i}\right)^d}{1 - \frac{1}{1+i}}$$

Therefore, after simplifying:

$$E_k = dTS_{1,k-1} - DA^A_{0,k-1}\left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right)$$

This equation gives the accounting profit in year k in terms of the characteristics of the project that was initiated in year (k-1). Similarly one could express the accounting profit in year (k+1) in terms of the characteristics of the project that was initiated in year k:

$$E_{k+1} = dTS_{1,k} - DA^A_{0,k}\left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right)$$

Where:

$$TS_{1,k} = \left(\frac{r}{1-t}\right) CA_{0,k}$$

$$+ \left(\frac{r-i}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right) DA^{A}_{0,k}$$

$$+ \left(\frac{r-i}{1-t}\right) NA^{A}_{0,k}$$

So that, after substituting and simplifying:

$$E_{k+1} = \left(\frac{d.r}{1-t}\right) CA_{0,k}$$

$$+\left(\left(\frac{d.(r-i)}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)\right.$$

$$\left. - \left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^{d}\right)\right) DA^{A}_{0,k}$$

$$+ \left(\frac{d.(r-i)}{1-t}\right) NA^{A}_{0,k} \qquad \ldots(22)$$

This gives the accounting earnings before tax. We shall also consider the accounting earnings after tax which is given by:

$$E^{T}_{k+1} = (1-t)E_{k+1}$$

where:

$$E^{T}_{k+1} = \text{earnings after tax}$$

Substituting (22):

$$E_{k+1} = d.r.CA_{0,k}$$

$$+ (d.(r-i).(\frac{1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}})$$

$$- (1-t)(\frac{1+i}{d.i})(1 - (\frac{1}{1+i})d))DA^{A}_{0,k}$$

$$+ d.(r-i).NA^{A}_{0,k} \qquad \ldots(23)$$

BOOK VALUE OF THE FIRM

The derivation of the book value of the theoretical firm in the absence of tax is presented in appendix 1. This derivation also applies to the tax paying firm, and will not be repeated here. From this derivation, the book value of the firm is determined to be:

$$A_{k} = dCA_{0,k}$$

$$+ DA^{A}_{0,k} ((\frac{1+i}{i}) - (\frac{1+i}{d.i^{2}}) + \frac{1}{d.i^{2}.(1+i)^{d-1}})$$

$$+ NA^{A}_{0,k}(\frac{1+i}{i}).(1 - (\frac{1}{1+i})^{d}) \qquad \ldots(24)$$

TRUE VALUE OF THE FIRM

The true value of the firm is the present value of the remaining cash flow streams of its current projects.

The value of the remaining cash flow streams of a project at the end of year j of the project is:

$$V_{j,k} = \sum_{m=j+1}^{d} \frac{F_{m,k}}{(1+r)}$$

Substituting (13) and (14) into (24):

$$V_{j,k} = \sum_{m=j+1}^{d} \left(\frac{(1-t)(1+i)^{m-1}TS_{1,k} - i(1+i)^{m-1}CA_{0,k} + (t/d)DA^{A}_{0,k}}{(1+r)^{m-j}}\right) + \frac{(1+i)^{d}(CA_{0,k} + NA^{A}_{0,k})}{(1+r)^{d-j}}$$

where:

$$TS_{1,k} = \left(\frac{r}{1-t}\right)CA_{0,k} + \left(\frac{r-i}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)DA^{A}_{0,k} + \left(\frac{r-i}{1-t}\right)NA^{A}_{0,k}$$

and therefore:

$$V_{j,k} = \sum_{m=j+1}^{d} \left(\frac{(1-t)(1+i)^{m-1}.r}{(1-t)} - i(1+i)^{m-1}\right)\left(\frac{CA_{0,k}}{(1+r)^{m-j}}\right)$$

$$+ \sum_{m=j+1}^{d} \left(\left(\frac{(1-t)(1+i)^{m-1}(r-i)}{(1-t)}\right)\left(\frac{1 - \frac{t}{d.r}(1 - (\frac{1}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}}\right.\right.$$

$$\left.\left. + \frac{t}{d}\right)\left(\frac{DA^{A}_{0,k}}{(1+r)^{m-j}}\right)\right)$$

$$+ \sum_{m=j+1}^{d} \left(\frac{(1-t)(1+i)^{m-1}(r-i)}{(1-t)}\right)\left(\frac{NA^{A}_{0,k}}{(1+r)^{m-j}}\right)$$

$$+ \frac{(1+i)^{d}}{(1+r)^{d-j}}(CA_{0,k} + NA^{A}_{0,k})$$

$$= CA_{0,k}\left(\frac{(1+i)^{d}}{(1+r)^{d-j}} + (r-i)\sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}}\right)$$

$$+ DA^{A}_{0,k}\left(\frac{t}{d}.\sum_{m=j+1}^{d} \frac{1}{(1+r)^{m-j}}\right.$$

$$\left. + \frac{(r-i)(1 - \frac{t}{d.r}(1 - (\frac{1}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}} . \sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}}\right)$$

$$+ NA^{A}_{0,k}\left(\frac{(1+i)^{d}}{(1+r)^{d-j}} + (r-i)\sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}}\right) \qquad \ldots(25)$$

But:

$$\sum_{m=j+1}^{d} \frac{(1+i)^{m-1}}{(1+r)^{m-j}}$$

$$= (1+i)^{j-1} \sum_{m=j+1}^{d} (\frac{1+i}{1+r})^{m-j}$$

$$= (1+i)^{j-1} \sum_{n=1}^{d-j} (\frac{1+i}{1+r})^{n}$$

$$= (1+i)^{j-1} (\frac{\frac{1+i}{1+r} - (\frac{1+i}{1+r})^{d-j+1}}{1 - \frac{1+i}{1+r}})$$

$$= \frac{(1+i)^{j}}{(1+r)} (\frac{1 - (\frac{1+i}{1+r})^{d-j}}{\frac{r-i}{1+r}})$$

$$= \frac{(1+i)^{j}}{r-i} (1 - (\frac{1+i}{1+r})^{d-j}) \qquad \ldots(26)$$

And:

$$\sum_{m=j+1}^{d} \frac{1}{(1+r)^{m-j}}$$

$$= \sum_{n=1}^{d-j} \frac{1}{(1+r)^{n}}$$

$$= \frac{\frac{1}{1+r} - (\frac{1}{1+r})^{d-j+1}}{1 - \frac{1}{1+r}}$$

$$= \frac{1+r}{r}(\frac{1}{1+r} - (\frac{1}{1+r})^{d-j+1})$$

$$= (\frac{1}{r})(1 - (\frac{1}{1+r})^{d-j}) \qquad ...(27)$$

Substituting (26) and (27) into (25):

$$V_{j,k} = CA_{0,k}(\frac{(1+i)^d}{(1+r)^{d-j}} + (r-i)(\frac{(1+i)^j}{(r-i)})(1 - (\frac{1+i}{1+r})^{d-j}))$$

$$+DA^A_{0,k}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d-j})$$

$$+ (\frac{(r-i)(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^d}{1 - (\frac{1+i}{1+r})^d})(\frac{(1+i)^j}{(r-i)})(1 - (\frac{1+i}{1+r})^{d-j}))$$

$$+ NA^A_{0,k}(\frac{(1+i)^d}{(1+r)^{d-j}} + (r-i)(\frac{(1+i)^j}{(r-i)})(1 - (\frac{1+i}{1+r})^{d-j})$$

$$= CA_{0,k}\left(\frac{(1+i)^d}{(1+r)^{d-j}} + (1+i)^j - \frac{(1+i)^d}{(1+r)^{d-j}}\right)$$

$$+ DA^A_{0,k}\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d-j}\right)\right.$$

$$\left. + \frac{(1+i)^j\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d-j}\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)$$

$$+ NA^A_{0,k}\left(\frac{(1+i)^d}{(1+r)^{d-j}} + (1+i)^j - \frac{(1+i)^d}{(1+r)^{d-j}}\right)$$

and therefore:

$$V_{j,k} = CA_{0,k}(1+i)^j$$

$$+ DA^A_{0,k}\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d-j}\right)\right.$$

$$\left. + \frac{(1+i)^j\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d-j}\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)$$

$$+ NA^A_{0,k}(1+i)^j \qquad \ldots (28)$$

The value of the firm is the value of its current projects, or:

$$V_k = V_{0,k} + V_{1,k-1} + V_{2,k-2} + \ldots\ldots\ldots + V_{d-1,k-(d-1)}$$

$$= CA_{0,k}(1+i)^0$$

$$+ DA^A_{0,k}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^d)$$

$$+ \frac{(1+i)^0(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^d))(1 - (\frac{1+i}{1+r})^d)}{1 - (\frac{1+i}{1+r})^d})$$

$$+ NA^A_{0,k}(1+i)^0$$

$$+ CA_{0,k-1}(1+i)^1$$

$$+ DA^A_{0,k-1}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d-1})$$

$$+ \frac{(1+i)^1(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^d))(1 - (\frac{1+i}{1+r})^{d-1})}{1 - (\frac{1+i}{1+r})^d})$$

$$+ NA^A_{0,k-1}(1+i)^1$$

+ ....

+ ....

+..

$$+ CA_{0,k-(d-1)}(1+i)^{d-1}$$

$$+ DA^{A}_{0,k-(d-1)}\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{1}\right)\right.$$

$$\left. + \frac{(1+i)^{d-1}\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{1}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ NA^{A}_{0,k-(d-1)}(1+i)^{d-1} \qquad \ldots(29)$$

But:

$$\begin{aligned} CA_{0,k} &= (1+i)CA_{0,k-1} \\ &= (1+i)^{2}CA_{0,k-2} \\ &= \ldots\ldots\ldots\ldots\ldots\ldots \\ &= (1+i)^{d-1}CA_{0,k-(d-1)} \end{aligned}$$

And:

$$\begin{aligned} DA^{A}_{0,k} &= (1+i)DA^{A}_{0,k-1} \\ &= (1+i)^{2}DA^{A}_{0,k-2} \\ &= \ldots\ldots\ldots\ldots\ldots\ldots \\ &= (1+i)^{d-1}DA^{A}_{0,k-(d-1)} \end{aligned}$$

Also:

$$NA^{A}_{0,k} = (1+i)NA^{A}_{0,k-1}$$

$$= (1+i)^{2}NA^{A}_{0,k-2}$$

$$= \dots\dots\dots\dots\dots\dots$$

$$= (1+i)^{d-1}NA^{A}_{0,k-(d-1)}$$

Substituting into (29):

$$V_{k} = CA_{0,k}$$

$$+ DA^{A}_{0,k}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})$$

$$+ \frac{(1+i)^{0}(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d}))(1 - (\frac{1+i}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}})$$

$$+ NA^{A}_{0,k}$$

$$+ CA_{0,k}$$

$$+ (\frac{DA^{A}_{0,k}}{(1+i)1})((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d-1})$$

$$+ \frac{(1+i)^{1}(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d}))(1 - (\frac{1+i}{1+r})^{d-1})}{1 - (\frac{1+i}{1+r})^{d}})$$

$$+ NA^{A}_{0,k}$$

+ ....

+ ....

+ ....

$$+ CA_{0,k}$$

$$+ \left(\frac{DA^{A}_{0,k}}{(1+i)^{d-1}}\right)\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{1}\right)\right.$$

$$\left. + \frac{(1+i)^{d-1}\left(1 - \left(\frac{t}{d.r}\right)\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{1}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ NA^{A}_{0,k}$$

And therefore:

$$V_k = d.CA_{0,k}$$

$$+ DA^{A}_{0,k}\left(\left(\frac{t}{d.r}\right)\sum_{m=0}^{d-1}\left(\frac{1 - \left(\frac{1}{1+r}\right)^{d-m}}{(1+i)^{m}}\right)\right.$$

$$\left. + \left(1 - \left(\frac{t}{d.r}\right)\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\sum_{n=1}^{d}\left(\frac{1 - \left(\frac{1+i}{1+r}\right)^{n}}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ d.NA^{A}_{0,k} \qquad \ldots(30)$$

But:

$$\sum_{n=1}^{d}\left(\frac{1-\left(\frac{1+i}{1+r}\right)^{n}}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$=\left(\frac{d}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right)-\left(\frac{1}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right)\sum_{n=1}^{d}\left(\frac{1+i}{1+r}\right)^{n}$$

$$=\left(\frac{d}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right)-\left(\frac{1}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right).\left(\frac{\left(\frac{1+i}{1+r}\right)-\left(\frac{1+i}{1+r}\right)^{d+1}}{1-\left(\frac{1+i}{1+r}\right)}\right)$$

$$=\left(\frac{d}{1-\left(\frac{1+i}{1+r}\right)^{d}}\right)-\left(\frac{\left(\frac{1+i}{1+r}\right)\left(1-\left(\frac{1+i}{1+r}\right)^{d}\right)}{\left(1-\left(\frac{1+i}{1+r}\right)^{d}\right)\left(\frac{1+r-1-i}{1+r}\right)}\right)$$

$$=\frac{d}{1-\left(\frac{1+i}{1+r}\right)^{d}}-\frac{1+i}{r-i}$$

And:

$$\sum_{m=0}^{d-1}\left(\frac{1-\left(\frac{1}{1+r}\right)^{d-m}}{(1+i)^{m}}\right)$$

$$=\sum_{m=0}^{d-1}\left(\frac{1}{1+i}\right)^{m}-\left(\frac{1}{1+r}\right)^{d}\sum_{m=0}^{d-1}\left(\frac{1+r}{1+i}\right)^{m}$$

$$= \frac{1 - \left(\frac{1}{1+i}\right)^d}{1 - \left(\frac{1}{1+i}\right)} - \left(\frac{1}{1+r}\right)^d \left(\frac{1 - \left(\frac{1+r}{1+i}\right)^d}{1 - \left(\frac{1+r}{1+i}\right)}\right)$$

$$= \left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right) - \left(\frac{1}{1+r}\right)^d \left(\frac{1+i}{r-i}\right)\left(\left(\frac{1+r}{1+i}\right)^d - 1\right)$$

$$= \left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right) - \left(\frac{1+i}{r-i}\right)\left(\left(\frac{1}{1+i}\right)^d - \left(\frac{1}{1+r}\right)^d\right)$$

And therefore, substituting into (30):

$$V_k = d.CA_{0,k}$$

$$+ DA^A_{0,k}\left(\left(\frac{t}{d.r}\right)\left(\left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right) - \left(\frac{1+i}{r-i}\right)\left(\left(\frac{1}{1+i}\right)^d - \left(\frac{1}{1+r}\right)^d\right)\right)\right.$$

$$\left. + \left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i}\right)\right)$$

$$+ d.NA^A_{0,k} \qquad \ldots(31)$$

ACCOUNTING RATE OF RETURN

The accounting rate of return is calculated on an after tax basis so that it can be compared to the internal rate of return which have also been defined on an after tax basis. To calculate the conventional accounting rate of return, the accounting profit after tax (23) is divided by the book value of assets (24), or:

$$ROI = \frac{E^T_{k+1}}{A_k} \qquad \ldots(32)$$

PROFIT ON VALUE

This alternative measure of accounting rate of return is also calculated on an after tax basis and is the accounting profit after tax (23) divided by the true value of the firm (31), or:

$$POV = \frac{E^T_{k+1}}{V_k} \qquad \ldots(33)$$

SUMMARY

The conventional accounting rate of return of the theoretical firm paying company income tax is given by:

$$ROI = \frac{E^T_{k+1}}{A_k} \qquad \ldots(32)$$

An alternative measure of accounting rate of return for the theoretical marginal firm paying company income tax is given by:

$$POV = \frac{E^T_{k+1}}{V_k} \qquad \ldots(33)$$

where:

$$E_{k+1} = d.r.CA_{0,k}$$

$$+ (d.(r-i).(\frac{1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^d)}{1 - (\frac{1+i}{1+r})^d})$$

$$- (1-t)(\frac{1+i}{d.i})(1 - (\frac{1}{1+i})d))DA^A_{0,k}$$

$$+ d.(r-i).NA^A_{0,k} \qquad \ldots(23)$$

and:

$$A_k = dCA_{0,k}$$

$$+ DA^A_{0,k} \left(\left(\frac{1+i}{i}\right) - \left(\frac{1+i}{d.i^2}\right) + \frac{1}{d.i^2.(1+i)^{d-1}} \right)$$

$$+ NA^A_{0,k}\left(\frac{1+i}{i}\right).\left(1 - \left(\frac{1}{1+i}\right)^d\right) \qquad \ldots(24)$$

and:

$$V_k = d.CA_{0,k}$$

$$+ DA^A_{0,k} \left(\left(\frac{t}{d.r}\right)\left(\left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right) - \left(\frac{1+i}{r-i}\right)\left(\left(\frac{1}{1+i}\right)^d - \left(\frac{1}{1+r}\right)^d\right)\right)\right.$$

$$\left. + \left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i}\right)\right)$$

$$+ d.NA^A_{0,k} \qquad \ldots(31)$$

THE CHARACTERISTICS OF SINGLE ASSET FIRMS

The characteristics of the theoretical firm is the weighted average of the effects of the different types of assets the firm employ. As an aid to the understanding of the characteristics of the multi-asset theoretical firm the characteristics of single asset firms consisting of either current, depreciable or non-depreciable assets will be studied.

For the 100 percent current asset firm:

$$DA^A_{0,k} = NA^A_{0,k} = 0$$

Substituting into (23), (24) and substituting ... in tur into (32):

$$ROI = \left(\frac{d.r.CA_{0,k}}{dCA_{0,k}}\right)$$

$$= r \qquad \text{...(34)}$$

Similarly, from (23), (31) and (33):

$$POV = \left(\frac{d.r.CA_{0,k}}{dCA_{0,k}}\right)$$

$$= r \qquad \text{...(35)}$$

From (34) and (35) it is clear that both the variants of ARR equal IRR for the tax 100 percent current asset firm, as was also the case for the firm not paying tax (see figures 3.1 to 3.14 in chapter 3 of the thesis).

For the 100 percent non-depreciable asset firm:

$$CA_{0,k} = DA^{A}_{0,k} = 0$$

From (23), (31) and (33):

$$POV = \left(\frac{d.(r-i).NA^{A}_{0,k}}{d.NA^{A}_{0,k}}\right)$$

$$= (r-i) \qquad \text{...(36)}$$

From (36) the firm consisting of only non-depreciable assets has an ARR (expressed as a percentage of the true value of the firm) equal to the difference between the IRR and the inflation rate. This is the same as the results obtained for the firm not paying tax (see figures 3.8 to 3.14 in chapter 3 of the thesis).

For the firm consisting of only depreciable assets:

$$CA_{0,k} = DA^{A}_{0.k} = 0$$

From (23), (31) and (33):

$$POV = \left(\frac{d.(r-i).\left(\dfrac{1 - \left(\dfrac{t}{d.r}\right)\left(1-\left(\dfrac{1}{1+r}\right)^{d}\right)}{1 - \left(\dfrac{1+i}{1+r}\right)^{d}}\right) - (1-t)\left(\dfrac{1+i}{d.i}\right)\left(1-\left(\dfrac{1}{1+i}\right)^{d}\right)}{\left(\dfrac{t}{d.r}\right)\left(\left(\dfrac{1+i}{i}\right)\left(1 - \left(\dfrac{1}{1+i}\right)^{d}\right) - \left(\dfrac{1+i}{r-i}\right)\left(\left(\dfrac{1}{1+i}\right)^{d} - \left(\dfrac{1}{1+r}\right)^{d}\right)\right) \ldots} \right.$$

$$\left. \ldots + \left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(\frac{d}{1 - \left(\dfrac{1+i}{1+r}\right)^{d}} - \frac{1+i}{r-i}\right)\right) \qquad \ldots(37)$$

In the absence of tax t=0. Substituting into (37):

$$POV = \left(\frac{\left(\dfrac{d.(r-i)}{1 - \left(\dfrac{1+i}{1+r}\right)^{d}}\right) - \left(\dfrac{1+i}{d.i}\right)\left(1 - \left(\dfrac{1}{1+i}\right)^{d}\right)}{\left(\dfrac{d}{1 - \left(\dfrac{1+i}{1+r}\right)^{d}}\right) - \left(\dfrac{1+i}{r-i}\right)} \right) \qquad \ldots(38)$$

Equation (38) is the same as the result obtained for the firm not paying tax (appendix 1) and serves to verify the derivation.

In the case of a firm employing extremely long lived depreciable assets d approaches infinity. From (37):

$$\lim_{d \to \infty} POV$$

$$= \left(\frac{\left(\frac{d(r-i)(1 - 0(1-0))}{(1-0)}\right) - 0(1\cdot}{0\left(\left(\frac{1+i}{i}\right)(1-0) - \left(\frac{1+i}{r-i}\right)(0-0)\right) + (1 - 0(1-0))\left(\left(\frac{d}{1-0}\right) - \left(\frac{1+i}{r-i}\right)\right)} \right)$$

$$= \left(\frac{d.(r-i)}{d - \left(\frac{1+i}{r-i}\right)} \right)$$

This is of the form (infinity/infinity) and therefore (*L'Hopital*):

$$POV = (r-i) \qquad \ldots(39)$$

This is the same as for the 100 percent non-depreciable asset firm (36). Depreciable assets with an extremely long life therefore approaches the nature of non-depreciable assets (in their influence on POV).

In the case of depreciable assets with a very short life d=1 (the shortest life allowed for under the assumptions of the model). Substituting into (37):

$$POV = \left(\frac{(r-i)\left(\frac{1 - \left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right)}{1 - \left(\frac{1+i}{1+r}\right)}\right) - (1-t)\left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)\right)}{\left(\frac{t}{r}\right)\left(\left(\frac{1+i}{i}\right)\left(1 - \left(\frac{1}{1+i}\right)\right) - \left(\frac{1+i}{r-i}\right)\left(\left(\frac{1}{1+i}\right) - \left(\frac{1}{1+r}\right)\right)\right) \ldots + \left(1 - \left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right)\right)\left(\left(\frac{1}{1 - \left(\frac{1+i}{1+r}\right)}\right) - \left(\frac{1+i}{r-i}\right)\right)} \right)$$

$$= \left(\frac{\left(\frac{1+r}{1-i}\right)(r-i)\left(1 - \left(\frac{t}{r}\right) + \left(\frac{t}{r.(1+r)}\right)\right) - (1-t)\left(\frac{1+i}{i}\right)\left(\frac{i}{1+i}\right)}{\left(\frac{t}{r}\right)\left(\left(\frac{1+i}{i}\right)\left(\frac{i}{1+i}\right)\right) - \left(\frac{1+i}{r-i}\right)\left(\frac{(1+r) - (1+i)}{(1+i)(1+r)}\right) \ldots} \right.$$

$$\left. \ldots + \left(1 - \left(\left(\frac{t}{r}\right) - \left(\frac{t}{r.(1+r)}\right)\right)\right)\left(\left(\frac{1+r}{r-i}\right) - \left(\frac{1+i}{r-i}\right)\right) \right)$$

$$= \left(\frac{(1+r)\left(1 - \left(\frac{t}{r}\right) - \left(\frac{t}{r.(1+r)}\right)\right) - (1-t)}{\left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right) + 1 - \left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right)} \right)$$

$$= 1 + r - \left(\frac{t}{r}\right) - t + \left(\frac{t}{r}\right) - 1 + t$$

$$= r \qquad \ldots(40)$$

This is the same as for the 100 percent current asset firm (35). Depreciable assets with a short life therefore approaches the nature of current assets (in their influence on POV).

APPENDIX 5

DERIVATION OF RELATIONSHIPS FOR A GROWING FIRM IN STEADY STATE PAYING INCOME TAX

This appendix presents the derivation of the relationships for the model discussed in section 4.3 of the thesis. It applies to a theoretical firm growing in steady state paying company income tax. The derivation proceeds along similar lines as those presented in appendices 1 and 4. (These derivations refer to firms in stationary state. A firm not paying tax is considered in appendix 1 and a firm paying company income tax in appendix 4.) The notation used in this appendix is described in appendix 1 and has also been used in appendix 4.

The theoretical firm is growing at a rate g (which can be either positive or negative) and is paying tax based on its accounting profit at a rate of t. Taxable income is calculated according to historical cost conventions , and the income tax becomes payable immediately. No capital gains tax applies.

PROJECT CASH FLOWS

The projects employed by the growing firm are similar to that employed by the firm in stationary state (appendix 4). The project variables for the two firms are in exactly the same relationships, the only difference being that the successive projects of the growing firm grow in real terms at a rate g while the projects of the firm in stationary state are all of the same size.

The derivation of the annual project cash flows will therefore not be repeated here but only the results taken from appendix 4 and presented below.

In year 0 of the project (the year in which the project is initiated):

$$F_{0,k} = - CA_{0,k} - DA^{A}_{0,k} - NA^{A}_{0,k} \qquad \ldots(1)$$

For any year j of the project (where j is greater than 0 but smaller than d):

$$F_{j,k} = (1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)CA_{0,k} + (\frac{t}{d})DA^{A}_{0,k} \qquad \ldots(2)$$

In the last year (year d) of the project:

$$F_{j,k} = (1-t)(1+i)^{j-1}TS_{1,k} - i(1+i)CA_{0,k}$$

$$+ (\frac{t}{d})DA^{A}_{0,k} + (1+i)^{d}(CA_{0,k} + NA^{A}_{0,k}) \quad \ldots(3)$$

The cash flows associated with a project can therefore be summarised from (1), (2) and (3) in Table A.5.1 as follows:

Table A.5.1

Project cash flows

Cash flow item	year 0 (initial year)	year j	year d (last year)
Initial investment	$-CA_{0,k}$ $-DA^{A}_{0,k}$ $-NA^{A}_{0,k}$	0	0
Trading surplus	0	$(1-t)(1+i)^{j-1}TS_{1,k}$	$(1-t)(1+i)^{d-1}TS_{1,k}$
Additional current assets	0	$-i(1+i)^{j-1}CA_{0,k}$	$-i(1+i)^{d-1}CA_{0,k}$
Depreciation tax shield	0	$(\frac{t}{d})DA^{A}_{0,k}$	$(\frac{t}{d})DA^{A}_{0,k}$
Wound-up	0	0	$(1+i)^{d}CA_{0,k}$ $+ (1+i)^{d}NA^{A}_{0,k}$

Where:

$$TS_{1,k} = \left(\frac{r}{1-t}\right) CA_{0,k}$$

$$+ \left(\frac{r-i}{1-t}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right) DA^{A}_{0,k}$$

$$+ \left(\frac{r-i}{1-t}\right) NA^{A}_{0,k} \qquad \ldots(4)$$

ACCOUNTING PROFIT OF THE FIRM

The accounting profit of the firm equals the turnover minus cost of sales, cash expenses and depreciation, or:

$$E_k = S_k - X_k - I^P_k - DA^A_k \qquad \ldots(5)$$

Seperating this into the contributions from each of the current projects of the firm:

$$E_k = S_{1,k-1} - X_{1,k-1} - I^P_{1,k-1} - \left(\frac{DA^A_{0,k-1}}{d}\right)$$

$$+ S_{2,k-2} - X_{2,k-2} - I^P_{2,k-2} - \left(\frac{DA^A_{0,k-2}}{d}\right)$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ S_{d,k-d} - X_{d,k-d} - I^P_{d,k-d} - \left(\frac{DA^A_{0,k-d}}{d}\right) \qquad \ldots(6)$$

But, because turnover stays constant in real terms over the duration of the project, we have that:

$$S_{2,k-1} = (1+i)S_{1,k-2}$$

$$S_{3,k-3} = (1+i)^2 S_{1,k-3}$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots$$

$$S_{d,k-d} = (1+i)^{d-1} S_{1,k-d} \qquad \ldots(7)$$

And, because each project is (1+g) times larger in real terms than the project started the year before, we also have that:

$$S_{2,k-2} = (S_{1,k-1})/(1+g)$$

$$S_{3,k-3} = (S_{1,k-1})/(1+g)^2$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$S_{d,k-d} = (S_{1,k-1})/(1+g)d-1 \qquad \ldots(8)$$

Substituting (8) into (7):

$$S_{2,k-2} = (S_{1,k-1})/(1+g)$$

$$S_{2,k-3} = (S_{1,k-1})/(1+g)^2$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$S_{2,k-d} = (S_{1,k-1})/(1+g)^d \qquad \ldots(9)$$

Similarly:

$$X_{2,k-2} = (X_{1,k-1})/(1+g)$$

$$X_{2,k-3} = (X_{1,k-1})/(1+g)^{2}$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots\ldots\ldots$$

$$X_{2,k-d} = (X_{1,k-1})/(1+g)^{d} \qquad \ldots(10)$$

and:

$$I^{P}_{2,k-2} = (I^{P}_{1,k-1})/(1+g)$$

$$I^{P}_{3,k-3} = (I^{P}_{1,k-1})/(1+g)^{2}$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots\ldots\ldots$$

$$I^{P}_{d,k-d} = (I^{P}_{1,k-1})/(1+g)^{d-1} \qquad \ldots(11)$$

Furthermore:

$$DA^{A}_{0,k-2} = \frac{DA^{A}_{0,k-1}}{((1+g)(1+i))}$$

$$DA^{A}_{0,k-3} = \frac{DA^{A}_{0,k-1}}{((1+g)(1+i))^{2}}$$

$$\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$DA^{A}_{0,k-d} = \frac{DA^{A}_{0,k-1}}{((1+g)(1+i))^{d-1}} \qquad \ldots(12)$$

Substituting (10), (11) and (12) into (6):

$$E_k = S_{1,k-1} - X_{1,k-1} - I^P_{1,k-1} - \left(\frac{1}{d}\right) DA^A_{0,k-1}$$

$$+ \frac{S_{1,k-1}}{(1+g)^2} - \frac{X_{1,k-1}}{(1+g)^2} - \frac{I^P_{1,k-1}}{(1+g)^2} - \frac{DA^A_{0,k-1}}{d((1+g)(1+i))^2}$$

$$+ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$+ \frac{S_{1,k-1}}{(1+g)^{d-1}} - \frac{X_{1,k-1}}{(1+g)^{d-1}} - \frac{I^P_{1,k-1}}{(1+g)^{d-1}} - \frac{DA^A_{0,k-1}}{d((1+g)(1+i))^{d-1}}$$

And therefore:

$$E_k = TS_{1,k} \sum_{m=1}^{d} \left(\frac{1}{(1+g)^{m-1}}\right)$$

$$- \left(\frac{1}{d}\right) DA^A_{0,k-1} \sum_{m=1}^{d} \left(\frac{1}{d((1+g)(1+i))^{d-1}}\right) \quad \ldots(13)$$

But:

$$\sum_{m=1}^{d} \left(\frac{1}{(1+g)^{m-1}}\right) = \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) \quad \ldots(14)$$

and:

$$\sum_{m=1}^{d} \left(\frac{1}{((1+g)(1+i))^{m-1}}\right) = \left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right) \quad \ldots(15)$$

Substituting (14) and (15) into (13):

$$E_k = TS_{1,k-1}\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)$$

$$- \left(\frac{1}{d}\right) DA^A_{0,k-1}\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right) \quad \ldots(16)$$

Substituting (4) into (16):

$$E_k = \left(\frac{(1+g).r}{g.(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) CA_{0,k-1}$$

$$+ \left(\left(\frac{(1+g)(r-i)}{g(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\right.$$

$$\left. - \left(\frac{1}{d}\right)\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right) DA^A_{0,k-1}$$

$$+ \left(\frac{(1+g)(r-i)}{g(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) NA^A_{0,k-1} \quad \ldots(17)$$

Similarly:

$$E_{k+1} = \left(\frac{(1+g).r}{g.(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right) CA_{0,k}$$

$$+ \left(\left(\frac{(1+g)(r-i)}{g(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)\right.$$

$$\left. - \left(\frac{1}{d}\right)\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right) DA^{A}_{0,k}$$

$$+ \left(\frac{(1+g)(r-i)}{g(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right) NA^{A}_{0,k} \qquad \ldots(18)$$

This gives the accounting earnings before tax. We shall also consider the accounting earnings after tax which is given by:

$$E^{T}_{k+1} = (1-t)E_{k+1}$$

where:

E^{T}_{k+1} = earnings after tax

so that, after substituting (18):

$$E^{T}_{k+1} = \left(\frac{(1+g).r}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}$$

$$+ \left(\left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)\right.$$

$$\left. + \left(\frac{t-1}{d}\right)\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right)DA^{A}_{0,k}$$

$$+ \left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)NA^{A}_{0,k} \qquad \ldots(19)$$

THE BOOK VALUE OF THE FIRM

The book value of the firm is equal to the book value of the current assets, non-depreciable assets and the depreciated value of the depreciable assets of all its current projects.

$$
\begin{aligned}
A_k = \; & CA_{0,k} + DA^A_{0,k} + NA^A_{0,k} \\
& + CA_{1,k-1} + \left(\frac{d-1}{d}\right) DA^A_{0,k-1} + NA^A_{0,k-1} \\
& + CA_{2,k-2} + \left(\frac{d-2}{d}\right) DA^A_{0,k-2} + NA^A_{0,k-2} \\
& + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
& + CA_{d-1,k-(d-1)} + \left(\frac{1}{d}\right) DA^A_{0,k-(d-1)} + NA^A_{0,k-(d-1)} \qquad \ldots(20)
\end{aligned}
$$

But, because the current assets associated with a project remains constant in real terms over the duration of the project:

$$
\begin{aligned}
CA_{1,k-1} &= (1+i)CA_{0,k-1} \\
CA_{2,k-2} &= (1+i)^2 CA_{0,k-2} \\
\ldots\ldots\ldots\ldots &= \ldots\ldots\ldots\ldots\ldots\ldots \\
CA_{d-1,k-(d-1)} &= (1+i)^{d-1} CA_{0,k-(d-1)} \qquad \ldots(21)
\end{aligned}
$$

Furthermore, each project is (1+g) times larger in real terms than the project started the year before, so that:

$$CA_{0,k-1} = \left(\frac{CA_{0,k}}{(1+g)(1+i)}\right)$$

$$CA_{0,k-2} = \left(\frac{CA_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots\ldots = \ldots\ldots\ldots\ \ldots\ldots\ldots$$

$$CA_{0,k-(d-1)} = \left(\frac{CA_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(22)$$

Substituting (22) into (21):

$$CA_{1,k-1} = \left(\frac{CA_{0,k}}{(1+g)}\right)$$

$$CA_{2,k-2} = \left(\frac{CA_{0,k}}{(1+g)^{2}}\right)$$

$$\ldots\ldots\ldots\ldots = \ldots\ldots\ldots$$

$$CA_{d-1,k-(d-1)} = \left(\frac{CA_{0,k}}{(1+g)^{d-1}}\right) \qquad \ldots(23)$$

Furthermore, because each project is (1+g) times larger in real terms than the project started a year before:

$$DA^{A}_{0,k-1} = \left(\frac{DA^{A}_{0,k}}{(1+g)(1+i)}\right)$$

$$DA^{A}_{0,k-2} = \left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$DA^{A}_{0,k-(d-1)} = \left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(24)$$

Similarly:

$$NA^{A}_{0,k-1} = \left(\frac{NA^{A}_{0,k}}{(1+g)(1+i)}\right)$$

$$NA^{A}_{0,k-2} = \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$NA^{A}_{0,k-(d-1)} = \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(25)$$

Substituting (23), (24) and (25) into (20):

$$
\begin{aligned}
A_k \; = \; & CA_{0,k} \; + \; DA^{A}_{0,k} \; + \; NA^{A}_{0,k} \\
& + \left(\frac{CA_{0,k}}{(1+g)}\right) + \left(\frac{d-1}{d}\right)\left(\frac{DA^{A}_{0,k}}{(1+g)(1+i)}\right) + \left(\frac{NA^{A}_{0,k}}{(1+g)(1+i)}\right) \\
& + \left(\frac{CA_{0,k}}{(1+g)^{2}}\right) + \left(\frac{d-2}{d}\right)\left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right) - \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right) \\
& + \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
& + \left(\frac{CA_{0,k}}{(1+g)^{d-1}}\right) + \frac{1}{d}\left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right) - \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right)
\end{aligned}
$$

And therefore:

$$
\begin{aligned}
A_k \; = \; & CA_{0,k} \sum_{m=1}^{d} \left(\frac{1}{1+g}\right)^{m-1} \\
& + DA^{A}_{0,k} \sum_{m=1}^{d} \left(\frac{d-(m-1)}{d}\right)\left(\frac{1}{((1+g)(1+i))^{m-1}}\right) \\
& + NA^{A}_{0,k} \sum_{m=1}^{d} \left(\frac{1}{((1+g)(1+i))^{m-1}}\right) \qquad \ldots(26)
\end{aligned}
$$

But:

$$
\sum^{d} \left(\frac{1}{1+g}\right)^{m-1} = \left(\frac{1-\left(\frac{1}{1+g}\right)^{d}}{1-\left(\frac{1}{1+g}\right)}\right) = \left(\frac{1+g}{g}\right)\left(1-\left(\frac{1}{1+g}\right)^{d}\right) \qquad \ldots(27)
$$

And:

$$\sum_{m=1}^{d} \left(\frac{1}{((1+g)(1+i))^{m-1}}\right) = \left(\frac{1-\left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1-\left(\frac{1}{(1+g)(1+i)}\right)}\right) \qquad \ldots(28)$$

Furthermore:

$$\sum_{m=1}^{d} \left(\frac{d-(m-1)}{d}\right)\left(\frac{1}{((1+g)(1+i))^{m-1}}\right)$$

$$= \sum_{k=0}^{d-1} \left(\frac{d-k}{d}\right)\left(\frac{1}{((1+g)(1+i))^{k}}\right)$$

$$= \sum_{k=0}^{d-1} \left(\frac{1}{((1+g)(1+i))^{k}}\right) - \left(\frac{1}{d}\right)\sum_{k=0}^{d-1} \left(\frac{k}{((1+g)(1+i))^{k}}\right) \qquad \ldots(29)$$

But:

$$\sum_{k=0}^{d-1} \left(\frac{1}{((1+g)(1+i))^{k}}\right) = \left(\frac{1-\left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1-\left(\frac{1}{(1+g)(1+i)}\right)}\right) \qquad \ldots(30)$$

And:

$$\sum_{k=0}^{d-1} \left(\frac{k}{((1+g)(1+i))^k}\right)$$

$$= \quad 0$$

$$+ \frac{1}{(1+g)(1+i)}$$

$$+ \frac{1}{((1+g)(1+i))^2} + \frac{1}{((1+g)(1+i))^2}$$

$$+ \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$

$$+ \frac{1}{((1+g)(1+i))^{d-2}} + \frac{1}{((1+g)(1+i))^{d-2}} + \cdots\cdots$$

$$\cdots\cdots + \frac{1}{((1+g)(1+i))^{d-1}}$$

$$+ \frac{1}{((1+g)(1+i))^{d-1}} + \frac{1}{((1+g)(1+i))^{d-1}} + \cdots\cdots$$

$$\cdots\cdots + \frac{1}{((1+g)(1+i))^{d-1}} + \frac{1}{((1+g)(1+i))^{d-1}}$$

$$= \sum_{j=1}^{d-1} \left(\frac{1}{((1+g)(1+i))^j}\right) + \sum_{j=2}^{d-1} \left(\frac{1}{((1+g)(1+i))^j}\right) + \cdots\cdots$$

$$\cdots\cdots + \sum_{j=d-1}^{d-1} \left(\frac{1}{((1+g)(1+i))^j}\right)$$

$$= \sum_{m=1}^{d-1} \sum_{j=m}^{d-1} \left(\frac{1}{((1+g)(1+i))^j}\right)$$

$$= \sum_{m=1}^{d-1} \left(\frac{\left(\frac{1}{((1+g)(1+i))^{m}}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)} \right)$$

$$= \left(\frac{1}{1 - \left(\frac{1}{(1+g)(1+i)}\right)} \right) \sum_{m=1}^{d-1} \left(\left(\frac{1}{((1+g)(1+i))^{m}}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right) \right)$$

$$= \left(\frac{1}{1 - \left(\frac{1}{(1+g)(1+i)}\right)} \right) \left(\left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)} \right) \quad \ldots$$

$$\ldots\ldots - (d-1)\left(\frac{1}{((1+g)(1+i))^{d}}\right)\right) \quad \ldots(31)$$

So that, substituting (30) and (31) into (29):

$$\sum_{m=1}^{d} \left(\frac{d-(m-1)}{d}\right)\left(\frac{1}{((1+g)(1+i))^{m-1}}\right)$$

$$= \left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$- \left(\frac{1}{d}\right)\left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{\left(1 - \left(\frac{1}{(1+g)(1+i)}\right)\right)^{2}}\right)$$

$$+ \left(\frac{d}{d}\right)\left(\frac{\left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$- \left(\frac{1}{d}\right)\left(\frac{\left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$= \left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^{d}}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$- \left(\frac{1}{d}\right)\left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d}}\right) \cdots + \left(\frac{1}{((1+g)(1+i))^{d}}\right) - \left(\frac{1}{((1+g)(1+i))^{d+1}}\right)}{\left(1 - \left(\frac{1}{(1+g)(1+i)}\right)\right)^{2}}\right)$$

$$= \left(\frac{1}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$- \left(\frac{1}{d}\right) \cdot \left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d+1}}\right)}{\left(1 - \left(\frac{1}{(1+g)(1+i)}\right)\right)^2}\right) \qquad \ldots(32)$$

So that, substituting (27), (28) and (32) into (26):

$$A_k = CA_{0,k}\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)$$

$$+ DA^A_{0,k}\left(\left(\frac{1}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right.$$

$$\left. - \left(\frac{1}{d}\right) \cdot \left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d+1}}\right)}{\left(1 - \left(\frac{1}{(1+g)(1+i)}\right)\right)^2}\right)\right)$$

$$+ NA^A_{0,k}\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right) \qquad \ldots(33)$$

TRUE VALUE OF THE FIRM

The true value of the firm is the present value of the remaining cash flow streams of its current projects.

The value of the remaining cash flow streams of a project at the end of year j of the project is:

$$V_{j,k} = \sum_{m=j+1}^{d} \frac{F_{m,k}}{(1+r)}$$

In appendix 4 of the thesis (the firm in stationary state) the project value was expressed in terms of the initial project investments in the three types of assets. This derivation also aplies to the growing firm and will not be repeated here. From appendix 4:

$$\begin{aligned} V_{j,k} = {} & CA_{0,k}(1+i)^{j} \\ & + DA^{A}_{0,k}\Bigg(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d-j}\right) \\ & + \frac{(1+i)^{j}\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d-j}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\Bigg) \\ & + NA^{A}_{0,k}(1+i)^{j} \qquad \ldots(34) \end{aligned}$$

The value of the firm is the sum of the value of its current projects, or:

$$V_k = V_{0,k} + V_{1,k-1} + V_{2,k-2} + \ldots\ldots\ldots\ldots + V_{d-1,k-(d-1)}$$

$$= CA_{0,k}(1+i)^{0}$$

$$+ DA^{A}_{0,k}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d})$$

$$+ \frac{(1+i)^{0}(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d}))(1 - (\frac{1+i}{1+r})^{d})}{1 - (\frac{1+i}{1+r})^{d}})$$

$$+ NA^{A}_{0,k}(1+i)^{0}$$

$$+ CA_{0,k-1}(1+i)^{1}$$

$$+ DA^{A}_{0,k-1}((\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d-1})$$

$$+ \frac{(1+i)^{1}(1 - (\frac{t}{d.r})(1 - (\frac{1}{1+r})^{d}))(1 - (\frac{1+i}{1+r})^{d-1})}{1 - (\frac{1+i}{1+r})^{d}})$$

$$+ NA^{A}_{0,k-1}(1+i)^{1}$$

+ ....

+ ....

+...

$$+ CA_{0,k-(d-1)}(1+i)^{d-1}$$

$$+ DA^{A}_{0,k-(d-1)}\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{1}\right)\right.$$

$$+ \left.\frac{(1+i)^{d-1}\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{1}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ NA^{A}_{0,k-(d-1)}(1+i)^{d-1} \qquad \ldots(35)$$

But, because each project is (1+g) times larger in real terms than the project started a year before:

$$CA_{0,k-1} = \left(\frac{CA_{0,k}}{(1+g)(1+i)}\right)$$

$$CA_{0,k-2} = \left(\frac{CA_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$CA_{0,k-(d-1)} = \left(\frac{CA_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(36)$$

Similarly:

$$DA^{A}_{0,k-1} = \left(\frac{DA^{A}_{0,k}}{(1+g)(1+i)}\right)$$

$$DA^{A}_{0,k-2} = \left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$DA^{A}_{0,k-(d-1)} = \left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(37)$$

And:

$$NA^{A}_{0,k-1} = \left(\frac{NA^{A}_{0,k}}{(1+g)(1+i)}\right)$$

$$NA^{A}_{0,k-2} = \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{2}}\right)$$

$$\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots$$

$$NA^{A}_{0,k-(d-1)} = \left(\frac{NA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right) \qquad \ldots(38)$$

Substituting (36), (37) and (38) into (35):

$$V_k = CA_{0,k}$$

$$+ DA^A_{0,k}\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right.$$

$$\left. + \frac{(1+i)^0\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)$$

$$+ NA^A_{0,k}$$

$$+ \left(\frac{CA_{0,k}}{(1+g)}\right)$$

$$+ \left(\frac{DA^A_{0,k}}{((1+g)(1+i))^1}\right)\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d-1}\right)\right.$$

$$\left. + \frac{(1+i)^1\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{d-1}\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)$$

$$+ \left(\frac{NA^A_{0,k}}{(1+g)}\right)$$

+ ....

+ ....

+...

$$+ \left(\frac{CA_{0,k}}{(1+g)^{d-1}}\right)$$

$$+ \left(\frac{DA^{A}_{0,k}}{((1+g)(1+i))^{d-1}}\right)\left(\left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{1}\right)\right.$$

$$\left. + \frac{(1+i)^{d-1}\left(1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)\right)\left(1 - \left(\frac{1+i}{1+r}\right)^{1}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right)$$

$$+ \left(\frac{NA^{A}_{0,k}}{(1+g)^{d-1}}\right)$$

And therefore:

$$V_k = CA_{0,k} \sum_{m=0}^{d-1} \left(\frac{1}{1+g}\right)^{m}$$

$$+ DA^{A}_{0,k} \left(\left(\frac{t}{d.r}\right) \sum_{m=0}^{d-1} \left(\frac{1 - \left(\frac{1}{1+r}\right)^{d-m}}{((1+g)(1+i))^{m}}\right)\right.$$

$$\left. + \left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^{d}\right)}{1 - \left(\frac{1+i}{1+r}\right)^{d}}\right) \sum_{m=0}^{d-1} \left(\frac{1 - \left(\frac{1+i}{1+r}\right)^{d-m}}{(1+g)^{m}}\right)\right)$$

$$+ NA^{A}_{0,k} \sum_{m=0}^{d-1} \left(\frac{1}{1+g}\right)^{m} \qquad \ldots(40)$$

But:

$$\sum_{m=0}^{d-1} \left(\frac{1}{1+g}\right)^m = \left(\frac{1 - \left(\frac{1}{1+g}\right)^d}{1 - \left(\frac{1}{1+g}\right)}\right)$$

$$= \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) \qquad \ldots(41$$

And:

$$\sum_{m=0}^{d-1} \left(\frac{1 - \left(\frac{1}{1+r}\right)^{d-m}}{((1+g)(1+i))^m}\right)$$

$$= \sum_{m=0}^{d-1} \left(\frac{1}{((1+g)(1+i))^m}\right) - \left(\frac{1}{1+r}\right)^d \sum_{m=0}^{d-1} \left(\frac{(1+r)}{(1+g)(1+i)}\right)^m$$

$$= \left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)$$

$$- \left(\frac{1}{1+r}\right)^d \left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right) \qquad \ldots(42)$$

And:

$$\sum_{m=0}^{d-1}\left(\frac{1-\left(\frac{1+i}{1+r}\right)^{d-m}}{(1+g)^{m}}\right)$$

$$=\sum_{m=0}^{d-1}\left(\frac{1}{1+g}\right)^{m}-\left(\frac{1+i}{1+r}\right)^{d}\sum_{m=0}^{d-1}\left(\frac{(1+r)}{(1+g)(1+i)}\right)$$

$$=\left(\frac{1+g}{g}\right)\left(1-\left(\frac{1}{1+g}\right)^{d}\right)$$

$$-\left(\frac{1+i}{1+r}\right)^{d}\left(\frac{1-\left(\frac{(1+r)}{(1+g)(1+i)}\right)^{d}}{1-\left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right) \qquad \ldots(43)$$

Substituting (41), (42) and (43) into (40):

$$V_k = \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)CA_{0,k}$$

$$+ \left(\left(\left(\frac{t}{d.r}\right)\left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right.\right.\right.$$

$$\left.\left. - \left(\frac{1}{1+r}\right)^d\left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)$$

$$+ \left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\left(\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\right.$$

$$\left.\left. - \left(\frac{1+i}{1+r}\right)^d\left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)\right)DA^A_{0,k}$$

$$+ \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)NA^A_{0,k} \qquad \ldots(44)$$

ACCOUNTING RATE OF RETURN

The accounting rate of return is calculated on an after tax basis so that it can be compared to the internal rate of return which have also been defined on an after tax basis. To calculate the conventional accounting rate of return, the accounting profit after tax (19) is divided by the book value of assets (33), or:

$$ROI = \frac{E^T_{k+1}}{A_k} \qquad \ldots(45)$$

PROFIT ON VALUE

This alternative measure of accounting rate of return is also calculated on an after tax basis and is the accounting profit after tax (19) divided by the true value of the firm (44), or:

$$POV = \frac{E^T_{k+1}}{V_k} \qquad \ldots(46)$$

SUMMARY

The conventional accounting rate of return of the theoretical firm paying company income tax is given by:

$$ROI = \frac{E^T_{k+1}}{A_k} \qquad \ldots(45)$$

An alternative measure of accounting rate of return for the theoretical marginal firm paying company income tax is given by:

$$POV = \frac{E^T_{k+1}}{V_k} \qquad \ldots(46)$$

where:

$$E^T_{k+1} = \left(\frac{(1+g).r}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) CA_{0,k}$$

$$+ \left(\left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\right.$$

$$\left. - \left(\frac{1-t}{d}\right)\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right) DA^A_{0,k}$$

$$+ \left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) NA^A_{0,k} \qquad \ldots(19)$$

And:

$$
\begin{aligned}
A_k = {} & CA_{0,k}\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) \\
& + DA^A_{0,k}\left(\left(\frac{1}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right. \\
& \qquad \left. - \left(\frac{1}{d}\right).\left(\frac{\left(\frac{1}{(1+g)(1+i)}\right) - \left(\frac{1}{((1+g)(1+i))^{d+1}}\right)}{\left(1 - \left(\frac{1}{(1+g)(1+i)}\right)\right)^2}\right)\right) \\
& + NA^A_{0,k}\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right) \qquad \ldots(37)
\end{aligned}
$$

And:

$$V_k = \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) CA_{0,k}$$

$$+ \left(\left(\frac{t}{d.r}\right)\left(\left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right.\right.\right.$$

$$\left. - \left(\frac{1}{1+r}\right)^d \left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)$$

$$+ \left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\left(\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\right.$$

$$\left.\left.\left. - \left(\frac{1+i}{1+r}\right)^d \left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)\right) DA^A_{0,k}$$

$$+ \left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right) NA^A_{0,k} \qquad \ldots(44)$$

THE CHARACTERISTICS OF SINGLE ASSET FIRMS

The characteristics of the theoretical firm is the weighted average of the effects of the different types of assets the firm employ. As an aid to the understanding of the characteristics of the multi-asset theoretical firm the characteristics of single asset firms consisting of either current, depreciable or non-depreciable assets will be studied.

For the 100 percent current asset firm:

$$DA^{A}_{0,k} = NA^{A}_{0,k} = 0$$

Substituting into (19), (33) and substituting this in turn into (45):

$$ROI = \left(\frac{\left(\frac{(1+g).r}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}{\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}\right)$$

$$= r \qquad \ldots(47)$$

Similarly, from (19), (44) and (46):

$$POV = \left(\frac{\left(\frac{(1+g).r}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}{\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}\right)$$

$$= r \qquad \ldots(48)$$

From (47) and (48) it is clear that both the variants of ARR equal IRR for the tax 100 percent current asset firm, as was also the case for the firm not paying tax (see figures 3.1 to 3.14 in chapter 3 of the thesis) and for the stationary firm (see appendix 4).

For the 100 percent non-depreciable asset firm:

THE CHARACTERISTICS OF SINGLE ASSET FIRMS

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$$= r \qquad \ldots(47)$$

Similarly, from (19), (44) and (46):

$$POV = \left(\frac{\left(\frac{(1+g).r}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}{\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^{d}\right)CA_{0,k}}\right)$$

$$= r \qquad \ldots(48)$$

From (47) and (48) it is clear that both the variants of ARR equal IRR for the tax 100 percent current asset firm, as was also the case for the firm not paying tax (see figures 3.. to 3.14 in chapter 3 of the thesis) and for the stationary firm (see appendix 4).

For the 100 percent non-depreciable asset firm:

$$CA_{0,k} = DA^A_{0,k} = 0$$

From (19), (44) and (46):

$$POV = \left(\frac{\left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)NA^A_{0,k}}{\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)NA^A_{0,k}}\right)$$

$$= (r-i) \qquad \ldots(49)$$

From (49) the firm consisting of only non-depreciable assets has an ARR (expressed as a percentage of the true value of the firm) equal to the difference between the IRR and the inflation rate. This is the same as the results obtained for the firm not paying tax (see figures 3.8 to 3.14 in chapter 3 of the thesis) or the firm in stationary state (see appendix 4).

For the firm consisting of only depreciable assets:

$$CA_{0,k} = DA^A_{0.k} = 0$$

Substituting into (19):

$$E^T_{k+1} = \left(\left(\frac{(1+g)(r-i)}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\right.$$

$$\left. - \left(\frac{1-t}{d}\right)\left(\frac{1 - \left(\frac{1}{((1+g)(1+i))^d}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right)DA^A_{0,k} \qquad \ldots(50)$$

And, substituting into (44):

$$V_k = \left(\left(\frac{t}{d.r}\right)\left(\left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right.\right.$$

$$\left. - \left(\frac{1}{1+r}\right)^d \left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)$$

$$+ \left(\frac{1 - \left(\frac{t}{d.r}\right)\left(1 - \left(\frac{1}{1+r}\right)^d\right)}{1 - \left(\frac{1+i}{1+r}\right)^d}\right)\left(\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)^d\right)\right.$$

$$\left.\left. - \left(\frac{1+i}{1+r}\right)^d \left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)^d}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)\right) DA^A_{0,k} \qquad \ldots(51)$$

In the case of depreciable assets with a very short life d=1 (the shortest life allowed for under the assumptions of the model). Substituting into (50):

$$E_{k+1} = \left(\left(\frac{(1+g)(r-i)}{g(1-t)}\right)\left(1 - \left(\frac{1}{1+g}\right)\right)\left(\frac{1 - \left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right)}{1 - \left(\frac{1+i}{1+r}\right)}\right)\right.$$

$$\left. - \left(\frac{1-t}{d}\right)\left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right) DA^A_{0,k}$$

$$= \left((r-i)\left(1 - \left(\frac{t}{r}\right)\left(\frac{r}{1+r}\right)\right)\left(\frac{1+r}{r-i}\right) \quad - \quad (1-t)\right)DA^{A}_{0,k}$$

$$= (1 + r - t - 1 + t)DA^{A}_{0,k}$$

$$= r.DA^{A}_{0,k} \qquad \ldots(52)$$

And, substituting into (51):

$$V_k = \left(\left(\frac{t}{r}\right)\left(\left(\frac{1 - \left(\frac{1}{(1+g)(1+i)}\right)}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right.\right.$$

$$\left.\left. - \left(\frac{1}{1+r}\right)\left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)$$

$$+ \left(\frac{1 - \left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right)}{1 - \left(\frac{1+i}{1+r}\right)}\right)\left(\left(\frac{1+g}{g}\right)\left(1 - \left(\frac{1}{1+g}\right)\right)\right.$$

$$\left.\left. - \left(\frac{1+i}{1+r}\right)\left(\frac{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}{1 - \left(\frac{(1+r)}{(1+g)(1+i)}\right)}\right)\right)\right)DA^{A}_{0,k}$$

$$= \left(\left(\frac{t}{r}\right)\left(1 - \left(\frac{1}{1+r}\right)\right) \quad + \quad \left(1 - \left(\frac{t}{1+r}\right)\right)\left(\frac{1+r}{r-i}\right)\left(1 - \left(\frac{1+i}{1+r}\right)\right)\right)DA^{A}_{0,k}$$

$$= \left(\left(\frac{t}{1+r}\right) + 1 - \left(\frac{t}{1+r}\right)\right) DA^{A}_{0,k}$$

$$= DA^{A}_{0,k} \qquad \ldots(53)$$

And therefore, substituting (52) and (53) into (46):

$$POV = \left(\frac{r.DA^{A}_{0,k}}{DA^{A}_{0,k}}\right)$$

$$= r \qquad \ldots(54)$$

This is the same as for the 100 percent current asset firm (48). Depreciable assets with a short life therefore approaches the nature of current assets (in their influence on POV).

In the absence of growth the depreciable asset firm has been found to approach the nature of non-depreciable assets as the life of the depreciable assets increases (see appendix 4). This does not hold for the growing firm as will be shown below.

As the life of the depreciable assets increases d approaches infinity. From (51):

$$E^{T}_{k+1} = \left(\left(\frac{(1+g)(r-i)}{g}\right)(1-0)\left(\frac{1 - 0(1-0)}{1 - 0}\right) - (0)\left(\frac{1 - 0}{1 - \left(\frac{1}{(1+g)(1+i)}\right)}\right)\right) DA^{A}_{0,k}$$

$$= \left(\frac{1+g}{g}\right)(r-i) DA^{A}_{0,k} \qquad \ldots(55)$$

(For g, r and i positive and r greater than i.)

Similarly, from (52):

$$V_k = ((0)((\frac{1 - 0}{1 - (\frac{1}{(1+g)(1+i)})}) - (\frac{(\frac{1}{1+r})^d - (\frac{1}{(1+g)(1+i)})^d}{1 - (\frac{(1+r)}{(1+g)(1+i)})}))$$

$$+ (\frac{1 - 0(1-0)}{1 - 0})((\frac{1+g}{g})(1 - (\frac{1}{1+g})^d) - (\frac{(\frac{1+i}{1+r})^d - (\frac{1}{(1+g)})^d}{1 - (\frac{(1+r)}{(1+g)(1+i)})}))DA^A_{0,k}$$

$$= ((0)((\frac{1 - 0}{1 - (\frac{1}{(1+g)(1+i)})}) - (\frac{0 - 0}{1 - (\frac{(1+r)}{(1+g)(1+i)})}))$$

$$+ (\frac{1 - 0(1-0)}{1 - 0})((\frac{1+g}{g})(1-0) - (\frac{0 - 0}{1 - (\frac{(1+r)}{(1+g)(1+i)})})))DA^A_{0,k}$$

$$= (\frac{1+g}{g})DA^A_{0,k} \qquad \ldots(56)$$

(For g, r and i positive and r greater than i.)

So that, substituting (55) and (56) into (46):

$$POV = \left(\frac{\left(\frac{1+g}{g}\right)(r-i)DA^{A}_{0,k}}{\left(\frac{1+g}{g}\right)DA^{A}_{0,k}}\right)$$

$$= (r-i) \qquad \ldots(57)$$

This is the same as for the 100 percent non-depreciable asset firm (49). Depreciable assets with an extremely long life therefore approaches the nature of non-depreciable assets (in their influence on POV).

APPENDIX 6

NUMERICAL E.AMPLE SHOW. [illegible] LATION OF ROI, A/V AND POV FOR A GROWING FIRM [illegible] TAX

This appendix presents a numerica. [illegible] le showing the calculation of ROI, A/V, and POV for a [illegible]rm with a specific asset structure, project duration, IRR, tax rate and growth rate, operating under a specific inflation rate.

The calculation follows the same lines as the mathematical derivations presented in appendices 4 and 5 and can therefore serve as both an aid to the understanding of the mathematical derivations and as a procedure to validate the results.

Because this example was produced on a computer "spreadsheet" it is possible to repeat the calculations for different asset structures, IRR's, inflation rates, tax rates and growth rates. The procedure has been set up specifically for firms with four-year projects and the complete spread-sheet has to be redefined if the project length is changed.to evaluate the effect of different project durations. It is therefore not a convenient method for evaluating the effect of different project durations and it would for instance be very cumbersome to use this method to generate the data for figures 4.1 to 4.4 of the thesis.

The numerical example presented below applies to a firm with a project asset structure of 50 percent current assets, 30 percent depreciable assets and 20 percent non-depreciable assets. The firm has a project life of four years, has an IRR of 20 percent per year and a growth rate of 5 percent per year. It pays 40 percent income tax and is operating under 10 percent per year inflation.

INFLATION, DISCOUNT, GROWTH AND TAXATION RATES

Inflation rate:	10 percent
Discount rate:	20 percent
Growth rate:	5 percent
Rate of taxation:	40 percent

PROJECT ANALYSIS

The project has a duration of four years and consists of:

- a 50 percent investment in current assets
- a 30 percent investment in depreciable assets
- a 20 percent investment in non-depreciable assets

Project cash flows:

	year 0	year 1	year 2	year 3	year 4
Investment:					
current	-500				
depreciable	-300				
non-depreciable	-200				
Additional investment in current assets		-50	-55	-60.5	-66.55
Wound-up value:					
current					732.05
non-depreciable					292.82
Depreciation tax shield:		30	30	30	30
Sub-total	-1000	-20	-25	-30.5	988.32

Present value:
year(-1):-479.214
year 0: -575.057

	year 0	year 1	year 2	year 3	year 4
Trading surplus (after tax):		195.6423	215.2065	236.7272	260.3999
TOTAL CASH FLOW:	-1000	175.6423	190.2065	206.2272	1248.719

Present value,
total: 5.4E-14 (This figure should be equal to 0)

CALCULATING ACCOUNTING PROFIT

The accounting profit of year 1 is calculated. The firm then has four current projects. These are the projects initiated in years (-3), (-2), (-1), and (0) respectively.

The trading surplus associated with the project initiated in year 0 is:

	year 0	year 1	year 2	year 3	year 4
after tax:	0	195.6423	215.2065	236.7272	260.3999
before tax:	0	326.0705	358.6776	394.5453	433.9999

The project initiated in year (-1) is smaller than the project initiated in year 0 by a factor of :0.865800

Year 1 represents the second year of this project, and the trading surplus is therefore 0.865800 times 358.6776 or 310.5433

Similarly for the other two projects, so that:

Trading surplus (before tax):

Project initiated in year (0):	326.0705
Project initiated in year (-1):	310.5433
Project initiated in year (-2):	295.7556
Project initiated in year (-3):	281.6720
Total trading surplus:	1214.041

Depreciation from project initiated in:

year (0): 0.25 of	300	is	75
year (-1): 0.25 of	259.7402	is	64.93506
year (-2): 0.25 of	224.8833	is	56.22083
year (-3): 0.25 of	194.7041	is	48.67604
Total depreciation:			244.8319

Accounting profit:

Total trading surplus:	1214.041
Minus total depreciation:	-244.831
PROFIT (before tax):	969.2095
TAX (@ 40 percent)	387.6838
PROFIT (after tax):	581.5257

CALCULATING BOOK VALUE

The book value of the firm is calculated at the end of year 0, when there are four projects contributing to the book assets. These are the projects initiated in years (-3), (-2), (-1) and (0) respectively.
The project initiated in year (-1) is smaller than the project initiated in year 0 by a factor of: 0.865800 The init [illegible]l investment associated with the project initiated in year [illegible]1) can therefore be determined by multiplying the amounts inv[illegible]ted in year 0 by: 0.865800

Similarly for the other projects, so that:

Project initiated		Initial investment	
	current	depreciable	non-depreciable
year (0)	500	300	200
year (-1)	432.9004	259.7402	173.1601
year (-2)	374.8055	224.8833	149.9222
year (-3)	324.5069	194.7041	129.8027

Project initiated		Book value	
	current	depreciable	non-depreciable
year (0)	500	300	200
year (-1)	476.1904	194.8051	173.1601
year (-2)	453.5147	112.4416	149.9222
year (-3)	431.9187	48.67604	129.8027
Sub totals	1861.624	655.9229	652.8851

TOTAL BOOK VALUE: 3170.432

CALCULATING TRUE VALUE

The true value of the firm is calculated in year 0. The true value is the present value of the remaining cash flows of the firm's current projects. The relevant projects are those initiated in year (-3), year (-2), year (-1) and year (0) respectively. The project initiated in year (-1) is smaller than the project initiated in year 0 by a factor of 0.865800 The cash flows can therefore be determined by multiplying those initiated in year 0 by this factor. Similarly for other projects, so that:

Project initiated in:	Remaining cash flows			
	year 1	year 2	year 3	year 4
year (0)	175.6423	190.2065	206.2272	1248.719
year (-1)	164.6810	178.5517	1081.142	
year (-2)	154.5902	936.0543		
year (-3)	810.4366			
TOTAL CASH FLOW	1305.350	1304.812	1287.370	1248.719

The value of the firm is the present value of these cash flows,

TRUE VALUE OF FIRM 3341.116

CALCULATING RATIOS

ROI(%) = 18.34216

A/V(%) = 94.89139

POV(%) = 17.40513

APPENDIX 7

DERIVATION OF THE RELATIONSHIP BETWEEN THE INFLATION RATE AND THE PRICE-EARNINGS RATIO

This appendix uses the theoretical relationships developed in chapter 3 of the thesis to determine the relationship between the inflation rate and the price-earnings ratio of the theoretical firm. The appendix is referenced in section 5.3.3 of the thesis.

The accounting earnings of a firm is given by (see chapter 3 and the derivation presented in appendix 1):

$$
\begin{aligned}
E_{k+1} &= d.r.CA_{0,k} \\
&+ d.DA^{A}_{0,k}\left(\frac{r-i}{1-\left(\frac{1+i}{1+r}\right)^{d}} + \left(\frac{1+i}{d.i}\right)\left(1-\left(\frac{1}{1+i}\right)^{d}\right)\right) \\
&+ d.(r-i).NA^{A}_{0,k} \qquad \ldots(1)
\end{aligned}
$$

where:

$CA_{0,k}$	=	initial investment in current assets for the project initiated in year k
d	=	duration (in years) of the projects making up the firm
$DA^{A}_{0,k}$	=	initial investment in depreciable assets for the project initiated in year k
E_{k+1}	=	accounting profit in year (k+1)
i	=	inflation rate
$NA^{A}_{0,k}$	=	initial investment in non-depreciable assets for the project initiated in year k
r	=	IRR of projects (and firm)

The price of the total firm will in an efficient market equal the value of the firm. This is given by:

$$V_k = dCA_{0,k} + DA^A_{0,k}\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^d} - \frac{1+i}{r-i} \right) + dNA^A_{0,k} \qquad \ldots(2)$$

where:

V_k = true value of the firm

The earnings yield of this theoretical firm is then given by:

$$EY = (E_{k+1})/(V_k) \qquad \ldots(3)$$

The price-earnings ratio is the reciprocal of the earnings yield, or:

$$P/E = 1/(EY) = (V_k)/(E_{k+1}) \qquad \ldots(4)$$

Substituting equation (1) into (3) and rearranging:

$$EY = d.r.CA_{0,k}/(V_k) + \left(\frac{d.(r-i)}{1 - \left(\frac{1+i}{1+r}\right)^d} + \left(\frac{1}{d.i} \cdot 1 - \left(\frac{1}{1+i}\right)^d\right) \right).DA^A_{0,k}/(V_k) + d.(r-i).NA^A_{0,k}/(V_k) \qquad \ldots($$

In order to simplify the expression the following variables are defined:

$$s_{CA} = \frac{d.CA_{0,k}}{V_k}$$

$$s_{DA} = \frac{DA^{A}_{0,k}}{}.\left(\frac{d}{1 - \left(\frac{1+i}{1+r}\right)^{d}} - \frac{1+i}{r-i}\right)$$

$$s^{NA} = \frac{d.(r-i).NA^{A}_{0,k}}{V_k}$$

where:

s_{CA}, s_{DA} and s_{NA}

represent the proportion- that current assets, depreciable assets and non-depreciable assets make up respectively of the total value of the firm, and therefore:

$$s_{CA} + s_{DA} + s_{NA} = 0$$

Substituting into (5), rearranging and simplifying:

$$EY = r.s_{CA} + f_{DA}.s_{DA} + (r-i).s_{NA}$$

where:

$$f_{DA} = \left(\frac{\dfrac{d.(r-i)}{1 - \left(\frac{1+i}{1+r}\right)^{d}} - \left(\dfrac{1+i}{d.i}\right).\left(1 - \left(\dfrac{1}{1+i}\right)^{d}\right)}{\dfrac{d}{1 - \left(\frac{1+i}{1+r}\right)^{d}} - \dfrac{1+i}{r-i}}\right)$$

So that the price-earnings ratio is given by:

$$P/E = \frac{1}{r.s_{CA} + f_{DA}.s_{DA} + (r-i).s_{NA}}$$

As an aid to the understanding of the price-earnings function the characteristics of the depreciable asset earnings yield factor will now be investigated.

In the case of depreciable assets with a very long life, d approaches infinity and:

$$\lim_{d \to \infty} (f_{DA}) = \frac{\dfrac{d.(r-1)}{1-0} - \dfrac{1+i}{d.i}(1-0)}{\dfrac{d}{1-0} - \dfrac{1+i}{r-i}}$$

$$= \frac{d.(r-i)}{1} \cdot \frac{(r-i)}{d.(r-i) - 1 + i}$$

$$= \frac{d.(r-i)^2}{d.(r-i) - 1 + i}$$

which is of the form infinity/infinity and therefore (L'Hopital):

$$\lim_{d \to \infty} (f_{DA}) = \frac{(r-i)^2}{r-i} = r-i$$

In the case of depreciable assets with a very short life, d=1 and then:

$$f_{DA} = \frac{\dfrac{r-i}{1-\dfrac{1+i}{1+r}} - \dfrac{1+i}{i}\left(1 - \dfrac{1}{1+i}\right)}{\dfrac{1}{1-\dfrac{1+i}{1+r}} - \dfrac{1+i}{r-i}}$$

$$= \frac{\dfrac{r-1}{(r-1)/(1+r)} - \dfrac{1+i}{i}\cdot\dfrac{i}{1+i}}{\dfrac{1+r}{r-i} - \dfrac{1+i}{r-i}}$$

$$= 1 + r - 1$$

$$= r$$

In the absence of inflation:

$$\lim_{i \to o} (f_{DA}) = \frac{\dfrac{d.r}{1 - (1+r)^{-d}} - \dfrac{1 + i - (1+i)^{1-d}}{d.i}}{\dfrac{d}{1 - (1+r)^{-d}} - \dfrac{1}{r}}$$

where $\lim_{i \to o} \dfrac{1 + i - (1+i)^{1-d}}{d.i}$

is of the form 0/0 and therefore (L'Hopital) is equal to:

$$\frac{1 - (1-d).(1+i)^{-d}}{d} = 1$$

and therefore:

$$\lim_{i \to o} f_{DA} = r$$

APPENDIX 8

RESULTS OF THE LINEAR REGRESSIONS OF INFLATION RATES AGAINST EARNINGS YIELDS

This appendix presents the full results of the linear regressions referred to in section 5.4 of the thesis.

The variables reported in the appendix refer to the following:

RSACOM: South African earnings yield (commercial shares)

RSAFIN South African earnings yield (financial shares)

RSAIND South African earnings yield (industrial shares)

RSAINF South African inflation rate

SECC Transformed variable, South African earnings yield (commercial shares)

SEFC Transformed variable, South African earnings yield (financial shares)

SEIC Transformed variable, South African earnings yield (industrial shares)

SICC Transformed variable, South African inflation rate, to be regressed against the transformed earnings yield (commercial shares)

SIFC Transformed variable, South African inflation rate, to be regressed against the transformed earnings yield (financial shares)

SIIC Transformed variable, South African inflation rate, to be regressed against the transformed earnings yield (industrial shares)

UKE/Y UK earnings yield

UKEC Transformed variable, UK earnings yield

UKIC UK inflation rate

UKINF Transformed variable, UK inflation rate

UK (FT-500) EARNINGS YIELD

SMPL 1 - 252
252 Observations
LS // Dependent Variable is UKE/Y

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	4.9336711	0.4277562	11.533839	0.000
UKINF	0.6919169	0.0380870	18.166770	0.000

R-squared	0.568989	Mean of dependent var	11.54230
Adjusted R-squared	0.567265	S.D. of dependent var	5.430590
S.E. of regression	3.572384	Sum of squared resid	3190.481
Durbin-Watson stat	0.126925	F-statistic	330.0315
Log likelihood	-677.4238		

GENERALISED DIFFERENCES

TRANSFORMED VARIABLES

SMPL 1 - 251
251 Observations
LS // Dependent Variable is UKEC

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.5187163	0.0937146	5.5350637	0.000
UKIC	0.3592153	0.0878905	4.0870782	0.000

R-squared	0.062868	Mean of dependent var	0.736822
Adjusted R-squared	0.059104	S.D. of dependent var	1.258238
S.E. of regression	1.220489	Sum of squared resid	370.9085
Durbin-Watson stat	1.846732	F-statistic	16.70421
Log likelihood	-405.1616		

RSA (FINANCIAL SHARES) EARNINGS YIELD

SMPL 1 - 213
213 Observations
LS // Dependent Variable is RSAFIN

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	5.8629340	0.8223168	7.1297753	0.000
RSAINF	0.4932430	0.0671899	7.3410339	0.000

R-squared	0.203[illegible]5	Mean of dependent var	11.57182
Adjusted R-squared	0.199670	S.D. of dependent var	4.360344
S.E. of regression	3.900814	Sum of squared resid	3210.650
Durbin-Watson stat	0.051536	F-statistic	53.89078
Log likelihood	-591.1617		

GENERALISED DIFFERENCES

TRANSFORMED VARIABLES

SMPL 1 - 212
212 Observations
LS // Dependent Variable is SEFC

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.3364024	0.0606531	5.5463308	0.000
SIFC	-0.0419175	0.0743958	-0.5634407	0.573

R-squared	0.001509	Mean of dependent var	0.321199
Adjusted R-squared	-0.003245	S.D. of dependent var	0.789635
S.E. of regression	0.790915	Sum of squared resid	131.3648
Durbin-Watson stat	1.485703	F-statistic	0.317465
Log likelihood	-250.0825		

RSA (INUSTRIAL SHARES) EARNINGS YIELD

SMPL 1 - 213
213 Observations
LS // Dependent Variable is RSAIND

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	10.659546	1.1739043	9.0804211	0.000
RSAINF	0.3016537	0.0959174	3.1449325	0.002

R-squared	0.044776	Mean of dependent var	14.150[illegible]4
Adjusted R-squared	0.040249	S.D. of dependent var	5.68420[illegible]
S.E. of regression	5.568636	Sum of squared resid	6543.048
Durbin-Watson stat	0.033746	F-statistic	9.890601
Log likelihood	-666.9822		

GENERALISED DIFFERENCES

TRANSFORMED VARIABLES

SMPL 1 - 212
212 Observations
LS // Dependent Variable is SEIC

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.2421353	0.0730047	3.3167104	0.001
SIIC	0.0233406	0.0941311	0.2479585	0.804

R-squared	0.000293	Mean of dependent var	0.248203
Adjusted R-squared	-0.004468	S.D. of dependent var	0.999238
S.E. of regression	1.001467	Sum of squared resid	210.6167
Durbin-Watson stat	1.613462	F-statistic	0.061483
Log likelihood	-300.1211		

RSA (COMMERCIAL SHARES) EARNINGS YIELD

SMPL 1 - 213
213 Observations
LS // Dependent Variable is RSACOM

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	10.118087	1.4597834	6.9312245	0.000
RSAINF	0.4423711	0.1192760	3.7088029	0.000

R-squared	0.061201	Mean of dependent var	15.23817
Adjusted R-squared	0.056752	S.D. of dependent var	7.130033
S.E. of regression	6.924757	Sum of squared resid	10117.93
Durbin-Watson stat	0.039911	F-statistic	13.75522
Log likelihood	-713.4081		

GENERALISED DIFFERENCES

TRANSFORMED VARIABLES

SMPL 1 - 212
212 Observations
LS // Dependent Variable is SECC

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	0.2525548	0.1015914	2.4859861	0.013
SICC	0.2054734	0.1289463	1.5934805	0.111

R-squared	0.011947	Mean of dependent var	0.313287
Adjusted R-squared	0.007242	S.D. of dependent var	1.376146
S.E. of regression	1.371154	Sum of squared resid	394.8131
Durbin-Watson stat	1.416297	F-statistic	2.539180
Log likelihood	-366.7286		

APPENDIX 9

DERIVATION OF RELATIONSHIPS USED TO DETERMINE THE PROJECT DURATION

This appendix presents the derivation or relationships that make it possible to determine the project duration of a firm from depreciation data in its annual financial statements. The appendix is referenced in section 6.2.1.4 of the thesis.

For a firm with a life of depreciable assets of d years (and therefore project duration of d years) the total cost of depreciable assets is given by:

$$DA^C_k = DA^A_{0,k} + DA^A_{0,k-1} + \dots\dots + DA^A_{0,k-(d-1)}$$

But the firm is operating under a constant inflation of i per year. Then, assuming steady state and no real growth:

$$DA^A_{0,k} = (1+i)\,DA^A_{0,k-1} + \dots\dots + (1+i)^{d-1}DA^A_{0,k-(d-1)}$$

Therefore:

$$DA^C_k = DA^A_{0,k}\Big(\sum_{m=0}^{d-1}\Big(\frac{1}{1+i}\Big)^m\Big)$$

$$= DA^A_{0,k}\left(\frac{1-\left(\frac{1}{1+i}\right)^d}{1-\frac{1}{1+i}}\right)$$

$$= DA^A_{0,k}\Big(\frac{1+i}{i}\Big)\Big(1-\Big(\frac{1}{1+i}\Big)^d\Big)$$

From the expression for the accounting profit of the firm discussed in section 3.3.7 of the thesis (the derivation is shown in appendix 1, equation 11) the annual depreciation of depreciable assets can be shown to be:

$$DA_k^D = DA_{0,k}^A \left(\frac{1+i}{d.i}\right)\left(1 - \left(\frac{1}{1+i}\right)^d\right)$$

So that:

$$\left(\frac{DA_k^C}{DA_k^D}\right) = d$$

The duration of projects can therefore be estimated by dividing the total cumulative depreciation by the current annual depreciation.

APPENDIX 10

FORTRAN PROGRAM USED TO CALCULATE THEORETICAL AND ACTUAL PRICE-EARNINGS RATIOS

This appendix presents the Fortran computer program that was used to calculate the theoretical and actual price-earnings ratios of industrial shares on the Johannesburg Stock Exchange. The functions of this program are discussed in section 6.4 of the thesis. The results obtained from the program are presented in appendices 11, 12 and 13 and discussed in section 6.5 of the thesis.

```
C
C     THIS PROGRAM COMPARES THE ACTUAL PRICE-EARNINGS RATIOS OF
C     INDUSTRIAL SHARES ON THE JOHANNESBURG STOCK EXCHANGE WITH
C     THEORETICAL PRICE-EARNINGS RATIOS.
C
C     THE ACTUAL PRICE-EARNINGS RATIOS ARE CALCULATED ON A
C     BEFORE TAX BASIS FOR THE TOTAL FIRM (THAT IS, TAKING THE
C     VALUE OF BOTH EQUITY AND BORROWED CAPITAL INTO ACCOUNT)
C
C     THE THEORY USED FOR CALCULATING THE THEORETICAL RATIOS
C     RELATES TO THE EFFECT OF INFLATION AND THE TYPES OF ASSETS
C     EMPLOYED BY FIRMS ON THE PRICE-EARNINGS RATIOS OF THEIR SHARES
C
C     ***********************************
C     *  SET DIMENSIONS OF ARRAYS  *
C     ***********************************
C
      CHARACTER*10 NAMES(218)
      DIMENSION DEPR(218,10), COFAS(218,10), BC(218,10), BD(218,10)
      DIMENSION D(218), BN(218,10), PCR(218), PDR(218), PNR(218)
      DIMENSION CUMDEP(218,10), BCR(218), BDR(218), BNR(218)
C
C     DIMENSIONS FOR ARRAYS READ IN WHEN ASSET STRUCTURES HAVE BEEN
C     CALCULATED
C
      DIMENSION PBIT(218,10),PEXT(218,10),BORR(218,10),PREF(218,10)
      DIMENSION PRAT(218,10),PMIN(218,10),SHRS(218,10),PJ(218,10)
C
C     DIMENSION OF CALCULATED PRICE-EARNINGS RATIOS
C
      DIMENSION APE(218),TPE(218),INP(218)
C
C     ***********************
C     *  SET PRINT LEVEL  *
C     ***********************
C
C     THE SETTING OF "P", TO BE DONE BY HAND, DETERMINES THE
C     AMOUNT OF INTERMEDIATE RESULTS TO BE PRINTED TO THE SCREEN.
C     ALTERNATIVES:
C       * P.LT.20     PRINTS NOTHING
C       * P.LT.40     PRINTS AVERAGE OF ALL FIRMS ONLY
C       * P.LT.80     PRINTS ALL FIRMS
C       * P.LT.100    PRINTS PROGRESS MESSAGE
C
      P = 90
C
C     THE SETTING OF "ISHY" SELECTS A FIRM FOR WHICH INTERMEDIATE
C     RESULTS ARE TO BE PRINTED TO THE SCREEN.  IF NO INTERMEDIATE
C     RESULTS ARE REQUIRED "ISHY" IS TO BE SET TO ZERO.
C
      ISHY = 166
C
C     **************************
C     *  SET INFLATION RATE  *
C     **************************
C
C     THE VARIABLE "FLA" IS USED IN THE PROGRAM FOR THE INFLATION
C     RATE.  THIS IS TO BE SET BY HAND BELOW.
C
```

```
      FLA = 0.1357
C
C
C     ************************
C     *  SET DISCOUNT RATES *
C     ************************
C
C     THE CALCULATION OF THEORETICAL PRICE-EARNINGS RATIOS
C     CAN EITHER BE UNDERTAKEN FOR ONLY ONE DISCOUNT RATE OR IT
C     CAN BE REPEATED FOR DIFFERENT DISCOUNT RATES.
C
C     TO MAKE THE PROGRAM CALCULATE FOR ONE DISCOUNT RATE
C     "IC" SHOULD BE SET TO 1 (THIS IS TO BE DONE BY HAND BELOW).
C
C     IF THE PROGRAM CALCULATES FOR ONLY ONE DISCOUNT RATE, THEN
C     THE THEORETICAL AND ACTUAL AVERAGE PRICE-EARNINGS RATIOS
C     OF ALL FIRMS WILL BE PRINTED TO A FILE.  FOR MORE THAN ONE
C     DISCOUNT RATE THESE INTERMEDIARY RESULTS WILL NOT BE PRINTED BUT
C     THE AVERAGE DISCREPANCY BETWEEN THEORETICAL AND ACTUAL RATIOS
C     WILL BE CALCULATED FOR EACH RATE AND PRINTED TO BOTH THE SCREEN
C     AND A FILE.
C
      IC = 0
C
      IF(IC.NE.1) GO TO 5
C
C     IF THE PROGRAM CALCULATES FOR ONLY ONE DISCOUNT RATE THIS RATE
C     ("R") IS TO BE SET BY HAND BELOW.  IF CALCULATIONS ARE TO BE
C     UNDERTAKEN FOR MORE THAN ONE DISCOUNT RATE THE RANGE OF DISCOUNT
C     RATES IS TO BE SET BY HAND IN THE APPROPRIATE "DO" STATEMENT
C     IN THE PROGRAM.
C
      R = 0.3625
C
    5 CONTINUE
C
C     ***************************************
C     *  READING IN DATA FROM CMS FILES  *
C     ***************************************
C
C     COMPANY NAMES READ FROM 99
      DO 90 I=1,218
      READ(99,10)NAMES(I)
   10 FORMAT(A10)
C     COST OF OTHER FIXED ASSETS READ FROM 12
C     DEPRECIATION OF OTHER FIXED ASSETS READ FROM 65
      READ(12,11)(COFAS(I,J),J=1,10)
      READ(65,11)(DEPR(I,J),J=1,10)
   11 FORMAT(10F9.3)
C     CURRENT ASSETS READ IN FROM 38
      READ(38,11)(BC(I,J),J=1,10)
C     DEPRECIABLE ASSETS HAVE TO BE CALCULATED FROM COFAS(I,J)
C     AND ACCUMULATED DEPRECIATION THAT WILL BE READ IN FROM 13 LATER.
C     NON-DEPRECIABLE ASSETS READ IN FROM 10
      READ(10,11)(BN(I,J),J=1,10)
   90 CONTINUE
      IF(P.LT.20) GO TO 99
      WRITE(6,95)
   95 FORMAT('  READING IN ASSET DATA')
```

```
   99 CONTINUE
C
C     ********************************************
C     *  CALCULATING THE AVERAGE PROJECT LENGTH  *
C     ********************************************
C
C     DSUM USED TO CALCULATE AVERAGE OF ALL FIRMS
      DSUM=0
      DO 160 I=1,218
C     DTOT USED TO CALCULATE AVERAGE OF ONE FIRM
      DTOT = 0
C     IN USED TO CALCULATE YEARS FOR WHICH DATA EXISTS
      IN = 0
      DO 140 J=1,10
      IF (COFAS(I,J).LT.0.001) GO TO 140
      IF (DEPR(I,J).LT.0.001) GO TO 140
      DEE =COFAS(I,J)/DEPR(I,J)
      DTOT = DTOT + DEE
      IN=IN+1
  140 CONTINUE
      IF (IN.GT.0) GO TO 145
C     IF NO DATA TAKE THE AVERAGE OF ALL FIRMS
C     (PUT IN BY HAND)
      D(I) = 12.01
      GO TO 150
C     IF DATA CALCULATE AVERAGE
  145 D(I) = DTOT/IN
  150 CONTINUE
      DSUM = DSUM + D(I)
  160 CONTINUE
C     CALCULATE OVERALL AVERAGE
C     (NUMBER OF FIRMS PUT IN BY HAND)
      DAVE = DSUM/218
C     PRINT THE DURATIONS
      IF (P.LT.20) GO TO 190
      IF (P.LT.40) GO TO 180
      IF (P.LT.80) GO TO 162
      WRITE(6,161) DAVE
  161 FORMAT('  CALCULATE PROJECT DURATIONS.  AVERAGE = ',F7.3,' YEARS')
      GO TO 190
  162 DO 164 I=1,218
      WRITE(6,163) NAMES(I), D(I)
  163 FORMAT('    ',A10,'DURATION=', F10.6)
  164 CONTINUE
      GO TO 190
  180 WRITE(6,183) DAVE
  183 FORMAT(' AVERAGE PROJECT DURATION ', F15.8)
  190 CONTINUE
      DO 195 I=1,218
      IF (IC.NE.1) GO TO 195
      IF (ISHY.NE.I) GO TO 195
      WRITE(6,193) NAMES(ISHY), D(ISHY)
  193 FORMAT('    ',A10,'DURATION = ', F10.6)
  195 CONTINUE
C
C     ******************************************
C     *  CALCULATE THE BOOK ASSET STRUCTURE  *
C     ******************************************
C
C     FOR EACH FIRM
```

```
      DO 220 I=1,218
C     THE BOOK VALUE OF DEPRECIABLE ASSETS HAS TO BE CALCULATED
C     FROM THE COST OF DEPRECIABLE ASSETS "COFAS(I,J)",ALREADY
C     READ IN FROM 12, AND THE CUMULATIVE DEPRECIATION FIGURE,
C     READ IN FROM 13 INTO "CUMDEP".
      READ(13,11)(CUMDE (I,J),J=1,10)
C     FOR EACH YEAR
      DO 210 J=1,10
      BD(I,J) = COFAS(I,J)-CUMDEP(I,J)
  210 CONTINUE
  220 CONTINUE
C     CALCULATE THE BOOK ASSET RATIOS
C     FOR EACH FIRM
      DO 230 I=1,218
C     USE IN FOR THE NUMBER OF YEARS FOR WHICH DATA EXIST
      IN = 0
      BCRT = 0
      BDRT = 0
      BNRT = 0
C     FOR FACH YEAR
      DO 225 J=1,10
C     TEST WHETHER DATA EXIST FOR THE YEAR
      BTEST =     BC(I,J)  + BD(I,J) + BN(I,J)
      IF (BTEST.LT.0.001) GO TO 225
C     CALCULATE THE SHARF OF EACH TYPE OF ASSETS BY DIVIDING BY TOTAL
C     BOOK ASSETS
      BT = BC(I,J) + BD(I,J) + BN(I,J)
      BCRY = BC(I,J)/BT
      BDRY = BD(I,J)/BT
      BNRY = BN(I,J)/BT
C     CALCULATE CUMULATIVE TOTAL
      BCRT = BCRT + BCRY
      BDRT = BDRT + BDRY
      BNRT = BNRT + BNRY
      IN = IN + 1
  225 CONTINUE
C     TEST WHETHER DATA EXIST FOR ANY YEAR
      IF(IN.GT.0) GO TO 227
      WRITE(6,226) NAMES(I)
  226 FORMAT('  NO DATA FOR ANY YEAR FOR ', A10)
      GO TO 230
  227 BCR(I) = BCRT/IN
      BDR(I) = BDRT/IN
      BNR(I) = BNRT/IN
C     WRITE THE RESULTS TO A CMS FILE
      WRITE(52,275) NAMES(I),IN,BCR(I),BDR(I),BNR(I)
  275 FORMAT(A10,' (',I2,'DATA POINTS)  BOOK ASSET RATIOS:  C=',
     *F5.2,' D=',F5.2,' N=',F5.2)
  230 CONTINUE
C     PRINT THE BOOK ASSET STRUCTURES
      IF (P.LT.20) GO TO 240
      IF (P.LT.40) GO TO 231
      IF (P.LT.80) GO TO 235
  231 WRITE(6,232)
  232 FORMAT('  CALCULATE BOOK ASSET STRUCTURES')
      GO TO 240
  235 DO 238 I=1,218
      WRITE(6,236) NAMES(I),BCR(J),BDR(J),BNR(J)
  236 FORMAT(' ',A10,'BOOK ASSETS: C= ',F5.2,' D= ',F5.2,' N= ',F5.2)
```

```
      DO 220 I=1,218
C     THE BOOK VALUE OF DEPRECIABLE ASSETS HAS TO BE CALCULATED
C     FROM THE COST OF DEPRECIABLE ASSETS "COFAS(I,J)",ALREADY
C     READ IN FROM 12, AND THE CUMULATIVE DEPRECIATION FIGURE,
C     READ IN FROM 13 INTO "CUMDEP".
      READ(13,11)(CUMDEP(I,J),J=1,10)
C     FOR EACH YEAR
      DO 210 J=1,10
      BD(I,J) = COFAS(I,J)-CUMDEP(I,J)
  210 CONTINUE
  220 CONTINUE
C     CALCULATE THE BOOK ASSET RATIOS
C     FOR EACH FIRM
      DO 230 I=1,218
C     USE IN FOR THE NUMBER OF YEARS FOR WHICH DATA EXIST
      IN = 0
      BCRT = 0
      BDRT = 0
      BNRT = 0
C     FOR EACH YEAR
      DO 225 J=1,10
C     TEST WHETHER DATA EXIST FOR THE YEAR
      BTEST =     BC(I,J)  + BD(I,J) + BN(I,J)
      IF (BTEST.LT.0.001) GO TO 225
C     CALCULATE THE SHARE OF EACH TYPE OF ASSETS BY DIVIDING BY TOTAL
C     BOOK ASSETS
      BT = BC(I,J) + BD(I,J) + BN(I,J)
      BCRY = BC(I,J)/BT
      BDRY = BD(I,J)/BT
      BNRY = BN(I,J)/BT
C     CALCULATE CUMULATIVE TOTAL
      BCRT = BCRT + BCRY
      BDRT = BDRT + BDRY
      BNRT = BNRT + BNRY
      IN = IN + 1
  225 CONTINUE
C     TEST WHETHER DATA EXIST FOR ANY YEAR
      IF(IN.GT.0) GO TO 227
      WRITE(6,226) NAMES(I)
  226 FORMAT('  NO DATA FOR ANY YEAR FOR ', A10)
      GO TO 230
  227 BCR(I) = BCRT/IN
      BDR(I) = BDRT/IN
      BNR(I) = BNRT/IN
C     WRITE THE RESULTS TO A CMS FILE
      WRITE(52,275) NAMES(I),IN,BCR(I),BDR(I),BNR(I)
  275 FORMAT(A10,' (',I2,'DATA POINTS)  BOOK ASSET RATIOS:  C=',
     *F5.2,' D=',F5.2,' N=',F5.2)
  230 CONTINUE
C     PRINT THE BOOK ASSET STRUCTURES
      IF (P.LT.20) GO TO 240
      IF (P.LT.40) GO TO 231
      IF (P.LT.80) GO TO 235
  231 WRITE(6,232)
  232 FORMAT('  CALCULATE BOOK ASSET STRUCTURES')
      GO TO 240
  235 DO 238 I=1,218
      WRITE(6,236) NAMES(I),BCR(J),BDR(J),BNR(J)
  236 FORMAT(' ',A10,'BOOK ASSETS: C= ',F5.2,' D= ',F5.2,' N= ',F5.2)
```

```
  238 CONTINUE
  240 CONTINUE
C     PRINT BOOK ASSET STRUCTURES FOR THE FIRM "ISHY"
      IF (IC.NE.1) GO TO 245
      DO 245 I=1,218
      IF (I.NE.ISHY) GO TO 245
      WRITE(6,236) NAMES(I),BCR(I),BDR(I),BNR(I)
      WRITE(6,241) NAMES(I)
  241 FORMAT('   DATA READ IN FOR ', A10)
      WRITE(6,242)
  242 FORMAT(' YEAR  COST/F.A.     DEPR.     CUM.DEP.    CURRENT   N-D')
      DO 244 J = 1,10
      WRITE(6,243)J,COFAS(I,J),DEPR(I,J),CUMDEP(I,J),BC(I,J),BN(I,J)
  243 FORMAT(' ',I2,'   ',5(F10.3,'  '))
  244 CONTINUE
  245 CONTINUE
C
C     ************************************************
C     *  CALCULATE THE PROJECT ASSET STRUCTURE  *
C     ************************************************
C
      DO 280 I=1,218
      PCI = BCR(I)/D(I)
      F1=(1+FLA)/FLA
      F2=(1+FLA)/(D(I)*FLA**2)
      F3=1/(D(I)*FLA**2*((1+FLA)**(D(I)-1)))
      PDI = BDR(I)/(F1-F2+F3)
      F4=1-((1/(1+FLA))**D(I))
      PNI = BNR(I)/(F1*F4)
      PTI = PCI+PDI+PNI
      PCR(I) = PCI/PTI
      PDR(I) = PDI/PTI
      PNR(I) = PNI/PTI
C     WRITE THE RESULTS TO A CMS FILE
      WRITE(53,270) NAMES(I),D(I),PCR(I),PDR(I),PNR(I)
  270 FORMAT(A10,' PROJECTS: DURATION =',F5.1,' YEARS,  C=',
     *F5.2,' D=',F5.2,' N=',F5.2)
  280 CONTINUE
C     PRINT THE PROJECT ASSET STRUCTURES
      IF (P.LT.20) GO TO 290
      IF (P.LT.40) GO TO 281
      IF (P.LT.80) GO TO 285
  281 WRITE(6,282)
  282 FORMAT('  CALCULATE PROJECT ASSET STRUCTURES')
      GO TO 290
  285 DO 288 I=1,218
      WRITE(6,286) NAMES(I),D(I),PCR(I),PDR(I),PNR(I)
  286 FORMAT(A10,'  PROJECTS:  DURATION= ',[illegible]2,' YEARS,  C=',
     *F5.2,' D=',F4.2,' N=',F4.2)
  288 CONTINUE
      GO TO 290
  290 CONTINUE
C     PRINT PROJECT ASSET STRUCTURES FOR THE FIRM "ISHY"
      IF (IC.NE.1) GO TO 300
      DO 300 I=1,218
      IF (I.NE.ISHY) GO TO 300
      WRITE(6,286) NAMES(I),D(I),PCR(I),PDR(I),PNR(I)
  300 CONTINUE
C
C     ******************************************
```

```
C      *  READ MORE DATA FROM CMS FILES  *
C      **********************************
C
       WRITE(6,310)
  310  FORMAT('  READING IN PROFIT AND SHARE PRICE DATA')
C
       DO 320 I=1,218
C
C      READ IN PROFITS BEFORE INTEREST AND TAX FROM 73
       READ(73,311)(PBIT(I,J),J=1,10)
C      READ IN EXTRAORDINARY PROFITS FROM 63
       READ(63,311)(PEXT(I,J),J=1,10)
C      READ IN BORROWINGS FROM 24
       READ(24,311)(BORR(I,J),J=1,10)
C      READ IN PREF SHARES FROM 8
       READ(8,311)(PREF(I,J),J=1,10)
C      READ IN PROFIT AFTER TAX FROM 77
       READ(77,311)(PRAT(I,J),J=1,10)
C      READ IN MINORITY INTEREST IN PROFITS FROM 78
       READ(78,311)(PMIN(I,J),J=1,10)
C      READ IN NUMBER OF SHARES FROM 1
       READ(1,311)(SHRS(I,J),J=1,10)
  311  FORMAT(10F9.3)
C      READ IN THE SHARE PRICE FROM 50
       READ(50,312)(PJ(I,J), J=1,10)
  312  FORMAT(10F9.2)
  320  CONTINUE
C
C      PRINT THE DATA READ IN FOR FIRM "ISHY" TO THE SCREEN
C
       IF (IC.NE.1) GO TO 324
       IF(ISHY.LE.0) GO TO 324
       DO 324 J = 1,10
       WRITE(6,321)ISHY,NAMES(ISHY),J,PBIT(ISHY,J),PEXT(ISHY,J),
      *SHRS(ISHY,J)
  321  FORMAT('  ',I3,A10,'YEAR',I2,'  PROFIT=',F10.3,'  EXTR.=',F10.3,
      *'SHARES=',F10.3)
       WRITE(6,322) PRAT(ISHY,J), PMIN(ISHY,J)
  322  FORMAT('  PROFIT A/T=',F10.3,' MINORITY SHARE=',F10.3)
  324  CONTINUE
C
C
       DO 490 I = 1,218
C
C      ******************
C      *  FOR EACH YEAR  *
C      ******************
C
C      USE "INP" TO CALCULATE THE NUMBER OF PAIRS OF YEARS FOR WHICH
C      DATA EXIST.
C
       INP(I) = 0
       CORP = 0
       CFVAL = 0
C
       DO 480 K = 1,9

C
C
C      **********************************
```

```
C     *  TEST WHETHER DATA EXISTS  *
C     ***********************************
C
      J=K+1
      BTEST1 =  ABS(BC(I,J)) + BD(I,J) + BN(I,J)
      BTEST2 =  ABS(BC(I,K)) + BD(I,K) + BN(I,K)
      IF (BTEST1.LT.0.001) GO TO 480
      IF (BTEST2.LT.0.001) GO TO 480
      IF (PJ(I,J).LT.0.01) GO TO 480
C     ELIMINATE THOSE WITH NEGATIVE PROFIT AFTER TAX
      IF (PRAT(I,J).LT.0) GO TO 480
C     ELIMINATE THE ONE PROBLEM YEAR FROM "51"
      IF(SHRS(I,J).LT.0.002) GO TO 480
C
C     *********************************************
C     *  CALCULATE ACTUAL PRICE EARNINGS RATIOS  *
C     *********************************************
C
      ORSH =  PJ(I,J) * SHRS(I,J)
      OAP =  ORSH  +  PREF(I,J)
      EQUIT = (OAP*PRAT(I,J))/(PRAT(I,J) - PMIN(I,J))
      FVAL = EQUIT + BORR(I,J)
      ORP  =  PBIT(I,K) - PEXT(I,K)
C
C     TEST FOR THE POSSIBILTY OF A ZERO PROFIT BEFORE CALCULATING
C     PRICE-EARNINGS
C
      IF(ABS(ORP).LT.0.001) GO TO 450
      PE = FVAL/ORP
      GO TO 460
  450 PE = 0
  460 CORP = CORP + ORP
      CFVAL = CFVAL + FVAL
      INP(I) = INP(I)+1
C     PRINT INTERMEDIATE RESULTS (BIT MUCH IF IN R DO LOOP)
C     IF (P.LT.20) GO TO 480
C     IF (P.LT.40) GO TO 485
C     IF (P.LT.60) GO TO 465
C     IF (P.LT.80) GO TO 468
C     WRITE(6,464)
C 464 FORMAT('  CALCULATING PRICE EARNINGS RATIOS')
C     GO TO 480
  465 IF (I.NE.ISHY) GO TO 480
      IF (IC.NE.1) GO TO 480
  468 WRITE (6,470)
  470 FORMAT(' ')
      WRITE(6,471) NAMES(I), J,K
  471 FORMAT('  INTERMEDIATE RESULTS: ',A10,' YEARS ',I2,' AND ',I1)
      WRITE(6,472)ORSH
  472 FORMAT('  ORDINARY SHAREHOLDERS FUNDS ',F12.3)
      WRITE(6,473)OAP
  473 FORMAT('  ORDINARY AND PREF FUNDS ',F12.3)
      WRITE(6,474)EQUIT
  474 FORMAT('  VALUE OF EQUITY    ',F12.3)
      WRITE(6,475)FVAL
  475 FORMAT('  VALUE OF THE FIRM ',F12.3)
      WRITE(6,476)ORP
  476 FORMAT('  PROFITS (PBIT, EXCL EXTR) ',F12.3)
      WRITE(6,477)PE
```

```
  477 FORMAT('  PRICE-EARNINGS RATIO ',F9.3)
      WRITE(6,479)CFVAL,CORP,INP(I)
  479 FORMAT('  CUM VALUE=',F10.3,' PROFIT=',F10.3,' YEARS= ',I3)
  480 CONTINUE
C
C     ***********************************************
C     *  CALCULATE AVERAGE PRICE EARNINGS RATIO *
C     ***********************************************
C
C     TEST WHETHER A USABLE PAIR EXISTS
      IF(INP(I).EQ.0) GO TO 485
C     IF IT EXISTS, CALCULATE
      APE(I) = CFVAL/CORP
C     PRINT INTERMEDIATE RESULT FOR ONE FIRM
      IF (I.NE.ISHY) GO TO 490
      IF (IC.NE.1) GO TO 490
      WRITE(6,481)
  481 FORMAT(' ')
      WRITE(6,482) INP(I),NAMES(I)
  482 FORMAT('  ',I1,' USABLE PAIRS FOUND FOR ',A10)
      WRITE(6,483)APE(I)
  483 FORMAT('  AVERAGE PRICE-EARNINGS ',F7.3)
      GO TO 490
  485 WRITE(6,486)I, NAMES(I)
  486 FORMAT('  NO USABLE PAIR FOR ',I3,' ',A10)
  490 CONTINUE
C
C     ************************************
C     *  FOR DIFFERENT DISCOUNT RATES  *
C     ************************************
C
      IF(IC.EQ.1) GO TO 550
C
C     IF CALCULATIONS ARE TO BE UNDERTAKEN FOR MORE THAN ONE DISCOUNT
C     RATE THESE ARE TO BE SET BY HAND BELOW.
C
      DO 900 R=0.30, 0.40  , 0.0025
C
  550 CONTINUE
C
C     *********************
C     *  FOR EACH FIRM  *
C     *********************
C
      DO 690 I=1,218
C
C     ****************************************************
C     *  CALCULATE SHARE OF ASSET TYPES IN FIRM VALUE  *
C     ****************************************************
C
      FC = D(I)*PCR(I)
      FD1 = D(I)/(1-((1+FLA)/(1+R))**D(I))
      FD2 = (1+FLA)/(R-FLA)
      FD3 = FD1*(R-FLA)
      FD4 = (1+FLA)*(1-(1/(1+FLA)**D(I)))/(D(I)*FLA)
      FD = (FD1 - FD2)*PDR(I)
      FN = D(I)*PNR(I)
      FT = FC + FD + FN
      SCA = FC/FT
```

```
      SDA = FD/FT
      SNA = ?N/FT
      FDA = (FD3-FD4)/(FD1-FD2)
C
C     ******************************************************
C     *  CALCULATE THEORETICAL PRICE-EARNINGS RATIO  *
C     ******************************************************
C
      TPE(I) = 1/(R*SCA + FDA*SDA + (R-FLA)*SNA)
C
C     PRINT PRICE-EARNINGS RATIOS TO A FILE IF CALCULATIONS ARE DONE
C     FOR ONLY ONE DISCOUNT RATE
C
      IF(IC.NE.1) GO TO 690
      WRITE(54,675) NAMES(I), INP(I), APE(I), TPE(I)
  675 FORMAT('  ',A10,'  ',I2,' USABLE PAIRS:  ACTUAL= ',F7.2,
     *' THEORETICAL= ',F7.2)
  690 CONTINUE
C
C     PRINT THE RESULTS FOR THE FIRM "ISHY" TO THE SCREEN
C     (IF FOR ONE DISCOUNT RATE ONLY)
C
      IF(IC.NE.1) GO TO 700
      DO 695  I = 1,218
      IF (I.NE.ISHY) GO TO 695
      WRITE (6,692) NAMES(I), R , TPE(I)
  692 FORMAT('  ',A10,' DISCOUNT RATE = ',F5.2,'THEORETICAL P/E = ',
     *F10.6)
  695 CONTINUE
C
C     ************************************************************
C     *  DISCREPANCY BETWEEN ACTUAL AND THEORETICAL RATIOS  *
C     ************************************************************
C
  700 CONTINUE
      SDIS = 0
      DO 720 I = 1,218
      DIS = ABS(TPE(I)-APE(I))
      SDIS = SDIS + DIS
  720 CONTINUE
      ADIS = SDIS/218
      WRITE(6,740) R, ADIS
  740 FORMAT('  DISCOUNT RATE: ', F8.6, '  DISCREPANCY: ', F8.6)
      WRITE(55,740) R, ADIS
  900 CONTINUE
      STOP
      END
```

APPENDIX 11

AVERAGE BOOK ASSET STRUCTURES OF INDUSTRIAL FIRMS ON THE JSE

This appendix presents the average book asset structures of industrial shares on the Johannesburg Stock Exchange for the period 1977 to 1986. The data were generated by means of the program presented in appendix 10. The results have been used to generate the points plotted in figure 6.1 and are discussed in section 6.5.1 of the thesis.

The number of "data points" that are listed with the results refer to the number of financial years for which usable data exist. The asset structure is given as a proportion of the total financing requirement of the firm. "C" refers to current assets, "D" to depreciable assets and "N" to non-depreciable assets.

A ALPHA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.04	D= 0.86	N= 0.11
ABERCOM	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.43	D= 0.36	N= 0.21
ABERDR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.54	D= 0.23	N= 0.23
ADCOCK	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.38	D= 0.27	N= 0.35
ADONIS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.61	D= 0.33	N= 0.06
A E C I	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.53	N= 0.19
AF CABLE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.35	D= 0.45	N= 0.21
ALTRON	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.68	D= 0.12	N= 0.20
AFCOL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.53	D= 0.26	N= 0.21
ANCHUSA	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.85	D= 0.01	N= 0.14
AF & OVR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.80	D= 0.10	N= 0.10
AFROX	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.17	D= 0.59	N= 0.25
AFR PERS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.26	D= 0.35	N= 0.39
ALEX LIP	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.94	D= 0.06	N= 0.00
AMAL IND	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.24	D= 0.62	N= 0.14
AMIC	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.16	D= 0.55	N= 0.29
A V I	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.42	D= 0.33	N= 0.25
ARGUS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.14	D= 0.43	N= 0.43
ASEA	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.36	D= 0.26	N= 0.38
ASSENG	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.41	D= 0.31	N= 0.28
ALTECH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.62	D= 0.20	N= 0.18
AMREL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.81	D= 0.16	N= 0.02
BARLOWS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.35	D= 0.35	N= 0.30
BEARES	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.79	D= 0.13	N= 0.09
BECKETTS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.40	D= 0.34	N= 0.26
BERZACK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.50	D= 0.38	N= 0.12
BIVEC	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.35	D= 0.30	N= 0.35
BLUCIRC	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.22	D= 0.53	N= 0.25
BON KOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.04	D= 0.27	N= 0.77
BOUMAT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.79	D= 0.13	N= 0.07
BRADLOW	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.95	D= 0.03	N= 0.02
BURLINGT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.52	D= 0.22	N= 0.26
BOYMANS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.80	D= 0.18	N= 0.02
BOLTONS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.59	D= 0.15	N= 0.26
BTRDUN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.43	D= 0.34	N= 0.23
CTP	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.18	D= 0.71	N= 0.12
CARLCOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.20	D= 0.49	N= 0.31
CAXTON	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.07	D= 0.72	N= 0.21
CEMENCO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.32	D= 0.30	N= 0.38
CHEMSVE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.23	N= 0.38
CHUBB	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.45	D= 0.27	N= 0.28
CLAUDE N	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.80	D= 0.04	N= 0.15
CNAGALO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.35	D= 0.24	N= 0.41
COATES	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.61	D= 0.18	N= 0.21
CONSOL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.30	D= 0.40	N= 0.30
CONTEX	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.65	D= 0.12	N= 0.24
COPI	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.72	D= 0.11	N= 0.17
CROOKES	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.03	D= 0.09	N= 0.94
CULINAN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.23	D= 0.43	N= 0.34
CURFIN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.50	D= 0.29	N= 0.21
CURRIES	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.60	D= 0.09	N= 0.31
CADSWEP	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.38	N= 0.34
CONCOR	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.30	D= 0.31	N= 0.38
CAFCA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.52	D= 0.23	N= 0.25
D & H	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.13	D= 0.65	N= 0.48
DELSWA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.67	D= 0.06	N= 0.27
DICOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.24	D= 0.48	N= 0.28
DORBYL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.33	D= 0.26	N= 0.41
DUROS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.05	N= 0.55

DUNDEE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.60	D= 0.32	N= 0.08
DELTA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.22	N= 0.39
EDGARS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.89	D= 0.06	N= 0.05
ED L BATE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.53	D= 0.21	N= 0.26
EVERITE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.23	D= 0.36	N= 0.41
ENSIGN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.74	D= 0.07	N= 0.19
FED VOLK	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.30	D= 0.32	N= 0.38
FOSCHNI	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.75	D= 0.16	N= 0.09
FRASERS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.64	D= 0.12	N= 0.25
FEDFOOD	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.35	N= 0.38
FRENCOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.67	D= 0.10	N= 0.23
ALEXNDR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.21	D= 0.45	N= 0.35
FRALEY	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.23	D= 0.34	N= 0.43
F-S IND	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.25	D= 0.28	N= 0.46
GARLICK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.46	D= 0.11	N= 0.42
GEN OPT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.49	D= 0.45	N= 0.06
GENREC	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.22	D= 0.39	N= 0.39
GENTYRE	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.30	D= 0.40	N= 0.30
GLOBE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.65	D= 0.08	N= 0.27
G I C	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.61	D= 0.23	N= 0.16
GOLDSTEIN	(9DATA POINTS)	BOOK ASSET RATIOS:	C=-0.04	D= 0.20	N= 0.84
GRESHAM	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.14	D= 0.31	N= 0.55
GRINAKR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.38	D= 0.39	N= 0.24
GUBINGS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.37	D= 0.33	N= 0.31
GYPSUM	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.37	N= 0.35
GROUP 5	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.12	D= 0.54	N= 0.34
HIVELD	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.10	D= 0.91	N= 0.19
HADDONS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.82	D= 0.03	N= 0.15
HORTORS	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.31	D= 0.63	N= 0.06
I C S	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.22	D= 0.34	N= 0.45
I & J	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.36	D= 0.42	N= 0.23
ICH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.32	D= 0.07	N= 0.61
IICO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.48	D= 0.15	N= 0.37
INTHOLD	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.10	D= 0.54	N= 0.36
INBOARD	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.46	D= 0.26	N= 0.28
JABULA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.43	D= 0.32	N= 0.25
JADE	(5DATA POINTS)	BOOK ASSET RATIOS:	C= 1.00	D= 0.00	N= 0.00
J ORR HLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.42	D= 0.19	N= 0.38
JAZZ	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.46	D= 0.08	N= 0.47
KANHYM	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.27	D= 0.13	N= 0.56
KOHLER	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.33	D= 0.41	N= 0.25
LEFIC	(8DATA POINTS)	BOOK ASSET RATIOS:	C= 1.00	D= 0.00	N= 0.00
L MATCH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.44	D= 0.27	N= 0.29
LONRHO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.07	D= 0.22	N= 0.71
L T A	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.13	D= 0.69	N= 0.44
LONSUGR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.17	D= 0.35	N= 0.48
LANCHEM	(5DATA POINTS)	BOOK ASSET RATIOS:	C= 0.04	D= 0.44	N= 0.52
LUCEM	(9DATA POINTS)	BOOK ASSET RATIOS:	C=-0.73	D= 1.14	N= 0.59
LANDLOK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.30	D= 0.32	N= 0.38
MCARTHY	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.55	D= 0.07	N= 0.38
MALHOLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.62	D= 0.20	N= 0.18
MERTRU	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.25	D= 0.35	N= 0.40
MASNITE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.27	D= 0.18	N= 0.55
MATH ASH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.58	D= 0.29	N= 0.14
METACLO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.42	D= 0.41	N= 0.16
METAIR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.47	D= 0.39	N= 0.14
MET BOX	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.37	D= 0.37	N= 0.26
METJE & Z	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.54	D= 0.06	N= 0.41
METKOR	(5DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.31	N= 0.41

MICOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.66	D= 0.28	N= 0.06
MOBILE	(1DATA POINTS)	BOOK ASSET RATIOS:	C= 0.98	D= 0.02	N= 0.00
MONTAYS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.96	D= 0.03	N= 0.01
MOOIRIV	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.36	D= 0.36	N= 0.28
MCPHAIL	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.61	D= 0.38	N= 0.00
M & R	([illegible]DATA POINTS)	BOOK ASSET RATIOS:	C= 0.21	D= 0.34	N= 0.46
MALBAK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.69	D= 0.17	N= 0.14
NAT CONS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.79	D= 0.10	N= 0.11
NATL BOL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.44	D= 0.35	N= 0.21
NATL TRD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.84	D= 0.05	N= 0.11
N CANVAS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.64	D= 0.06	N= 0.31
NICTUS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.26	D= 0.04	N= 0.70
NINIAN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.58	D= 0.25	N= 0.17
NEI AFR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.59	D= 0.19	N= 0.22
NAMPAK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.32	N= 0.29
OIL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.17	D= 0.07	N= 0.76
O K	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.46	D= 0.25	N= 0.30
OCFISH	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.55	D= 0.13	N= 0.31
OTIS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.20	N= 0.41
OMHOLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.29	D= 0.51	N= 0.20
OCMAN	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.59	D= 0.13	N= 0.28
OVGROUP	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.70	D= 0.11	N= 0.19
PEPKOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.71	D= 0.23	N= 0.06
PICBEL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.14	D= 0.25	N= 0.61
PICCAN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.25	D= 0.28	N= 0.48
PIKNPAY	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.38	D= 0.71	N= 0.67
PLATE GL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.41	D= 0.22	N= 0.37
PLACOR	(5DATA POINTS)	BOOK ASSET RATIOS:	C=-1.31	D= 0.03	N= 2.29
PLEVANS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.56	D= 0.15	N= 0.29
PPC	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.10	D= 0.72	N= 0.18
PREM IND	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.24	D= 0.62	N= 0.14
PREM GRP	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.23	D= 0.33	N= 0.43
PRESCAT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.87	D= 0.12	N= 0.02
PICHOLD	(7DATA POINTS)	BOOK ASSET RATIOS:	C= 0.33	D= 0.27	N= 0.40
PROGRES	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.33	D= 0.41	N= 0.26
PRS SUP	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.92	D= 0.08	N= 0.00
PUTCO	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.02	D= 0.65	N= 0.37
PORTHLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.15	D= 0.28	N= 0.57
PORT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.08	N= 0.53
RE[illegible]P BEH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.74	D= 0.10	N= 0.16
REMGRO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.74	D= 0.10	N= 0.16
RENTBEL	(4DATA POINTS)	BOOK ASSET RATIOS:	C= 0.19	D= 0.40	N= 0.41
REUNERT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.55	D= 0.17	N= 0.28
REX TRUE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.82	D= 0.10	N= 0.08
ROMATEX	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.32	N= 0.29
SAAN	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.07	D= 0.54	N= 0.40
SA BIAS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.57	D= 0.13	N= 0.30
SA BREWS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]8	D= 0.38	N= 0.34
SAKERS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]5	D= 0.15	N= 0.20
S ATLANT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.43	D= 0.35	N= 0.22
SAMSTEL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.74	D= 0.03	N= 0.22
SAPPI	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.05	D= 0.57	N= 0.38
S A WOOL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.79	D= 0.07	N= 0.15
SCHUS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.64	D= 0.23	N= 0.13
SEARDEL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.59	D= 0.21	N= 0.20
SEASWA	(7DATA POINTS)	BOOK ASSET RATIOS:	C= 0.47	D= 0.10	N= 0.43
SENCHEM	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.31	D= 0.57	N= 0.12
SILV TAN	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.52	D= 0.25	N= 0.23
SINCLAR	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.66	D= 0.32	N= 0.02

CGSMITH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.18	D= 0.44	N= 0.37
SPITZ	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.45	D= 0.32	N= 0.23
STD BRAS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.38	N= 0.22
STERNS	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.78	D= 0.22	N= 0.00
ST METAL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.78	D= 0.11	N= 0.12
SUNCRSH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.12	D= 0.42	N= 0.47
SWA FISH	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.85	D= 0.05	N= 0.09
SVENMILL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.57	D= 0.29	N= 0.13
SAFICON	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.64	D= 0.16	N= 0.20
SASOL	(8DATA POINTS)	BOOK ASSET RATIOS:	C= 0.10	D= 0.79	N= 0.11
SUTHSUN	(9DATA POINTS)	BOOK ASSET RATIOS:	C=-0.10	D= 0.19	N= 0.91
TRADEGRO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.00	D= 0.52	N= 0.48
TEGKOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.83	D= 0.04	N= 0.14
T E J	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.51	D= 0.15	N= 0.34
TEX MIL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.42	D= 0.23	N= 0.35
TIB	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.87	D= 0.04	N= 0.09
TIG OATS	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.24	D= 0.28	N= 0.48
TOLGATE	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.10	D= 0.58	N= 0.33
TOYOTA	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.28	D= 0.32	N= 0.40
TREK	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.21	D= 0.42	N= 0.37
TRENCOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.42	D= 0.23	N= 0.35
TRIOMF	(9DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]	D= 0.56	N= 0.40
TURF HLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-2.70	D= 0.39	N= 3.31
TONGAAT	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.16	D= 0.46	N= 0.38
UN GOLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.93	D= 0.00	N= 0.07
UN STEEL	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.34	D= 0.46	N= 0.21
UNIEWYN	(10DATA POINTS)	BOOK ASSET RATIOS:	C=-0.05	D= 0.34	N= 0.71
UTICO	(10DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]	D= [illegible]	N= 0.26
UNIHOLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.44	D= 0.24	N= 0.32
VDRLAND	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 1.00	D= 0.00	N= 0.00
VEKA	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.39	D= 0.15	N= 0.46
VERREF	(9DATA POINTS)	BOOK ASSET RATIOS:	C= 0.37	D= 0.42	N= 0.21
W & A	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.68	D= [illegible]	N= 0.22
WELFIT O	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.37	D= 0.19	N= 0.44
WESCOB	(7DATA POINTS)	BOOK ASSET RATIOS:	C= 0.26	D= 0.32	N= 0.42
WILBARZ	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 1.00	D= 0.00	N= 0.00
WOOLTRU	(10DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]	D= 0.18	N= 0.46
WORLD	(10DATA POINTS)	BOOK ASSET RATIOS:	C= [illegible]	D= 0.02	N= 0.01
WALTONS	(8DATA POINTS)	BOOK ASSET RATIOS:	C= 0.77	D= 0.21	N= 0.03
WAICOR	(7DATA POINTS)	BOOK ASSET RATIOS:	C= 0.80	D= 0.05	N= 0.16
YORKCOR	(10DATA POINTS)	BOOK ASSET RATIOS:	C= 0.10	D= 0.29	N= 0.61

APPENDIX 12

AVERAGE PROJECT ASSET STRUCTURES OF INDUSTRIAL FIRMS ON THE JSE

This appendix presents the theoretical project asset structures of industrial shares on the Johannesburg Stock Exchange calculated over the period 1977 to 1986. The data were generated by means of the program presented in appendix 10. The results have been used to generate the points plotted in figure 6.2 and are discussed in section 6.5.2 of the thesis.

The asset structure is given as a proportion of the total financing requirement of the firm's theoretical projects. "C" refers to current assets, "D" to depreciable assets and "N" to non-depreciable assets.

A ALPHA	PROJECTS:	DURATION = 44.0 YEARS,	C= 0.01	D= 0.90	N= 0.09
ABERCOM	PROJECTS:	DURATION = 11.6 YEARS,	C= 0.24	D= 0.54	N= 0.21
ABERDR	PROJECTS:	DURATION = 12.9 YEARS,	C= 0.33	D= 0.40	N= 0.27
ADCOCK	PROJECTS:	DURATION = 9.1 YEARS,	C= 0.24	D= 0.42	N= 0.35
ADONIS	PROJECTS:	DURATION = 9.6 YEARS,	C= 0.40	D= 0.54	N= 0.06
A E C I	PROJECTS:	DURATION = 12.8 YEARS,	C= 0.13	D= 0.70	N= 0.17
AF CABLE	PROJECTS:	DURATION = 20.9 YEARS,	C= 0.14	D= 0.65	N= 0.22
ALTRON	PROJECTS:	DURATION = 9.0 YEARS,	C= 0.53	D= 0.23	N= 0.24
AFCOL	PROJECTS:	DURATION = 11.0 YEARS,	C= 0.34	D= 0.43	N= 0.23
ANCHUSA	PROJECTS:	DURATION = 5.2 YEARS,	C= 0.81	D= 0.01	N= 0.17
AF & OVR	PROJECTS:	DURATION = 9.1 YEARS,	C= 0.67	D= 0.20	N= 0.13
AFROX	PROJECTS:	DURATION = 31.0 YEARS,	C= 0.04	D= 0.72	N= 0.24
AFR PERS	PROJECTS:	DURATION = 12.0 YEARS,	C= 0.14	D= 0.50	N= 0.37
ALEX LIP	PROJECTS:	DURATION = 7.7 YEARS,	C= 0.88	D= 0.12	N= 0.00
AMAL IND	PROJECTS:	DURATION = 13.6 YEARS,	C= 0.10	D= 0.78	N= 0.12
AMIC	PROJECTS:	DURATION = 18.4 YEARS,	C= 0.06	D= 0.69	N= 0.26
A V I	PROJECTS:	DURATION = 11.1 YEARS,	C= 0.24	D= 0.50	N= 0.25
ARGUS	PROJECTS:	DURATION = 13.2 YEARS,	C= 0.06	D= 0.56	N= 0.37
ASEA	PROJECTS:	DURATION = 10.7 YEARS,	C= 0.21	D= 0.41	N= 0.38
ASSENG	PROJECTS:	DURATION = 11.0 YEARS,	C= 0.24	D= 0.48	N= 0.28
ALTECH	PROJECTS:	DURATION = 8.5 YEARS,	C= 0.45	D= 0.35	N= 0.21
AMREL	PROJECTS:	DURATION = 7.2 YEARS,	C= 0.67	D= 0.30	N= 0.03
BARLOWS	PROJECTS:	DURATION = 13.5 YEARS,	C= 0.18	D= 0.53	N= 0.30
BEARES	PROJECTS:	DURATION = 7.2 YEARS,	C= 0.66	D= 0.24	N= 0.10
BECKETTS	PROJECTS:	DURATION = 11.7 YEARS,	C= 0.22	D= 0.52	N= 0.26
BERZACK	PROJECTS:	DURATION = 10.0 YEARS,	C= 0.30	D= 0.58	N= 0.12
BIVEC	PROJECTS:	DURATION = 9.7 YEARS,	C= 0.21	D= 0.45	N= 0.34
BLUCIRC	PROJECTS:	DURATION = 19.5 YEARS,	C= 0.08	D= 0.69	N= 0.23
BON KOR	PROJECTS:	DURATION = 9.8 YEARS,	C=-0.02	D= 0.35	N= 0.67
BOUMAT	PROJECTS:	DURATION = 8.9 YEARS,	C= 0.64	D= 0.26	N= 0.09
BRADLOW	PROJECTS:	DURATION = 18.3 YEARS,	C= 0.86	D= 0.11	N= 0.04
BURLINGT	PROJECTS:	DURATION = 16.2 YEARS,	C= 0.29	D= 0.39	N= 0.32
BOYMANS	PROJECTS:	DURATION = 21.6 YEARS,	C= 0.52	D= 0.44	N= 0.04
BOLTONS	PROJECTS:	DURATION = 8.7 YEARS,	C= 0.44	D= 0.27	N= 0.29
BTRDUN	PROJECTS:	DURATION = 13.6 YEARS,	C= 0.23	D= 0.53	N= 0.24
CTP	PROJECTS:	DURATION = 12.5 YEARS,	C= 0.08	D= 0.83	N= 0.09
CARLCOR	PROJECTS:	DURATION = 16.0 YEARS,	C= 0.08	D= 0.64	N= 0.28
CAXTON	PROJECTS:	DURATION = 10.8 YEARS,	C= 0.03	D= 0.82	N= 0.15
CEMENCO	PROJECTS:	DURATION = 11.6 YEARS,	C= 0.17	D= 0.45	N= 0.38
CHEMSVE	PROJECTS:	DURATION = 10.5 YEARS,	C= 0.24	D= 0.37	N= 0.40
CHUBB	PROJECTS:	DURATION = 9.8 YEARS,	C= 0.28	D= 0.43	N= 0.29
CLAUDE N	PROJECTS:	DURATION = 8.4 YEARS,	C= 0.70	D= 0.09	N= 0.21
CNAGALO	PROJECTS:	DURATION = 10.5 YEARS,	C= 0.21	D= 0.38	N= 0.42
COATES	PROJECTS:	DURATION = 9.9 YEARS,	C= 0.43	D= 0.33	N= 0.24
CONSOL	PROJECTS:	DURATION = 11.1 YEARS,	C= 0.16	D= 0.56	N= 0.28
CONTEX	PROJECTS:	DURATION = 10.0 YEARS,	C= 0.48	D= 0.22	N= 0.30
COPI	PROJECTS:	DURATION = 14.7 YEARS,	C= 0.51	D= 0.25	N= 0.24
CROOKES	PROJECTS:	DURATION = 8.2 YEARS,	C=-0.02	D= 0.13	N= 0.89
CULINAN	PROJECTS:	DURATION = 14.0 YEARS,	C= 0.10	D= 0.58	N= 0.31
CURFIN	PROJECTS:	DURATION = 8.1 YEARS,	C= 0.33	D= 0.45	N= 0.22
CURRIES	PROJECTS:	DURATION = 9.5 YEARS,	C= 0.45	D= 0.17	N= 0.38
CADSWEP	PROJECTS:	DURATION = 12.2 YEARS,	C= 0.14	D= 0.54	N= 0.32
CONCOR	PROJECTS:	DURATION = 10.6 YEARS,	C= 0.17	D= 0.46	N= 0.37
CAFCA	PROJECTS:	DURATION = 19.6 YEARS,	C= 0.26	D= 0.41	N= 0.32
D & H	PROJECTS:	DURATION = 7.0 YEARS,	C=-0.07	D= 0.72	N= 0.34
DELSWA	PROJECTS:	DURATION = 10.6 YEARS,	C= 0.52	D= 0.13	N= 0.35
DICOR	PROJECTS:	DURATION = 22.3 YEARS,	C= 0.08	D= 0.64	N= 0.28
DORBYL	PROJECTS:	DURATION = 10.8 YEARS,	C= 0.19	D= 0.40	N= 0.41
DUROS	PROJECTS:	DURATION = 26.3 YEARS,	C= 0.16	D= 0.10	N= 0.74

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DUNDEE     PROJECTS: DURATION =  8.3 YEARS,  C= 0.40 D= 0.51 N= 0.09
DELTA      PROJECTS: DURATION = 11.2 YEARS,  C= 0.24 D= 0.35 N= 0.42
EDGARS     PROJECTS: DURATION =  7.0 YEARS,  C= 0.81 D= 0.13 N= 0.06
ED L BATE  PROJECTS: DURATION =  5.6 YEARS,  C= 0.41 D= 0.33 N= 0.26
EVERITE    PROJECTS: DURATION = 17.4 YEARS,  C= 0.10 D= 0.50 N= 0.40
ENSIGN     PROJECTS: DURATION = 12.2 YEARS,  C= 0.58 D= 0.14 N= 0.28
FED VOLK   PROJECTS: DURATION =  9.9 YEARS   C= 0.18 D= 0.47 N= 0.36
FOSCHNI    PROJECTS: DURATION =  6.5 YEARS,  C= 0.62 D= 0.28 N= 0.11
FRASERS    PROJECTS: DURATION = 10.2 YEARS,  C= 0.47 D= 0.22 N= 0.31
FEDFOOD    PROJECTS: DURATION = 10.5 YEARS,  C= 0.15 D= 0.50 N= 0.35
FRENCOR    PROJECTS: DURATION =  7.3 YEARS,  C= 0.55 D= 0.18 N= 0.27
ALEXNDR    PROJECTS: DURATION =  6.0 YEARS,  C= 0.13 D= 0.58 N= 0.29
FRALEX     PROJECTS: DURATION =  5.7 YEARS,  C= 0.15 D= 0.47 N= 0.38
F-S IND    PROJECTS: DURATION = 12.3 YEARS,  C= 0.13 D= 0.42 N= 0.45
GARLICK    PROJECTS: DURATION =  9.5 YEARS,  C= 0.32 D= 0.20 N= 0.48
GEN OPT    PROJECTS: DURATION = 10.0 YEARS,  C= 0.28 D= 0.67 N= 0.05
GENREC     PROJECTS: DURATION =  9.0 YEARS,  C= 0.12 D= 0.54 N= 0.34
GENTYRE    PROJECTS: DURATION = 10.8 YEARS,  C= 0.16 D= 0.56 N= 0.27
GLOBE      PROJECTS: DURATION = 11.9 YEARS,  C= 0.48 D= 0.17 N= 0.35
G I C      PROJECTS: DURATION = 11.7 YEARS,  C= 0.40 D= 0.41 N= 0.19
GOLDSTEIN  PROJECTS: DURATION =  7.1 YEARS,  C=-0.02 D= 0.28 N= 0.75
GRESHAM    PROJECTS: DURATION =  6.9 YEARS,  C= 0.09 D= 0.43 N= 0.48
GRINAKR    PROJECTS: DURATION =  8.6 YEARS,  C= 0.22 D= 0.55 N= 0.22
GUBINGS    PROJECTS: DURATION = 14.6 YEARS,  C= 0.19 D= 0.50 N= 0.32
GYPSUM     PROJECTS: DURATION = 11.0 YEARS,  C= 0.15 D= 0.52 N= 0.33
GROUP 5    PROJECTS: DURATION =  7.9 YEARS,  C= 0.06 D= 0.67 N= 0.27
HIVELD     PROJECTS: DURATION = 23.3 YEARS,  C=-0.02 D= 0.89 N= 0.14
HADDONS    PROJECTS: DURATION = 11.8 YEARS,  C= 0.69 D= 0.07 N= 0.24
HORTORS    PROJECTS: DURATION = 11.9 YEARS,  C= 0.14 D= 0.81 N= 0.05
I C S      PROJECTS: DURATION =  9.2 YEARS,  C= 0.12 D= 0.47 N= 0.41
I & J      PROJECTS: DURATION = 12.8 YEARS,  C= 0.18 D= 0.60 N= 0.22
ICH        PROJECTS: DURATION =  8.6 YEARS,  C= 0.22 D= 0.12 N= 0.65
IICO       PROJECTS: DURATION = 11.7 YEARS,  C= 0.31 D= 0.27 N= 0.43
INTHOLD    PROJECTS: DURATION =  9.1 YEARS,  C= 0.05 D= 0.66 N= 0.29
INBOARD    PROJECTS: DURATION = 17.8 YEARS,  C= 0.23 D= 0.44 N= 0.33
JABULA     PROJECTS: DURATION = 12.6 YEARS,  C= 0.24 D= 0.50 N= 0.26
JADE       PROJECTS: DURATION = 12.0 YEARS,  C= 1.00 D= 0.00 N= 0.00
J ORR HLD  PROJECTS: DURATION = 12.1 YEARS,  C= 0.25 D= 0.32 N= 0.42
JAZZ       PROJECTS: DURATION =  8.9 YEARS,  C= 0.33 D= 0.13 N= 0.53
KANHYM     PROJECTS: DURATION =  8.7 YEARS,  C= 0.17 D= 0.27 N= 0.56
KOHLER     PROJECTS: DURATION = 12.2 YEARS,  C= 0.17 D= 0.59 N= 0.24
LEFIC      PROJECTS: DURATION = 12.0 YEARS,  C= 1.00 D= 0.00 N= 0.00
L MATCH    PROJECTS: DURATION = 14.1 YEARS,  C= 0.24 D= 0.43 N= 0.33
LONRHO     PROJECTS: DURATION = 12.1 YEARS,  C= 0.03 D= 0.31 N= 0.66
L T A      PROJECTS: DURATION =  6.5 YEARS,  C=-0.07 D= 0.75 N= 0.31
LONSUGR    PROJECTS: DURATION = 15.0 YEARS,  C= 0.07 D= 0.48 N= 0.45
LANCHEM    PROJECTS: DURATION = 27.4 YEARS,  C= 0.01 D= 0.52 N= 0.47
LUCEM      PROJECTS: DURATION = 10.4 YEARS,  C=-0.23 D= 0.91 N= 0.31
LANDLOK    PROJECTS: DURATION = 15.0 YEARS,  C= 0.14 D= 0.47 N= 0.38
MCARTHY    PROJECTS: DURATION = 10.5 YEARS,  C= 0.40 D=  .13 N= 0.47
MALHOLD    PROJECTS: DURATION =  8.1 YEARS,  C= 0.46 D= 0.35 N= 0.19
MERTRU     PROJECTS: DURATION = 12.3 YEARS,  C= 0.13 D= 0.50 N= 0.37
MASNITE    PROJECTS: DURATION = 19.2 YEARS,  C= 0.12 D= 0.27 N= 0.61
MATH ASH   PROJECTS: DURATION =  8.3 YEARS,  C= 0.39 D= 0.47 N= 0.14
METACLO    PROJECTS: DURATION =  9.9 YEARS,  C= 0.24 D= 0.60 N= 0.16
METAIR     PROJECTS: DURATION =  8.4 YEARS,  C= 0.29 D= 0.58 N= 0.13
MET BOX    PROJECTS: DURATION = 11.8 YEARS,  C= 0.20 D= 0.55 N= 0.25
METJE & Z  PROJECTS: DURATION = 10.2 YEARS,  C= 0.39 D= 0.11 N= 0.50
METKOR     PROJECTS: DURATION =  8.7 YEARS,  C= 0.17 D= 0.45 N= 0.38
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MICOR	PROJECTS:	DURATION = 9.7 YEARS,	C= 0.45	D= 0.48	N= 0.07
MOBILE	PROJECTS:	DURATION = 4.1 YEARS,	C= 0.97	D= 0.03	N= 0.00
MONTAYS	PROJECTS:	DURATION = 14.5 YEARS,	C= 0.90	D= 0.07	N= 0.03
MOOIRIV	PROJECTS:	DURATION = 13.3 YEARS,	C= 0.18	D= 0.54	N= 0.28
MCPHAIL	PROJECTS:	DURATION = 6.8 YEARS,	C= 0.42	D= 0.57	N= 0.00
M & R	PROJECTS:	DURATION = 8.5 YEARS,	C= 0.12	D= 0.47	N= 0.41
MALBAK	PROJECTS:	DURATION = 8.0 YEARS,	C= 0.53	D= 0.31	N= 0.16
NAT CONS	PROJECTS:	DURATION = 11.9 YEARS,	C= 0.62	D= 0.23	N= 0.15
NATL BOL	PROJECTS:	DURATION = 14.8 YEARS,	C= 0.23	D= 0.55	N= 0.23
NATL TRD	PROJECTS:	DURATION = 9.3 YEARS,	C= 0.73	D= 0.11	N= 0.15
N CANVAS	PROJECTS:	DURATION = 12.6 YEARS,	C= 0.46	D= 0.12	N= 0.42
NICTUS	PROJECTS:	DURATION = 9.8 YEARS,	C= 0.17	D= 0.07	N= 0.76
NINIAN	PROJECTS:	DURATION = 11.5 YEARS,	C= 0.37	D= 0.44	N= 0.19
NEI AFR	PROJECTS:	DURATION = 9.0 YEARS,	C= 0.42	D= 0.33	N= 0.25
NAMPAK	PROJECTS:	DURATION = 12.2 YEARS,	C= 0.21	D= 0.49	N= 0.29
OIL	PROJECTS:	DURATION = 10.3 YEARS,	C= 0.11	D= 0.11	N= 0.78
O K	PROJECTS:	DURATION = 18.5 YEARS,	C= 0.22	D= 0.42	N= 0.36
OCFISH	PROJECTS:	DURATION = 13.4 YEARS,	C= 0.36	D= 0.25	N= 0.39
OTIS	PROJECTS:	DURATION = 8.2 YEARS,	C= 0.26	D= 0.32	N= 0.42
OMHOLD	PROJECTS:	DURATION = 17.3 YEARS,	C= 0.12	D= 0.69	N= 0.19
OCMAN	PROJECTS:	DURATION = 9.2 YEARS,	C= 0.43	D= 0.24	N= 0.33
OVGROUP	PROJECTS:	DURATION = 7.6 YEARS,	C= 0.57	D= 0.20	N= 0.23
PEPKOR	PROJECTS:	DURATION = 10.0 YEARS,	C= 0.51	D= 0.41	N= 0.08
PICBEL	PROJECTS:	DURATION = 8.8 YEARS,	C= 0.08	D= 0.36	N= 0.56
PICCAN	PROJECTS:	DURATION = 12.1 YEARS,	C= 0.13	D= 0.40	N= 0.47
PIKNPAY	PROJECTS:	DURATION = 8.1 YEARS,	C=-0.16	D= 0.72	N= 0.44
PLATE GL	PROJECTS:	DURATION = 7.9 YEARS,	C= 0.28	D= 0.34	N= 0.38
PLACOR	PROJECTS:	DURATION = 14.4 YEARS,	C=-0.38	D= 0.03	N= 1.36
PLEVANS	PROJECTS:	DURATION = 8.9 YEARS,	C= 0.41	D= 0.26	N= 0.33
PPC	PROJECTS:	DURATION = 24.8 YEARS,	C= 0.03	D= 0.82	N= 0.15
PREM IND	PROJECTS:	DURATION = 13.7 YEARS,	C= 0.10	D= 0.78	N= 0.12
PREM GRP	PROJECTS:	DURATION = 12.1 YEARS,	C= 0.12	D= 0.47	N= 0.41
PRESCAT	PROJECTS:	DURATION = 14.6 YEARS,	C= 0.69	D= 0.28	N= 0.03
PICHOLD	PROJECTS:	DURATION = 8.3 YEARS,	C= 0.21	D= 0.40	N= 0.39
PROGRES	PROJECTS:	DURATION = 22.1 YEARS,	C= 0.13	D= 0.60	N= 0.28
PRS SUP	PROJECTS:	DURATION = 9.3 YEARS,	C= 0.82	D= 0.18	N= 0.00
PUTCO	PROJECTS:	DURATION = 15.4 YEARS,	C=-0.01	D= 0.73	N= 0.28
PORTHLD	PROJECTS:	DURATION = 34.9 YEARS,	C= 0.04	D= 0.36	N= 0.60
PORT	PROJECTS:	DURATION = 8.7 YEARS,	C= 0.28	D= 0.14	N= 0.58
REMB BEH	PROJECTS:	DURATION = 8.8 YEARS,	C= 0.60	D= 0.20	N= 0.20
REMGRO	PROJECTS:	DURATION = 8.8 YEARS,	C= 0.60	D= 0.20	N= 0.20
RENTBEL	PROJECTS:	DURATION = 9.0 YEARS,	C= 0.11	D= 0.54	N= 0.36
REUNERT	PROJECTS:	DURATION = 8.0 YEARS,	C= 0.40	D= 0.29	N= 0.30
REX TRUE	PROJECTS:	DURATION = 9.0 YEARS,	C= 0.69	D= 0.21	N= 0.10
ROMATEX	PROJECTS:	DURATION = 13.0 YEARS,	C= 0.[illegible]1	D= 0.49	N= 0.30
SAAN	PROJECTS:	DURATION = 10.9 YEARS,	C= 0.[illegible]3	D= 0.65	N= 0.32
SA BIAS	PROJECTS:	DURATION = 9.8 YEARS,	C= 0.41	D= 0.24	N= 0.36
SA BREWS	PROJECTS:	DURATION = 16.5 YEARS,	C= 0.12	D= 0.54	N= 0.[illegible]4
SAKERS	PROJECTS:	DURATION = 7.6 YEARS,	C= 0.50	D= 0.27	N= 0.23
S ATLANT	PROJECTS:	DURATION = 12.4 YEARS,	C= 0.23	D= 0.54	N= 0.23
SAMSTEL	PROJECTS:	DURATION = 11.2 YEARS,	C= 0.61	D= 0.07	N= 0.32
SAPPI	PROJECTS:	DURATION = 22.8 YEARS,	C= 0.02	D= 0.66	N= 0.33
S A WOOL	PROJECTS:	DURATION = 16.6 YEARS,	C= 0.59	D= 0.16	N= 0.25
SCHUS	PROJECTS:	DURATION = 11.1 YEARS,	C= 0.43	D= 0.42	N= 0.15
SEARDEL	PROJECTS:	DURATION = 8.4 YEARS,	C= 0.42	D= 0.36	N= 0.22
SEASWA	PROJECTS:	DURATION = 18.3 YEARS,	C= 0.26	D= 0.18	N= 0.56
SENCHEM	PROJECTS:	DURATION = 20.0 YEARS,	C= 0.12	D= 0.77	N= 0.12
SILV TAN	PROJECTS:	DURATION = 10.1 YEARS,	C= 0.34	D= 0.41	N= 0.25
SINCLAR	PROJECTS:	DURATION = 16.3 YEARS,	C= 0.38	D= 0.59	N= 0.03

CGSMITH	PROJECTS:	DURATION = 12.4	YEARS,	C= 0.09	D= 0.59	N= 0.33
SPITZ	PROJECTS:	DURATION = 8.8	YEARS	C= 0.28	D= 0.49	N= 0.23
STD BRAS	PROJECTS:	DURATION = 9.6	YEARS,	C= 0.23	D= 0.56	N= 0.21
STERNS	PROJECTS:	DURATION = 11.9	YEARS,	C= 0.56	D= 0.43	N= 0.01
ST METAL	PROJECTS:	DURATION = 6.1	YEARS,	C= 0.67	D= 0.19	N= 0.13
SUNCRSH	PROJECTS.	DURATION = 11.7	YEARS,	C= 0.06	D= 0.54	N= 0.40
SWA FISH	PROJECTS:	DURATION = 10.6	YEARS,	C= 0.74	D= 0.12	N= 0.14
S[illegible]NMILL	PROJECTS:	DURATION = 8.9	YEARS,	C= 0.38	D= 0.47	N= 0.14
SAFICON	PROJECTS·	DURATION = 7.6	YEARS,	C= 0.50	D= 0.27	N= 0.23
SASOL	PROJECTS:	DURATION = 31.2	YEARS,	C= 0.02	D= 0.88	N= 0.09
SUTHSUN	PROJECTS:	DURATION = 9.6	YEARS,	C=-0.05	D= 0.26	N= 0.79
TRADEGRO	PROJECTS:	DURATION = 9.5	YEARS,	C= 0.00	D= 0.62	N= 0.38
TEGKOR	PROJECTS:	DURATION = 9.0	YEARS,	C= 0.73	D= 0.08	N= 0.19
T E J	PROJECTS:	DURATION = 29.6	YEARS,	C= 0.21	D= 0.29	N= 0.50
TEX MIL	PROJECTS:	DURATION = 17.6	YEARS,	C= 0.21	D= 0.39	N= 0.41
TIR	PROJECTS:	DURATION = 9.0	YEARS,	C= 0.79	D= 0.08	N= 0.13
TIG OATS	PROJECTS:	DURATION = 8.7	YEARS,	C= 0.14	D= 0.40	N= 0.45
TOLGATE	PROJECTS:	DURATION = 12.1	YEARS,	C= 0.04	D= 0.70	N= 0.26
TOYOTA	PROJECTS:	DURATION = 6.8	YEARS,	C= 0.18	D= 0.46	N= 0.36
TREK	PROJECTS:	DURATION = 10.4	YEARS,	C= 0.11	D= 0.57	N= 0.32
TRENCOR	PROJECTS:	DURATION = 6.9	YEARS,	C= 0.29	D= 0.35	N= 0.35
TRIOMF	PROJECTS:	DURATION = 19.9	YEARS,	C= 0.01	D= 0.65	N= 0.33
TURF HLD	PROJECTS:	DURATION = 10.2	YEARS,	C=-0.70	D= 0.26	N= 1.44
TONGAAT	PROJECTS:	DURATION = 17.8	YEARS,	C= 0.06	D= 0.60	N= 0.34
UN COLD	PROJECTS:	DURATION = 5.3	YEARS,	C= 0.90	D= 0.00	N= 0.09
UN STEEL	PROJECTS:	DURATION = 17.5	YEARS,	C= 0.14	D= 0.65	N= 0.21
UNIEWYN	PROJECTS:	DURATION = 9.9	YEARS,	C=-0.03	D= 0.43	N= 0.59
UTICO	PROJECTS:	DURATION = 13.4	YEARS,	C= 0.30	D= 0.39	N= 0.30
UNIHOLD	PROJECTS:	DURATION = 10.5	YEARS,	C= 0.27	D= 0.38	N= 0.34
VDRLAND	PROJECTS:	DURATION = 12.0	YEARS,	C= 1.00	D= 0.00	N= 0.00
VEKA	PROJECTS:	DURATION = 13.3	YEARS,	C= 0.22	D= 0.25	N= 0.53
VERREF	PROJECTS:	DURATION = 12.8	YEARS,	C= 0.19	D= 0.61	N= 0.21
W & A	PROJECTS:	DURATION = 10.4	YEARS,	C= 0.52	D= 0.20	N= 0.28
WELFIT O	PROJECTS:	DURATION = 13.2	YEARS,	C= 0.21	D= 0.31	N= 0.48
WESCOB	PROJECTS:	DURATION = 9.6	YEARS,	C= 0.15	D= 0.46	N= 0.39
WILBARZ	PROJECTS:	DURATION = 10.1	YEARS,	C= 0.99	D= 0.01	N= 0.00
WOOLTRU	PROJECTS:	DURATION = 10.5	YEARS,	C= 0.22	D= 0.29	N= 0.48
WORLD	PROJECTS:	DURATION = 8.3	YEARS,	C= 0.94	D= 0.04	N= 0.02
WALTONS	PROJECTS:	DURATION = 9.7	YEARS,	C= 0.58	D= 0.39	N= 0.03
WAICOR	PROJECTS:	DURATION = 6.5	YEARS,	C= 0.72	D= 0.09	N= 0.20
YORKCOR	PROJECTS:	DURATION = 10.3	YEARS,	C= 0.05	D= 0.40	N= 0.54

APPENDIX 13

AVERAGE ABSOLUTE DIFFERENCE BETWEEN THEORETICAL AND ACTUAL PRICE-EARNINGS RATIOS FOR DIFFERENT DISCOUNT RATES

This appendix presents the average absolute difference between the theoretical and actual price-earnings ratios of industrial firms on the Johannesburg Stock Exchange calculated for different discount rates. The data were generated by means of the program presented in appendix 10. The results are discussed in section 6.5.3 of the thesis.

The results were used to select an appropriate discount rate to generate the theoretical price-earnings ratios presented in appendix 14. The average absolute difference is referred to as "discrepancy" in the printout. It reaches its minimum value at a discount rate of 36,25 percent.

DISCOUNT RATE:	0.300000	DISCREPANCY:	2.248337
DISCOUNT RATE:	0.302500	DISCREPANCY:	2.228762
DISCOUNT RATE:	0.305000	DISCREPANCY:	2.210512
DISCOUNT RATE:	0.307500	DISCREPANCY:	2.193490
DISCOUNT RATE:	0.310000	DISCREPANCY:	2.177305
DISCOUNT RATE:	0.312500	DISCREPANCY:	2.162427
DISCOUNT RATE:	0.315000	DISCREPANCY:	2.148725
DISCOUNT RATE:	0.317500	DISCREPANCY:	2.136085
DISCOUNT RATE:	0.320000	DISCREPANCY:	2.124162
DISCOUNT RATE:	0.322500	DISCREPANCY:	2.112713
DISCOUNT RATE:	0.325000	DISCREPANCY:	2.101756
DISCOUNT RATE:	0.327500	DISCREPANCY:	2.091042
DISCOUNT RATE:	0.330000	DISCREPANCY:	2.081159
DISCOUNT RATE:	0.332500	DISCREPANCY:	2.071856
DISCOUNT RATE:	0.335000	DISCREPANCY:	2.063177
DISCOUNT RATE:	0.337500	DISCREPANCY:	2.056245
DISCOUNT RATE:	0.340000	DISCREPANCY:	2.050250
DISCOUNT RATE:	0.342500	DISCREPANCY:	2.044815
DISCOUNT RATE:	0.345000	DISCREPANCY:	2.040377
DISCOUNT RATE:	0.347500	DISCREPANCY:	2.036425
DISCOUNT RATE:	0.350000	DISCREPANCY:	2.032959
DISCOUNT RATE:	0.352500	DISCREPANCY:	2.030181
DISCOUNT RATE:	0.355000	DISCREPANCY:	2.028323
DISCOUNT RATE:	0.357500	DISCREPANCY:	2.026862
DISCOUNT RATE:	0.360000	DISCREPANCY:	2.025879
DISCOUNT RATE:	0.362500	DISCREPANCY:	2.025661
DISCOUNT RATE:	0.365000	DISCREPANCY:	2.025799
DISCOUNT RATE:	0.367500	DISCREPANCY:	2.026179
DISCOUNT RATE:	0.370000	DISCREPANCY:	2.027388
DISCOUNT RATE:	0.372500	DISCREPANCY:	2.029743
DISCOUNT RATE:	0.375000	DISCREPANCY:	2.032359
DISCOUNT RATE:	0.377500	DISCREPANCY:	2.035519
DISCOUNT RATE:	0.380000	DISCREPANCY:	2.039203
DISCOUNT RATE:	0.382500	DISCREPANCY:	2.043222
DISCOUNT RATE:	0.385000	DISCREPANCY:	2.047736
DISCOUNT RATE:	0.387500	DISCREPANCY:	2.052288
DISCOUNT RATE:	0.390000	DISCREPANCY:	2.057369
DISCOUNT RATE:	0.392500	DISCREPANCY:	2.062462
DISCOUNT RATE:	0.395000	DISCREPANCY:	2.067833
DISCOUNT RATE:	0.397500	DISCREPANCY:	2.073642

APPENDIX 14

ACTUAL AND THEORETICAL PRICE-EARNINGS RATIOS OF INDUSTRIAL SHARES ON THE JOHANNESBURG STOCK EXCHANGE

This appendix presents the average actual and theoretical price-earnings ratios of industrial firms on the Johannesburg Stock Exchange calculated over the period 1977 to 1986. The data were generated by means of the program presented in appendix 10. The appendix is referenced in section 6.5.3 and the results were used in the regression discussed in section 6.5.6 of the thesis.

The number of usable pairs refer to the number of consecutive annual pairs of data that were used to calculate the results. A maximum of nine pairs can be obtained from the ten years data, but for some firms fewer pairs are available as a result of the non-availability of data in some years. This problem is discussed in section 6.3.3 of the thesis. The actual price-earnings ratios are calculated on a before tax basis for the reconstructed unleveraged firm. The theoretical ratios are calculated assuming a discount rate of 36,25 percent.

A ALPHA	9	USABLE PAIRS:	ACTUAL=	4.49	THEORETICAL=	4.01
ABERCOM	7	USABLE PAIRS:	ACTUAL=	6.25	THEORETICAL=	3.35
ABERDR	9	USABLE PAIRS:	ACTUAL=	4.18	THEORETICAL=	3.35
ADCOCK	7	USABLE PAIRS:	ACTUAL=	3.63	THEORETICAL=	3.44
ADONIS	9	USABLE PAIRS:	ACTUAL=	2.67	THEORETICAL=	3.05
A E C I	9	USABLE PAIRS:	ACTUAL=	5.73	THEORETICAL=	3.44
AF CABLE	8	USABLE PAIRS:	ACTUAL=	7.12	THEORETICAL=	3.63
ALTRON	9	USABLE PAIRS:	ACTUAL=	4.43	THEORETICAL=	3.14
AFCOL	9	USABLE PAIRS:	ACTUAL=	4.89	THEORETICAL=	3.28
ANCHUSA	9	USABLE PAIRS:	ACTUAL=	11.78	THEORETICAL=	2.95
AF & OVR	8	USABLE PAIRS:	ACTUAL=	3.76	THEORETICAL=	2.98
AFROX	9	USABLE PAIRS:	ACTUAL=	4.37	THEORETICAL=	3.91
AFR PERS	9	USABLE PAIRS:	ACTUAL=	1.67	THEORETICAL=	3.62
ALEX LIP	7	USABLE PAIRS:	ACTUAL=	9.03	THEORETICAL=	2.79
AMAL IND	4	USABLE PAIRS:	ACTUAL=	46.90	THEORETICAL=	3.44
AMIC	9	USABLE PAIRS:	ACTUAL=	5.64	THEORETICAL=	3.73
A V I	9	USABLE PAIRS:	ACTUAL=	2.10	THEORETICAL=	3.38
ARGUS	9	USABLE PAIRS:	ACTUAL=	2.60	THEORETICAL=	3.72
ASEA	7	USABLE PAIRS:	ACTUAL=	3.70	THEORETICAL=	3.53
ASSENG	5	USABLE PAIRS:	ACTUAL=	4.46	THEORETICAL=	3.41
ALTECH	9	USABLE PAIRS:	ACTUAL=	5.22	THEORETICAL=	3.15
AMREL	7	USABLE PAIRS:	ACTUAL=	2.72	THEORETICAL=	2.87
BARLOWS	9	USABLE PAIRS:	ACTUAL=	3.06	THEORETICAL=	3.53
BEARES	8	USABLE PAIRS:	ACTUAL=	1.87	THEORETICAL=	2.95
BECKETTS	9	USABLE PAIRS:	ACTUAL=	2.61	THEORETICAL=	3.42
BERZACK	9	USABLE PAIRS:	ACTUAL=	1.59	THEORETICAL=	3.19
BIVEC	9	USABLE PAIRS:	ACTUAL=	1.67	THEORETICAL=	3.47
BLUCIRC	9	USABLE PAIRS:	ACTUAL=	4.52	THEORETICAL=	3.70
BON KOR	4	USABLE PAIRS:	ACTUAL=	2.20	THEORETICAL=	4.08
BOUMAT	8	USABLE PAIRS:	ACTUAL=	2.80	THEORETICAL=	2.96
BRADLOW	8	USABLE PAIRS:	ACTUAL=	2.94	THEORETICAL=	2.85
BURLINGT	8	USABLE PAIRS:	ACTUAL=	3.88	THEORETICAL=	3.47
BOYMANS	5	USABLE PAIRS:	ACTUAL=	4.05	THEORETICAL=	3.11
BOLTONS	9	USABLE PAIRS:	ACTUAL=	2.41	THEORETICAL=	3.24
BTRDUN	9	USABLE PAIRS:	ACTUAL=	4.17	THEORETICAL=	3.43
CTP	6	USABLE PAIRS:	ACTUAL=	2.26	THEORETICAL=	3.41
CARLCOR	9	USABLE PAIRS:	ACTUAL=	4.52	THEORETICAL=	3.67
CAXTON	7	USABLE PAIRS:	ACTUAL=	1.85	THEORETICAL=	3.47
CEMENCO	9	USABLE PAIRS:	ACTUAL=	3.38	THEORETICAL=	3.58
CHEMSVE	9	USABLE PAIRS:	ACTUAL=	3.22	THEORETICAL=	3.51
CHUBB	9	USABLE PAIRS:	ACTUAL=	3.05	THEORETICAL=	3.36
CLAUDE N	9	USABLE PAIRS:	ACTUAL=	2.30	THEORETICAL=	3.03
CNAGALO	9	USABLE PAIRS:	ACTUAL=	2.80	THEORETICAL=	3.56
COATES	9	USABLE PAIRS:	ACTUAL=	2.68	THEORETICAL=	3.21
CONSOL	9	USABLE PAIRS:	ACTUAL=	2.96	THEORETICAL=	3.48
CONTEX	9	USABLE PAIRS:	ACTUAL=	5.53	THEORETICAL=	3.23
COPI	9	USABLE PAIRS:	ACTUAL=	4.33	THEORETICAL=	3.20
CROOKES	9	USABLE PAIRS:	ACTUAL=	7.78	THEORETICAL=	4.32
CULINAN	8	USABLE PAIRS:	ACTUAL=	4.01	THEORETICAL=	3.63
CURFIN	9	USABLE PAIRS:	ACTUAL=	2.88	THEORETICAL=	3.22
CURRIES	8	USABLE PAIRS:	ACTUAL=	2.93	THEORETICAL=	3.32
CADSWEP	9	USABLE PAIRS:	ACTUAL=	3.81	THEORETICAL=	3.56
CONCOR	7	USABLE PAIRS:	ACTUAL=	5.18	THEORETICAL=	3.55
CAFCA	9	USABLE PAIRS:	ACTUAL=	3.45	THEORETICAL=	3.52
D & H	8	USABLE PAIRS:	ACTUAL=	6.03	THEORETICAL=	3.66
DELSWA	9	USABLE PAIRS:	ACTUAL=	1.82	THEORETICAL=	3.26
DICOR	4	USABLE PAIRS:	ACTUAL=	5.21	THEORETICAL=	3.76
DORBYL	9	USABLE PAIRS:	ACTUAL=	3.19	THEORETICAL=	3.58
DUROS	7	USABLE PAIRS:	ACTUAL=	18.47	THEORETICAL=	3.97

DUNDEE	7	USABLE PAIRS:	ACTUAL=	4.5[illegible]	THEORETICAL=	3.05
DELTA	9	USABLE PAIRS:	ACTUAL=	2.50	THEORETICAL=	3.54
EDGARS	9	USABLE PAIRS:	ACTUAL=	4.47	THEORETICAL=	2.86
ED L BATE	9	USABLE PAIRS:	ACTUAL=	3.04	THEORETICAL=	3.19
EVERITE	9	USABLE PAIRS:	ACTUAL=	3.82	THEORETICAL=	[illegible].77
ENSIGN	8	USABLE PAIRS:	ACTUAL=	3.40	THEORETICAL=	3.17
FED VOLK	6	USABLE PAIRS:	ACTUAL=	3.14	THEORETICAL=	3.52
FOSCHNI	9	USABLE PAIRS:	ACTUAL=	3.75	THEORETICAL=	2.96
FRASERS	9	USABLE PAIRS:	ACTUAL=	3.10	THEORETICAL=	3.25
FEDFOOD	7	USABLE PAIRS:	ACTUAL=	3.27	THEORETICAL=	3.55
FRENCOR	7	USABLE PAIRS:	ACTUAL=	1.85	THEORETICAL=	3.15
ALEXNDR	8	USABLE PAIRS:	ACTUAL=	3.71	THEORETICAL=	3.39
FRALEX	9	USABLE PAIRS:	ACTUAL=	3.45	THEORETICAL=	3.47
F-S IND	7	USABLE PAIRS:	ACTUAL=	3.61	THEORETICAL=	3.70
GARLICK	9	USABLE PAIRS:	ACTUAL=	2.75	THEORETICAL=	3.51
GEN OPT	9	USABLE PAIRS:	ACTUAL=	2.64	THEORETICAL=	3.13
GENREC	7	USABLE PAIRS:	ACTUAL=	5.20	THEORETICAL=	3.54
GENTYRE	7	USABLE PAIRS:	ACTUAL=	2.31	THEORETICAL=	3.47
GLOBE	9	USABLE PAIRS:	ACTUAL=	4.56	THEORETICAL=	3.29
G I C	6	USABLE PAIRS:	ACTUAL=	2.14	THEORETICAL=	3.20
GOLDSTEIN	4	USABLE PAIRS:	ACTUAL=	2.77	THEORETICAL=	4.14
GRESHAM	5	USABLE PAIRS:	ACTUAL=	2.28	THEORETICAL=	3.68
GRINAKR	9	USABLE PAIRS:	ACTUAL=	3.34	THEORETICAL=	3.31
GUBINGS	9	USABLE PAIRS:	ACTUAL=	0.98	THEORETICAL=	3.55
GYPSUM	9	USABLE PAIRS:	ACTUAL=	3.57	THEORETICAL=	3.54
GROUP 5	7	USABLE PAIRS:	ACTUAL=	4.29	THEORETICAL=	3.48
HIVELD	9	USABLE PAIRS:	ACTUAL=	4.94	THEORETICAL=	3.85
HADDONS	9	USABLE PAIRS:	ACTUAL=	2.09	THEORETICAL=	3.06
HORTORS	6	USABLE PAIRS:	ACTUAL=	3.17	THEORETICAL=	3.29
I C S	9	USABLE PAIRS:	ACTUAL=	4.56	THEORETICAL=	3.61
I & J	9	USABLE PAIRS:	ACTUAL=	3.29	THEORETICAL=	3.44
ICH	9	USABLE PAIRS:	ACTUAL=	3.66	THEORETICAL=	3.77
IICO	9	USABLE PAIRS:	ACTUAL=	3.12	THEORETICAL=	3.49
INTHOLD	7	USABLE PAIRS:	ACTUAL=	4.88	THEORETICAL=	3.54
INBOARD	7	USABLE PAIRS:	ACTUAL=	6.85	THEORETICAL=	3.55
JABULA	9	USABLE PAIRS:	ACTUAL=	5.76	THEORETICAL=	3.42
JADE	9	USABLE PAIRS:	ACTUAL=	9.43	THEORETICAL=	2.76
J ORR HLD	9	USABLE PAIRS:	ACTUAL=	4.19	THEORETICAL=	3.54
JAZZ	7	USABLE PAIRS:	ACTUAL=	12.37	THEORETICAL=	3.55
KANHYM	6	USABLE PAIRS:	ACTUAL=	6.41	THEORETICAL=	3.72
KOHLER	8	USABLE PAIRS:	ACTUAL=	4.98	THEORETICAL=	3.46
LEFIC	9	USABLE PAIRS:	ACTUAL=	15.23	THEORETICAL=	2.76
L MATCH	9	USABLE PAIRS:	ACTUAL=	3.49	THEORETICAL=	3.49
LONRHO	9	USABLE PAIRS:	ACTUAL=	10.44	THEORETICAL=	4.02
L T A	8	USABLE PAIRS:	ACTUAL=	3.15	THEORETICAL=	3.60
LONSUGR	9	USABLE PAIRS:	ACTUAL=	8.08	THEORETICAL=	3.81
LANCHEM	3	USABLE PAIRS:	ACTUAL=	21.38	THEORETICAL=	4.06
LUCEM	4	USABLE PAIRS:	ACTUAL=	8.24	THEORETICAL=	3.99
LANDLOK	7	USABLE PAIRS:	ACTUAL=	4.42	THEORETICAL=	3.66
MCARTHY	9	USABLE PAIRS:	ACTUAL=	1.95	THEORETICAL=	3.45
MALHOLD	9	USABLE PAIRS:	ACTUAL=	3.03	THEORETICAL=	3.13
MERTRU	8	USABLE PAIRS:	ACTUAL=	2.67	THEORETICAL=	3.63
MASNITE	8	USABLE PAIRS:	ACTUAL=	2.67	THEORETICAL=	3.92
MATH ASH	8	USABLE PAIRS:	ACTUAL=	2.65	THEORETICAL=	3.11
METACLO	9	USABLE PAIRS:	ACTUAL=	2.72	THEORETICAL=	3.26
METAIR	8	USABLE PAIRS:	ACTUAL=	2.67	THEORETICAL=	3.[illegible]7
MET BOX	9	USABLE PAIRS:	ACTUAL=	4.95	THEORETICAL=	3.43
METJE & Z	9	USABLE PAIRS:	ACTUAL=	1.77	THEORETICAL=	3.47
METKOR	9	USABLE PAIRS:	ACTUAL=	3.80	THEORETICAL=	3.54

MICOR	9 USABLE PAIRS:	ACTUAL=	1.66	THEORETICAL=	3.04
MOBILE	9 USABLE PAIRS:	ACTUAL=	5.17	THEORETICAL=	2.76
MONTAYS	8 USABLE PAIRS:	ACTUAL=	2.14	THEORETICAL=	2.82
MOOIRIV	9 USABLE PAIRS:	ACTUAL=	3.17	THEORETICAL=	3.50
MCPHAIL	7 USABLE PAIRS:	ACTUAL=	16.22	THEORETICAL=	2.93
M & R	9 USABLE PAIRS:	ACTUAL=	3.98	THEORETICAL=	3.61
MALBAK	9 USABLE PAIRS:	ACTUAL=	3.02	THEORETICAL=	3.05
NAT CONS	9 USABLE PAIRS:	ACTUAL=	5.10	THEORETICAL=	3.04
NATL BOL	7 USABLE PAIRS:	ACTUAL=	3.74	THEORETICAL=	3.44
NATL TRD	8 USABLE PAIRS:	ACTUAL=	3.44	THEORETICAL=	2.97
N CANVAS	[illegible] USABLE PAIRS:	ACTUAL=	5.03	THEORETICAL=	3.36
NICTUS	5 [illegible]LE PAIRS:	ACTUAL=	2.36	THEORETICAL=	3.93
NINIAN	7 USABLE PAIRS:	ACTUAL=	2.04	THEORETICAL=	3.23
NEI AFR	8 USABLE PAIRS:	ACTUAL=	3.31	THEORETICAL=	3.21
[illegible]AMPAK	9 USABLE PAIRS:	ACTUAL=	3.82	THEORETICAL=	3.47
OIL	9 USABLE PAIRS:	ACTUAL=	4.40	THEORETICAL=	4.03
O K	9 USABLE PAIRS:	ACTUAL=	5.00	THEORETICAL=	3.59
OCFISH	7 USA[illegible] [illegible]IRS:	ACTUAL=	2.59	THEORETICAL=	3.43
OTIS	9 US[illegible] IRS:	ACTUAL=	4.06	THEORETICAL=	3.49
OMHOLD	5 USA[illegible] IRS:	ACTUAL=	-3.62	THEORETICAL=	3.57
OCMAN	4 USABLE PAIRS:	ACTUAL=	5.24	THEORETICAL=	3.29
OVGROUP	6 USABLE PAIRS:	ACTUAL=	3.14	THEORETICAL=	3.10
PEPKOR	9 USABLE PAIRS:	ACTUAL=	3.63	THEORETICAL=	3.02
PICBEL	8 USABLE PAIRS:	ACTUAL=	2.40	THEORETICAL=	3.81
PICCAN	6 USABLE PAIRS:	ACTUAL=	2.15	THEORETICAL=	3.71
PIKNPAY	9 USABLE PAIRS:	ACTUAL=	5.58	THEORETICAL=	3.96
PLATE GL	9 USABLE PAIRS:	ACTUAL=	3.[illegible]	THEORETICAL=	3.42
PLACOR	9 USABLE PAIRS:	ACTUAL=	10.11	THEORETICAL=	5.68
PLEVANS	9 USABLE PAIRS:	ACTUAL=	3.10	THEORETICAL=	3.30
PPC	9 USABLE PAIRS:	ACTUAL=	2.57	THEORETICAL=	3.80
PREM IND	5 USABLE PAIRS:	ACTUAL=	8.35	THEORETICAL=	44
PREM GRP	9 USABLE PAIRS:	ACTUAL=	5.73	THEORETICAL=	67
PRESCAT	9 USABLE PAIRS:	ACTUAL=	2.42	THEORETICAL=	[illegible].93
PICHOLD	9 USABLE PAIRS:	ACTUAL=	5.11	THEORETICAL=	3.49
PROGRES	7 USABLE PAIRS:	[illegible]CTUAL=	3.63	THEORETICAL=	3.70
PRS SUP	8 USABLE PAIRS:	[illegible]CTUAL=	1.38	THEORETICAL=	2.82
PUTCO	9 USABLE PAIRS:	ACTUAL=	1.82	THEORETICAL=	3.78
PORTHLD	9 USABLE PAIRS:	ACTUAL=	2.71	THEORETICAL=	4.13
PORT	8 USABLE PAIRS:	ACTUAL=	2.29	THEORETICAL=	3.64
REMB BEH	9 USABLE PAIRS:	ACTUAL=	3.43	THEORETICAL=	3.07
REMGRO	9 USABLE PAIRS:	AC[illegible]UAL=	3.60	THEORETICAL=	3.07
RENTBEL	9 USABLE PAIRS:	ACTUAL=	3.79	THEORETICAL=	3.57
REUNERT	8 USABLE PAIRS:	ACTUAL=	4.44	THEORETICAL=	3.26
REX TRUE	8 USABLE PAIRS:	ACTUAL=	3.77	THEORETICAL=	2.95
ROMATEX	9 USABLE PAIRS:	ACTUAL=	3.60	THEORETICAL=	3.48
SAAN	7 USABLE PAIRS:	ACTUAL=	2.90	THEORETICAL=	3.66
SA BIAS	8 USABLE PAIRS:	ACTUAL=	0 93	THEORETICAL=	3.33
SA BREWS	9 USABLE PAIRS:	ACTUAL=	5.39	THEORETICAL=	3.68
SAKERS	9 USABLE PAIRS:	ACTUAL=	2.44	THEORETICAL=	3.13
S ATLANT	9 USABLE PAIRS:	ACTUAL=	2.47	THEORETICAL=	3.39
SAMSTEL	9 USABLE PAIRS:	ACTUAL=	2.67	THEORETICAL=	3.18
SAPPI	9 USABLE PAIRS:	ACTUAL=	7.41	THEORETICAL=	3.91
S A WOOL	9 USABLE PAIRS:	ACTUAL=	2.14	THEORETICAL=	3.15
SCH[illegible]	7 USABLE PAIRS:	ACTUAL=	1.85	THEORETICAL=	3.15
SEARDEL	9 USABLE PAIRS:	ACTUAL=	3.06	THEORETICAL=	3.18
SEASWA	7 USABLE PAIRS:	ACTUAL=	2.39	THEORETICAL=	3.69
SENCHEM	8 USABLE PAIRS:	ACTUAL=	5.35	THEORETICAL=	3.56
SILV TAN	8 USABLE PAIRS:	ACTUAL=	3.42	THEORETICAL=	3.28
SINCLAR	7 USABLE PAIRS:	ACTUAL=	7.63	THEORETICAL=	3.16

COSMITH	9	USABLE PAIRS:	ACTUAL=	3.55	THEORETICAL=	[illegible]
SPITZ	7	USABLE PAIRS:	ACTUAL=	5.13	THEORETICAL=	3.28
STD BRAS	9	USABLE PAIRS:	ACTUAL=	3.74	THEORETICAL=	3.32
STERNS	7	USABLE PAIRS:	ACTUAL=	2.80	THEORETICAL=	2.95
ST METAL	9	USABLE PAIRS:	ACTUAL=	1.63	THEORETICAL=	2.96
SUNCRSH	9	USABLE PAIRS:	ACTUAL=	3.02	THEORETICAL=	3.74
SWA FISH	9	USABLE PAIRS:	ACTUAL=	1.97	THEORETICAL=	2.96
SVENMILL	7	USABLE PAIRS:	ACTUAL=	2.73	THEORETICAL=	3.13
SAFICON	9	USABLE PAIRS:	ACTUAL=	2.34	THEORETICAL=	3.14
SASOL	6	USABLE PAIRS:	ACTUAL=	3.43	THEORETICAL=	3.86
SUTHSUN	7	USABLE PAIRS:	ACTUAL=	8.56	THEORETICAL=	4.27
TRADEGRO	4	USABLE PAIRS:	ACTUAL=	8.87	THEORETICAL=	3.72
TEGFOR	9	USABLE PAIRS:	ACTUAL=	3.34	THEORETICAL=	3.00
T E J	6	USABLE PAIRS:	ACTUAL=	2.23	THEORETICAL=	3.77
TEX MIL	8	USABLE PAIRS:	ACTUAL=	1.47	[illegible]ORETICAL=	3.64
TIB	9	USABLE PAIRS:	ACTUAL=	3.[illegible]	[illegible]TICAL=	2.[illegible]
TIG OATS	7	USABLE PAIRS:	ACTUAL=	3.[illegible]	[illegible]TICAL=	3[illegible]
TOLGATE	9	USABLE PAIRS:	ACTUAL=	2.[illegible]	[illegible]ICAL=	[illegible]
TOYOTA	8	USABLE PAIRS:	ACTUAL=	1[illegible]	[illegible]CAL=	[illegible]
TREK	9	USABLE PAIRS:	ACTUAL=	[illegible]	[illegible]CAL=	[illegible]
TRENCOR	9	USABLE PAIRS:	ACTUAL=	[illegible]	[illegible]AL=	[illegible]
TRIOMF	5	USABLE PAIRS:	ACTUAL=	[illegible]	[illegible]	[illegible]
TURF HLD	5	USABLE PAIRS:	ACTUAL=	-1[illegible].91	[illegible]EORE[illegible]	[illegible]
TONGAAT	9	USABLE PAIRS:	ACTUAL=	4.65	[illegible]EORE[illegible]	[illegible]
UN COLD	9	USABLE PAIRS:	ACTUAL=	5.91	THEORE[illegible]	[illegible]
UN STEEL	8	USABLE PAIRS:	ACTUAL=	3 18	THEORE[illegible]	[illegible]
UNIEWYN	6	USABLE PAIRS:	ACTUAL=	3 [illegible]	THEORE[illegible]	[illegible]
UTICO	9	USABLE PAIRS:	ACTUAL=	2.5[illegible]	THEORE[illegible]	[illegible]
UNIHOLD	4	USABLE PAIRS:	ACTUAL=	3.34	THEORETI[illegible]	3.[illegible]
VDRLAND	9	USABLE PAIRS:	ACTUAL=	11.24	THE[illegible]ICAL=	2.76
VEKA	5	USABLE PAIRS:	ACTUAL=	2.76	[illegible]EORETICAL=	3.6[illegible]
VERREF	7	USABLE PAIRS:	ACTUAL=	2.74	THEORETICAL=	3.42
W & A	9	USABLE PAIRS:	ACTUAL=	43.1[illegible]	THEORETICAL=	3.19
WELFIT O	7	USABLE PAIRS:	ACTUAL=	1.[illegible]8	THEORETICAL=	3.65
WESCOB	6	USABLE PAIRS:	ACTUAL=	[illegible]	THEORETICAL=	3.57
WILBARZ	9	USABLE PAIRS:	ACTUAL=	3.0[illegible]	THEORETICAL=	2.76
WOOLTRU	9	USABLE PAIRS:	ACTUAL=	5.49	THEORETICAL=	3.61
WORLD	9	USABLE PAIRS:	ACTUAL=	2.87	THEORETICAL=	2.79
WALTONS	7	USABLE PAIRS:	ACTUAL=	2.12	THEORETICAL=	2.94
WAICOR	7	USABLE PAIRS:	ACTUAL=	5.52	THEORETICAL=	3.01
YORKCOR	7	USABLE PAIRS:	ACTUAL=	6.03	THEORETICAL=	3.86

APPENDIX 15

NUMERICAL EXAMPLE OF THE CALCULATION OF ACTUAL AND THEORETICAL PRICE-EARNINGS RATIOS

This appendix presents a numerical example showing the calculation of the actual and theoretical price-earnings ratios for one firm, S A Breweries.

The calculations proceed along the same lines as those employed in the Fortran program presented in appendix 10 and can therefore be used to follow the logic of that program. The calculations can also be used to confirm the results of the program. These results are presented in appendices 11, 12 and 14.

Inflation rate 0.1357

Discount rate 0.3625

CALCULATING THE AVERAGE PROJECT LENGTH

Other fixed assets:

Year	Cost	Depreciation	Project leng
'86	1337600	67600	19.78698
'85	1615720	72210	22.37529
'84	1509050	76300	19.77785
'83	1028504	59342	17.33180
'82	683776	43910	15.57221
'81	451448	35164	12.83835
'80	342084	24675	13.86358
'79	330137	21705	15.21018
'78	318206	18254	17.43212
'77	246817	22480	10.97940
		AVERAGE	16.51678

CALCULATE THE BOOK ASSET STRUCTURE

Depreciable assets:

Year	Cost	Cum. deprec.	Book value	Current assets
'86	1337600	547500	790100	747500
'85	1615720	447750	1157970	626810
'84	1509050	365730	1143320	540670
'83	1028504	302374	726130	474962
'82	683776	201284	482492	288104
'81	451448	151801	299647	212925
'80	342084	113804	228280	175367
'79	330137	117640	212497	192307
'78	318206	104094	214112	166748
'77	246817	63228	183589	214911

Book asset ratios:

Year	Current assets	Depreciable assets
'36	0.318994	0.337174
'85	0.256891	0.478680
'84	0.237968	0.503217
'83	0.264569	0.404478
'82	0.246308	0.412495
'81	0.253148	0.356253
'80	0.273321	0.355790
'79	0.298367	0.329692
'78	0.266537	0.342246
'77	0.347740	0.297059
AVERAGE	0.276384	0.381708

CALCULATE THE PROJECT ASSET STRUCTURE

From the average book asset structures and the inflati
project asset indices are calculated:

Current assets	0.016733
Depreciable assets	0.074968
Non-depreciable assets	0.046542

From the indices the project asset ratios are calculat

Current assets	0.121043
Depreciable assets	0.542287
Non-depreciable assets	0.336668
Project length	16.51678 years

CALCULATE THE ACTUAL PRICE-EARNINGS RATIOS

Calculate the value of the firm

Year	Share Price	Number of Shares	Ordinary S.hldrs' Funds	Pref Shares	Ordinary and Prefs
'85	6.15	261710	1609516.	147100	1756616.
'84	7.63	261440	1994787.	47100	2041887.
'83	7.41	254702	1887341.	47506	1934847.
'82	4.4	249253	1096713.	47906	1144619.
'81	3.84	222405	854035.2	48306	902341.2
'80	3.01	222405	669439.0	48706	718145.0
'79	1.36	222405	302470.8	49106	351576.8
'78	1.15	222040	255346	60354	315700
'77	0.8	220708	176566.4	71172	247738.4

Year	Profit after tax	Profit Minority S.hldrs	Total Equity	Total Ammount Borrowed	Value of Firm
'85	222990	28440	2013404.	617680	2631084.
'84	285580	42940	2403239.	536350	2939589.
'83	310557	52616	2329527.	451815	2781342.
'82	250719	44618	1392413.	356733	1749146.
'81	163099	39561	1191301.	239876	1431177.
'80	97180	20231	906955.7	193931	1100886.
'79	71965	11614	419234.5	170382	589616.5
'78	73456	8160	355152.8	168674	523826.8
'77	65156	10723	296541.4	188652	485193.4
				TOTAL	14231863

Calculate the ordinary profit

Year	Profit bef.int. and tax	Extr. profit	Ordinary profit	Year
'86	388900	-2200	391100	'86
'85	394560	3180	391380	'85
'84	402990	-110	403100	'84
'83	442757	1913	440844	'83
'82	344510	6475	338035	'82
'81	258186	-305	258491	'81
'80	153650	-1310	154960	'80
'79	131369	-8148	139517	[illegible]
'78	129426	4622	124804	'78
		TOTAL	2642233	

Calculate the average price-earnings ratio

Average P/E = 5.386305

CALCULATE THEORETICAL PRICE-EARNINGS RATIO

Calculate theoretical share of assets in firm val

Asset indices:

Current assets	1.999252
Depreciable assets	6.707079
Non-depreciable assets	5.560681

Asset ratios:

Current assets	0.140131
Depreciable assets	0.470110
Non-depreciable assets	0.389757

Calculate P/E factors

Current assets	0.3625
Depreciable assets	0.282663
Non-depreciable assets	0.2268

Calculate theoretical ratio

Theoretical P/E = 3.675415

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