Modelling the efficiency and profitability of a share portfolio

HUGH O'REILLY demonstrates a model for measuring an equity investment's efficiency and profitability. This model converts the six percentage rates that determine share performance into two summary percentage rates.

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According to the Australian Stock Exchange share ownership survey (2004), the proportion of adult Australians that own shares has jumped to a record 55% and direct share ownership has also risen to 23%. Geared share investments have also become more popular, with an increasing number of financial institutions offering loans aimed at the ordinary share investor.

Since rational investors are keen to monitor the return of their investments and wish to be properly informed when making decisions about their investment strategies, there is a strong need for access to easily comprehensible information on the performance of share portfolios. However, with so many determinants of an individual's return from a geared investment in shares, the information available is often overwhelming and confusing for ordinary investors.

Consumers with home loans are familiar with home loan calculators and computer models that generate graphs and clearly present information about their loan repayments, interest and principal outstanding, and how these would alter given a change to any variable. Financial advisers now need a simpler method of clearly explaining to their clients the different returns from share investments, to ensure the investor can make informed decisions and also compare the effects of altering any of the underlying variables.

A new model

Just as home loan providers currently use models as tools to clarify explanations and to improve understanding of a client's loan, financial advisers can also use models. The model presented in this article is intended to provide a useful tool in understanding performance for equity investors. This model effectively converts six input rates into (only) two outputs, to provide information in a format accessible to average investors. The two outputs or resultant rates produced by this model give measures of profitability and efficiency. They are easy to understand and allow simple comparative analyses.

Profitability is measured by the Return on Equity (ROE), the percentage return on the investor's own funds. This is the dominant indicator of an investment's efficacy, telling the investor how well his investment is working. Efficiency refers to the net effect on the investor's hip pocket of holding that investment, being measured by the Cash Flow Rate (CFR).

The CFR illustrates how smoothly an investment runs by illustrating the annual flow of funds. If the CFR is positive then the investment's distributions (dividends) will outweigh the investor's debt payments after tax. If the CFR is negative then the investor must provide extra cash payments over the year to maintain the investment.

As an introductory example, imagine Company XYZ has a yield of 5%, with a franking credit rate of 30% and an expected capital growth of 2%. An investor is considering investing in Company XYZ. This investor has a marginal tax rate of 48.5%, the interest rate charged on borrowings is 7% and the proportion borrowed is 40%. Taking into account each of these

determinant rates, what does this mean for the investor in terms of the performance expected from this investment in Company XYZ?

The six (input) percentage rates above could be entered into the new model, which then responds with two (output) performance measures: the expected profitability is 7.06% and the expected efficiency is 2.24%. So the investor can easily see that these input factors would produce a Return on Equity (ROE) of 7.06% p.a. and, since the Cash Flow Rate (CFR) is 2.24% p.a., the net cash flow will be 2.24% of the amount invested.

Before discussing this model's strengths further, this same example will be used to derive the model and subsequently to interpret the model.

Interpretation of the model

The derivation of this model may be considered a protracted process, but its interpretation is almost intuitive. We can develop the formulas for the CFR and the ROE from first principles.

Consider that *y* is the yield that the shares are providing, and *c* is the franking credit rate of the share companies. If we divide the yield, *y*, by the compliment of the franking credit rate, (1-c), then the earnings rate is given by y/(1 - c) or y/c'.

With *r* being the interest rate charged on borrowings, and *p* being the proportion borrowed, then *rp* must be netted from our above earnings. The earnings rate after interest is given by y/c' - rp.

Now t is the personal tax rate. If we multiply the above by (1 - t) or *t'* so as to net the earnings rate of tax, then the Cash Flow Rate (CFR) is given by (y/c' - rp)t'.

With g as the capital growth rate, we can gross this up by the compliment of the proportion borrowed. Now the real growth rate due to borrowing is given by g/(1 - p) or g/p'.

Adding the real net earnings rate of (y/c' - rp)t'/p' to this real growth rate of g/p' provides the Return on Equity (ROE) of [(y/c' - rp)t' + g]/p'.

To reiterate: **CFR = (y/c' - rp)t'**
and **ROE = [(y/c' - rp)t' + g]/p'**

Derivation of the model

For the above investment in Company XYZ:

The yield that the shares are providing is 5%;	Let y = 0.05
The franking credit rate of the share company is 30%;	Let c = 0.30
The capital growth rate of the shares is 2%.	Let g = 0.02

For the investor:

The interest rate charged on borrowings is 7%;	Let r = 0.07
The personal tax rate is 48.5%;	Let t = 0.485
The proportion borrowed is 40%.	Let p = 0.40

For ease of manipulation:

Let c' = 1 - c	= 1 - 0.30	= 0.70
Let t' = 1 - t	= 1 - 0.485	= 0.515
Let p' = 1 - p	= 1 - 0.40	= 0.60

The specific example is illustrated below in an accounting framework on the left, and with generalised symbols (including x as the total investment) provided to the right of the page.

Investment details			
	Borrowings	$4,000.00	px
	Personal funds	$6,000.00	p'x
	Total	$10,000.00	x
Income details			
	Dividends	$500.00	yx
	Imputation credits	$214.29	yx/c' - yx
	Gross income	$714.29	yx/c'
less	Interest expense	$280.00	rpx
	Net taxable income	$434.29	yx/c' - rpx
Tax details			
	Tax at marginal rate	$210.63	tyx/c' - trpx
less	Imputation credits	$214.29	yx/c' - yx
	Net surplus credit	$3.66	t'yx/c' - yx + trpx
Real income return			
	Dividend	$500.00	yx
add	Tax surplus credit	$3.66	t'yx/c' - yx + trpx
less	Interest expense	$280.00	rpx
	Net cash flow	$223.66	(y/c' - rp)t'x
So the Cash Flow Rate	**CFR**	**= 2.24%**	**(y/c' - rp)t'**
After tax income return on personal funds		= 3.73%	(y/c' - rp)t'/p'
Capital growth			
	Total investment	$10,000.00	x
	Growth rate	2%	g
	Capital gain	$200.00	gx
Capital return on personal funds		= 3.33%	g/p'
So the Return on Equity	**ROE**	**= 7.06%**	**[(y/c'- rp)t'+ g]/p'**

To summarise the model: **CFR = (y/c' - rp)t'**
and: **ROE = [(y/c' - rp)t' + g]/p'**

Demonstration of the model

This model is not merely an academic exercise; it has extensive practical applications. Immediate use of this model can be made by substitution.

Again, using the example of an investment in Company XYZ:

If the yield that the shares are providing is 5%, then y = 0.05.

If the franking credit rate is 30%, then c = 0.30 and c' = 1 - 0.30 = 0.70.

If the interest rate charged on borrowings is 7%, then r = 0.07.

If the proportion borrowed is 40%, then p = 0.40 and p' = 1 - 0.40 = 0.60.

If the personal tax rate is 48.5%, then t = 0.485 and t' = 1 - 0.485 = 0.515.

This would provide a CFR
= (y/c' - rp)t'
= (0.05 / 0.70 0.07 x 0.40) x 0.515
= 0.02237
= 2.24%
If the average capital growth rate of the shares is 2%, then g = 0.02, so this would provide a ROE
= [(y/c' - rp)t' + g]/p'
= [(0.05 / 0.70 - 0.07 x 0.40) x
0.515 + 0.02] / 0.60
= [0.022237 + 0.02] / 0.60
= 0.07062
= 7.06%
From the 6 input percentage rates provided, this model has 2 output performance rates. The CFR is 2.24%, so the net cash flow is 2.24% of $10,000 invested, or $224. This positive net cash flow indicates that the investment's distributions outweighed the investor's payments after tax. The ROE of 7.06% indicates the investor's profitability for this investment.

We can adjust this example to promote further understanding. Consider an alternative investment in Company ABC. This alternative investment has a lower yield of only 4%, but Company ABC's capital growth is expected to be greater at 3%?

This would provide a CFR
= (y/c' - rp)t'
= (0.04 / 0.70 - 0.07 x 0.40) x 0.515
= 0.01501
= 1.50%
and a ROE
= [(y/c' - rp)t' + g]/p'
= [(0.04 / 0.70 - 0.07 x 0.40) x
0.515 + 0.03] / 0.60
= [0.01501 + 0.03] / 0.60
= 0.07501
= 7.50%
Note that comparing Company ABC to Company XYZ shows a decrease in the yield from 5% to 4% and an increase in the capital growth from 2% to 3%. For this particular investor this results in a lower CFR and a higher ROE. The efficiency has dropped from 2.24% to 1.50% but the profitability has risen from 7.06% to 7.50%. This particular investment in Company ABC has less net cash flow, but outperforms the investment in Company XYZ in its profitability.

This is an example of the many alternative variations than can be similarly investigated, but this model can further clarify multiple situations simultaneously the above formulas for CFR and ROE are integrated into a spreadsheet. This spreadsheet form of the model is extremely informative for investors and allows simple sensitivity analyses. Table 1 illustrates the CFR and the ROE for the above two alternatives, as well as for other yields and growth rates.

By monitoring the changes in the values of the CFR and ROE for the different columns and rows of Table 1, it can be observed that:

- As the yield increases, the ROE and the CFR both increase.
- As the capital growth rate increases, the ROE increases.
- As the capital growth rate increases, the CFR does not vary.

In the spreadsheet version of the model, the specified rates at the top of Table 1 can be altered to suit any situation, and so many "What if .....?" questions can be answered. For example, what would be the effect (on the original investment in Company XYZ) if the investor were to increase the proportion borrowed from 40% to 60%? The effect would be to reduce the CFR from 2.24% to 1.52% and increase the ROE from 7.06% to 8.79%. Also, what would be the effect (on the original investment in Company XYZ) if interest rates increased from 7% to 8%? This time the CFR would reduce from 2.24% to 2.03% and the ROE would decrease from 7.06% to 6.72%.

These resultant changes in values above can be checked, either by substitution into the model's two formulae, or more simply by obtaining a free spreadsheet from the author at hugh.oreilly@buseco.monash.edu.au. Further practical extensions of this model are illustrated below.

Practical extensions

Frequently, investors ask advisors

TABLE 1 EFFICIENCY AND PROFITABILITY

Franking Credit Rate	**30.00%**
Borrowing Interest Rate	**7.00%**
Personal Tax Rate	**48.50%**
Proportion Borrowed	**40.00%**

	Yield						
	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
CFR	-1.44%	-0.71%	0.03%	0.77%	1.50%	2.24%	2.97%

ROE		Yield						
		0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
	0%	-2.40%	-1.18%	0.05%	1.28%	2.50%	3.73%	4.95%
G	1%	-0.74%	0.49%	1.72%	2.94%	4.17%	5.39%	6.62%
r	2%	0.93%	2.16%	3.38%	4.61%	5.83%	7.06%	8.29%
o	3%	2.60%	3.82%	5.05%	6.28%	7.50%	8.73%	9.95%
w	4%	4.26%	5.49%	6.72%	7.94%	9.17%	10.39%	11.62%
t	5%	5.93%	7.16%	8.38%	9.61%	10.83%	12.06%	13.29%
h	6%	7.60%	8.82%	10.05%	11.28%	12.50%	13.73%	14.95%
	7%	9.26%	10.49%	11.72%	12.94%	14.17%	15.39%	16.62%

questions in an attempt to clarify and/or understand the effect of gearing, or the effect increased borrowing would have on their investment. This model assists in this area.

Table 2, which is taken from the spreadsheet model, illustrates the effect of different levels of borrowing on the Cash Flow Rate (CFR).

By monitoring the changes in the values of the CFR for the different columns and rows of Table 2, it can be observed that:

- As the yield increases, the CFR increases.
- As the proportion borrowed increases, the CFR decreases.
- For low yields and high proportions of borrowings the CFR can become negative.

As well as illustrating the effect of changes to borrowing level on Efficiency (above), this model can also illustrate the effect of different levels of borrowing on Profitability. Table 3, which is also taken from the spreadsheet model, illustrates the effect of borrowing on the Return on Equity (ROE).

By monitoring the changes in the values of the ROE for the different columns and rows of Table 3, it can be observed that:

- For high proportions of borrowings, the ROE can become extremely high/low.
- As the yield increases, the ROE increases.
- As the proportion borrowed increases, the ROE sometimes increases and sometimes decreases.

It appears from the above that, given a specific capital growth, there is a minimum yield which is necessary to make borrowing a worthwhile process. With yields above this minimum, the ROE continually increases with further borrowings (see 4 right-hand columns). However with yields below this minimum, the ROE continually decreases with further borrowings (see 3 left-hand columns). In this latter case it is not beneficial to borrow at all.

Many respected authors have made the general statement that, "As the proportion borrowed increases, the returns (be they profit or loss) are magnified". The above has illustrated that, although this statement is often true, it is not always true. In certain instances (when the yield is too low) borrowing actually diminishes the profit!

Conclusion

To make rational decisions, investors need valid and reliable information. With so many investors new to share investment and margin lending, many do not fully understand the implications of altering their investment parameters. This article aims to assist investors in their understanding and advisors in their explanations, by introducing a model to measure share investment performance.

The model is derived, interpreted and demonstrated. It converts the six percentage rates that determine share investment performance into the two summary percentage rates of efficiency and profitability. These two performance measures have also been illustrated using a spreadsheet tool that integrates the model. As a further illustration, the spreadsheet tool is used to demonstrate its ability to monitor changes to an investor's performance for varying levels of debt. The model and the spreadsheet provide advisors with a practical tool to describe the share investment's performance in a format that allows for multiple comparative analyses and one that is accessible to average investors. J

TABLE 2 THE EFFECT OF BORROWING ON EFFICIENCY

Franking Credit Rate	**30.00%**
Borrowing Interest Rate	**7.00%**
Personal Tax Rate	**48.50%**

CFR		**Yield**						
		0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
	0%	0.00%	0.74%	1.47%	2.21%	2.94%	3.68%	4.41%
B	10%	-0.36%	0.38%	1.11%	1.85%	2.58%	3.32%	4.05%
o	20%	-0.72%	0.01%	0.75%	1.49%	2.22%	2.96%	3.69%
r	30%	-1.08%	-0.35%	0.39%	1.13%	1.86%	2.60%	3.33%
r	40%	-1.44%	-0.71%	0.03%	0.77%	1.50%	2.24%	2.97%
o	50%	-1.80%	-1.07%	-0.33%	0.40%	1.14%	1.88%	2.61%
w	60%	-2.16%	-1.43%	-0.69%	0.04%	0.78%	1.52%	2.25%
e	70%	-2.52%	-1.79%	-1.05%	-0.32%	0.42%	1.16%	1.89%
d	80%	-2.88%	-2.15%	-1.41%	-0.68%	0.06%	0.79%	1.53%
	90%	-3.24%	-2.51%	-1.77%	-1.04%	-0.30%	0.43%	1.17%

TABLE 3 THE EFFECT OF BORROWING ON PROFITABILITY

Franking Credit Rate	**30.00%**
Borrowing Interest Rate	**7.00%**
Personal Tax Rate	**48.50%**
Capital Growth	**2.00%**

R.O.E.		**Yield**						
		0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
	0%	2.00%	2.74%	3.47%	4.21%	4.94%	5.68%	6.41%
B	10%	1.82%	2.64%	3.46%	4.27%	5.09%	5.91%	6.73%
o	20%	1.60%	2.52%	3.44%	4.36%	5.28%	6.20%	7.12%
r	30%	1.31%	2.36%	3.41%	4.47%	5.52%	6.57%	7.62%
r	40%	0.93%	2.16%	3.38%	4.61%	5.83%	7.06%	8.29%
o	50%	0.40%	1.87%	3.34%	4.81%	6.28%	7.75%	9.22%
w	60%	-0.41%	1.43%	3.27%	5.11%	6.95%	8.79%	10.63%
e	70%	-1.75%	0.71%	3.16%	5.61%	8.06%	10.52%	12.97%
d	80%	-4.42%	-0.74%	2.94%	6.62%	10.29%	13.97%	17.65%
	90%	-12.45%	-5.09%	2.27%	9.63%	16.98%	24.34%	31.70%