AGRIBUSINESS INVESTMENTS AND "THE PRIME RATE"

(This newsletter was written in June 1980 to the prevailing economic conditions of that time. Even though currently, 2003, the prime rate is at a low 4.25%, one should focus on the principles herein).

If you have directed any of your managerial concerns towards the nation's money market and fiscal practices in recent months and years, you will surely have wondered about the sensitivity of a system which, heretofore, was characterized by stability, an isolation from political pressures, and a close adherence to broadly accepted economic theories. Unfortunately, the recent rapid and perilous rise to a 19 percent "prime rate" fits none of these prior characterizations. Is the economy truly out of control, or is it overreacting to conditions never before confronted? Has politics now superseded sound fiscal controls, or is the system simply breaking its longstanding adherence to economic theories and textbook strategies, which have long ago become obsolete?

To be sure, such questions abound, while the answers are few and often unsatisfactory. An inverted rate structure (short- vs. long-term), the record high prime rates, and the near-violent fluctuations in short-term rates have surely burdened all sectors of the agribusiness industry in recent years. Most agribusiness managers acknowledge their concern over the financial uncertainties concomitant with this volatile money market. Most agribusinesses have also responded, predictably, to the rising cost of credit by reducing their use of it or seeking alternative sources. However, few agribusiness managers have altered their procedures for alternative investment analysis.

Herein lies the major problem; i.e., those managers who do employ sophisticated procedures for evaluating investment alternatives (see the Evaluating Capital Investments and Evaluating Alternative Capital Investment Programs newsletters) have reacted to this new, more volatile environment by simply implanting into those established procedures the higher discount factors and rates of return commensurate with the current market conditions. Future project cash flows are simply discounted by 15 percent rather than the 10 percent used previously. New project acceptance now rests on a 20 percent internal rate of return where a 15 percent rate would have met with management approval just one year ago.

The Management Fallacy

The true fallacy here rests not with the fact that higher rates and discount factors are now being employed. Rather, the fallacy rests with the proposition that these record high rates will remain unchanged over the entire duration of the investment's projected useful life. Recent history should have taught agribusiness managers two distinct and separate lessons. First, the industry must now recognize that rates can, indeed, reach levels never before considered possible. Our views that government and the built-in stability of the Federal Reserve System would always act so as to dampen the effect of temporary variations have now been shattered. In fact, the policies of the Fed have recently contributed as much to the establishment of

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high rates as they have to the dampening of the trend.

Second, the industry should have learned that rate stability, once characterizing their traditional sources of debt capital, can no longer be depended on. The industry viewed the market aberrations of 1973-75 as a purely temporary distortion in the market and rapidly returned to their more complacent attitude. With the advent of 1979, the industry was caught napping as few managers ever anticipated the rate volatility of recent months.

Agribusiness managers have learned from the first lesson, above, by adjusting their discount factors and internal rates of return upwards. However, it is the second lesson (that related to the volatility of rates) that agribusiness managers have yet to learn from. Raising those rates used in their investment analysis procedures implies a degree of permanency, at that higher level, which the market history cannot support. Quite simply, *recent history has shown us that while higher rate levels are needed, we must incorporate into our investment analysis procedures some appreciation for the rate variations associated with those higher levels*. Where agribusiness-planning horizons approximate five years or less, this procedural incorporation is a reasonable and practical alternative.

Adjusting Older Procedures

Alternative investment analysis procedures, via the textbook approach, involves the identification of cash flows and the subsequent use of a net present value or an internal rate of return criteria for the choice of the most attractive investment. When using the net present value procedure, one discounts the cash flows at a rate equal to the firm's cost of capital, and accepts all those investment alternatives generating a positive net present value. When using the internal rate of return procedure, one calculates the rate of return (yield) on the investments and accepts only those, which generate a rate (or yield) greater than the cost of capital.

While both procedures render consistent results for those decisions as to whether or not an investment alternative should be accepted, it has long been known that the two procedures may give conflicting results when one wishes to rank the investment alternatives in order of their desirability. In an overly simplified way, this conflict evolves from the use of different implicit assumptions concerning which rate to use in discounting the cash flows associated with the alternative opportunities. The NPV method discounts cash flows implicitly at the cost of capital while the IRR method discounts cash flows implicitly at the internal rate of return. Hence, the differences in the ranking of investment alternatives result from the different assumptions about that rate at which cash flows are reinvested.

Agribusiness managers should keep in mind that both procedures are based on economic theory, which presumes there exists no restrictions on raising the additional capital needed to finance, any or all, desirable investments. Given this underlying presumption, it has always been argued that the question of ranking investment alternatives is not relevant; i.e., all investment alternatives meeting the DPN or IRR criteria would be undertaken. But now agribusiness managers must ask themselves just how realistic is this presumption. Because of institutional and regulatory restrictions, few agribusiness firms are being served by financial agencies with a truly unlimited supply of loan able funds. As President Carter imposes further credit restrictions throughout the economy, our presumption becomes even more unrealistic. Indeed, much of the agribusiness industry is already confronting an economic environment characterized by "capital rationing."

Many academicians have suggested solutions to this capital rationing problem. These

range from simple decision rules relating to payback periods to complex mathematical computer programming routines.[1] My proposed solution is based on the work of Bierman and Smidt.[2] These authors state:

> In the more severe forms of capital rationing, the present value method may still be used, but it is now less correct to use a constant rate of discount for all future years. The rate of discount used in each future year must reflect the cost of obtaining additional funds, the value of external investments available to the firm, or the desires of the owners for present versus future proceeds.

I find Bierman and Smidt's statement logical and attractive to the current environment where experience has shown us that we can no longer afford the luxury of assuming constant rates or discount factors throughout the useful life of the investment.

An Industry Example

To illustrate my proposed solution to this problem of ranking investment alternatives during periods of significant rate volatility and capital rationing, I shall first generate an industry example.

Let us assume that your agribusiness corporation has a longstanding relationship with a commercial source of credit. Your firm has always been able to borrow at the prime rate. Therefore, let's assume the prime rate to be a fair measure of the reinvestment rate.

Since this prime rate has risen to a record level and because prime rate variations have become so volatile in recent months, the agribusiness manager begins his investment analysis procedure by attempting to predict the prime rate over the alternative investments' useful lives (say 5 years). How, you may ask, can this be done with your limited skills? Indeed, many agribusiness managers would look at this task as an impossible or fruitless exercise. However, of course, those agribusiness managers who currently employ fixed rates or discount factors in their DPV or IRR procedures are already implicitly predicting that the current rates will hold indefinitely. Based on recent experience, such an implicit prediction is quite impossible. Errors associated with management's prediction of future rate level changes are likely, therefore, to be less significant than would be those errors implied in the use of fixed rates. Difficult though it might be, the manager is being asked to make decisions as they are based on future conditions.

To keep the arithmetic associated with our example as simple as possible, let's assume our manager has studied the prime rates and estimates that they will approximate the following.[3]

Year	Management's Estimate of Prime Rate
1980	7
1981	8
1982	9
1983	10
1984	11

Based on his past experiences with the commercial lender, the agribusiness manager realizes there are alternative ways he might follow in structuring a $1 million, 5-year term loan, the funds from which are needed for internal investment purposes. These four

[1] Wyman, H. E. and J. E. McFarland. "Financial Investments and the True Rate of Return." *Management Accounting,* August 1977.
Ismail, Ahmad. "Multiperiod Linear Programming of Cash Flows." Ph.D. Thesis, Washington State University, Pullman, Washington, 1979.
[2] Bierman, Jr., H. and Seymour Schmidt. The Capital Budgeting Decision. Macmillan Company, 1971, p. 189.

[3] Levels are used to simplify the arithmetic and are not designed to be predictive of the current situation.

optional loan structures are comprised as follows:

1. Loan A - interest will be set at 3 percent over the current prime rate and assessed against the outstanding balance with principal repaid in equal amounts annually.

2. Loan B - interest will be fixed at 11.5 percent and assessed against the outstanding balance with principal repaid in equal amounts annually.

3. Loan C - interest will be fixed at 11.5 percent and assessed against the outstanding balance with five equal annual payments covering both principal repayment and interest.

4. Loan D - interest will be fixed at 11.5 percent and assessed on the outstanding balance with four equal annual payments covering 40 percent of the principal repayment and a balloon payment equal to 60 percent of the loan as the fifth payment.

Given the above alternatives, it is not immediately obvious to the agribusiness manager, which is best, or how the alternatives might be ranked. Averaging the predicted prime rates for the next five years, the manager finds it to be 9 percent. For Alternative A, this suggests an interest rate paid of 12 percent, on the average. Does this mean that A is less preferred than those options with a fixed rate of 11.5 percent? Are Alternatives B, C, and D equally preferable, given they assess a similar fixed rate? Such questions cannot be accurately answered without the existence of a formal analytical framework, which explicitly recognizes the amounts available for reinvestment and the reinvestment rates associated with each alternative. Before going into the specifics of the analytical procedures, the cash flows associated with each alternative must be identified. Exhibit

1, at the end of the newsletter, provides these data.

Using the same example, let's assume cash flows occur at the end of each year and that the reinvestment of these monies earns the prime rate. Then the accumulation of cash flows and reinvestment earnings can be shown in Exhibit 2, in Appendix I

As shown below, Option A with its highest average interest rate, has the lowest value of cash flow at the end of 1984. Options, B, C, and D, all of which had a fixed interest rate, provided different results. In practice, we have impacted the terminal value of cash flows by making explicit assumptions about reinvestment. This is done in concert with current financial theory [4]

Discounted Cash Flows

It is quite possible to generate a similar result from this same illustration by discounting the cash flows at the reinvestment rate (see Exhibit 3 in Appendix I).

True Rate of Return

As described in Exhibits 2 and 3, the agribusiness manager could choose the best alternative using either the terminal value (of reinvesting cash flows) or the present value (discounting cash flows) framework. Some difficulty does arise in explaining exactly what the data in our two exhibits really stand for. For example, one way to explain the terminal value is to assume that all cash flows (including profits) are reinvested. This is sometimes contrary to the agribusiness understanding that profits are those cash flows, which can be consumed (not necessarily reinvested) while maintaining the principal intact. Perhaps a better way of assessing the alternatives is the so-called "true rate of return."

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[4] Zolomon, Ezra. "The Arithmetic of Capital Budgeting Decisions." *The Journal of Business,* April 1956.

In general terms, the true rate of return is expressed as that percent of the original investment that can be consumed each year while leaving the principal intact as of the end of the investment period.[5] More simply, the true rate of return assumes that the cash flows not consumed as profits are reinvested to maintain the principal intact. Profits consumed in this sense are the residual component after satisfying the reinvestment mandate.

Returning to Option A as an example, Exhibit 4 demonstrates how a true rate of return of 10.7282 percent meets the above criteria.

As shown in Exhibit 4 (in Appendix I), a sum of $107,282 is withdrawn as a profit (and consumed) from the annual cash flow generated from the original investment sum of $1,000,000. The true rate of return, when withdrawn, allows for the reinvestment of that differential between the 10.7282 percent and the cash flow each year. Reinvesting this differential each year results in a 1980 period end value of $1,000,000. Calculating the true rate of return is based on the terminal values as follows:

1. Divide the excess of terminal value over principal by the sum of the interest factors; i.e.,

$$\frac{\$1,654,339 \quad \$1,000,000 \quad \$654,339}{1.08 \quad 1.09 \quad 1.10 \quad 1.11 \quad 6.09926} \quad \$107,282$$

$$1.09 \quad 1.10 \quad 1.11$$

$$1.10 \quad 1.11 \quad 1.11 \quad 1$$

2. Divide the results from No. 1 above, by the principal and convert to a percentage; i.e.,

$$\frac{\$107,282}{\$1,000,000} \quad 100 \quad 10.7282\%$$

It is also possible to obtain this same true rate of return from the NPV procedure. Here we must first identify the excess terminal value for an investment that is left to compound at the prime rate as follows:

1. First multiply the investment by the compounding factors; i.e.,

$$\$1,000,000 \quad 1.07 \quad 1.08 \quad 1.09 \quad 1.10 \quad 1.11$$

$$\$1,537,976$$

2. Then reduce this sum by the amount of the principal to identify the excess; i.e.,

$$\$1,537,976 \quad \$1,000,000 \quad \$537,976$$

3. Next, the excess terminal value is divided by the sum of the interest factors; i.e.,

$$\frac{\$537,976}{6.09926} \quad \$88,203$$

4. Then divide this amount by the principal and convert to a percentage; i.e.,

$$\frac{\$88,203}{\$1,000,000} \quad \$88,203$$

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[5] Adler, Michael. "The True Rate of Return and the Reinvestment Rate." *Engineering Economist,* Spring 1970.

5. Because the above rate is expressed as a net present value, it is necessary to add the discount factors; i.e.,

$$\frac{1}{1.07} \quad \frac{1}{1.07} \quad \frac{1}{1.08} \quad \frac{1}{1.07} \quad \frac{1}{1.08} \quad \frac{1}{1.09}$$

$$\frac{1}{1.07} \quad \frac{1}{1.08} \quad \frac{1}{1.09} \quad \frac{1}{1.10}$$

$$\frac{1}{1.07} \quad \frac{1}{1.08} \quad \frac{1}{1.09} \quad \frac{1}{1.10} \quad \frac{1}{1.11} \quad 3.9658\%$$

6. The net present value in excess of the principal is then divided by this factor; i.e.,

$$\frac{\$1,076,658 \quad \$1,000,000}{3.9658} \quad \$19,077$$

7. This result is then divided by the principal, converted to a percentage, and added to the rate of return (No. 4 above); i.e.,

$$\frac{\$19,077}{\$1,000,000} \quad 100 \quad 8.8203\% \quad 10.728\%$$

CONCLUSION

The end product of this complex true rate of return calculation is a consistent measure of each management option. Regardless of whether management follows the NPV or IRR methodology, the resultant true rate of return remains the same. Finally, the listing of those true rates of return will allow agribusiness managers to rank, in order of preference, all the investment alternatives. Where market conditions make it difficult or impossible to secure the desired amounts of debt capital, this ranking of preferred options will allow the agribusiness manager to intelligently accommodate the process of capital rationing. Returning to our example alternatives, the ranking would be as shown above.

When interest rates are as unstable as they have been in recent times, it is necessary for management to estimate the expected rates for their decision-making horizon. NPV and IRR methods for evaluating investments fail to provide complete decision criteria where such investment capital is being rationed or institutionally restricted. The "true rate of return" provides agribusiness managers with a means for dealing intelligently with both rate volatility and debt capital rationing.

Ken D. Duft
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APPENDIX I

EXHIBIT 1
Cash Flows for Loan Alternatives
($)

Loan	Item	1980	1981	1982	1983	1984
A	Principal	200,000	200,000	200,000	200,000	200,000
	LBO	1,000,000	800,000	600,000	400,000	200,000
	Interest Rate (%)	10	11	12	13	14
	Interest Paid	100,000	88,000	72,000	52,000	28,000
	Cash Flow	300,000	288,000	272,000	252,000	228,000
B	Principal	200,000	200,000	200,000	200,000	200,000
	LBO	1,000,000	800,000	600,000	400,000	200,000
	Interest Rate (%)	11.5	11.5	11.5	11.5	11.5
	Interest Paid	115,000	92,000	69,000	46,000	23,000
	Cash Flow	315,000	292,000	269,000	246,000	223,000
C	Principal	158,982	177,265	197,650	220,380	245,723
	LBO	1,000,000	841,018	663,753	446,103	245,723
	Interest Rate (%)	11.5	11.5	11.5	11.5	11.5
	Interest Paid	155,000	96,717	76,332	53,602	28,259
	Cash Flow	273,982	273,982	273,982	273,982	273,982
D	Principal	100,000	100,000	100,000	100,000	600,000
	LBO	1,000,000	900,000	800,000	700,000	600,000
	Interest Rate (%)	11.5	11.5	11.5	11.5	11.5
	Interest Paid	115,000	103,500	92,000	80,500	69,000
	Cash Flow	215,000	203,500	192,000	180,500	669,000

EXHIBIT 2
Accumulated Cash Flows and Reinvested Earnings

End of Year	Estimated Interest Factor for Reinvested Cash Flows
1980	(1.08)(1.09)(1.10)(1.11)
1981	(1.09)(1.10)(1.11)
1982	(1.10)(1.11)
1983	(1.11)
1984	(1)

Exhibit 2, continued

	Loan A		**Loan B**
Cash Flow	**Value at End of 1984**	**Cash Flow**	**Value at End of 1984**
$ 300,000	$ 431,208	$ 315,000	$ 452,768
288,000	383,299	292,000	388,623
272,000	332,112	269,000	328,449
252,000	279,720	246,000	273,060
228,000	228,000	223,000	223,000
	$1,654,339		$1,665,900

	Loan C		**Loan D**
Cash Flow	**Value at End of 1984**	**Cash Flow**	**Value at End of 1984**
$ 273,982	$ 393,811	$ 215,000	$ 309,032
273,982	364,640	203,500	270,838
273,982	334,532	192,000	234,432
273,982	304,120	180,500	200,355
273,982	273,982	669,000	669,000
	$1,671,085		$1,683,657

EXHIBIT 3
Discounted Cash Flows for Reinvestments

End of Year	Estimated Interest Factor for Reinvested Cash Flows
1980	$\dfrac{1}{1.07}$
1981	$\dfrac{1}{1.07} \quad \dfrac{1}{1.08}$
1982	$\dfrac{1}{1.07} \quad \dfrac{1}{1.08} \quad \dfrac{1}{1.09}$
1983	$\dfrac{1}{1.07} \quad \dfrac{1}{1.08} \quad \dfrac{1}{1.09} \quad \dfrac{1}{1.10}$
1984	$\dfrac{1}{1.07} \quad \dfrac{1}{1.08} \quad \dfrac{1}{1.09} \quad \dfrac{1}{1.10} \quad \dfrac{1}{1.11}$

EXHIBIT 3 continued

	Loan A		**Loan B**
Cash Flow	**Value at 1980 Beginning**	**Cash Flow**	**Value at 1980 Beginning**
$ 300,000	$ 280,374	$ 315,000	$ 294,393
288,000	249,221	292,000	252,683
272,000	215,941	269,000	213,559
252,000	181,875	246,000	177,545
228,000	148,247	223,000	144,996
	$1,076,658		$1,083,176

	Loan C		**Loan D**
Cash Flow	**Value at 1980 Beginning**	**Cash Flow**	**Value at 1980 Beginning**
$ 273,982	$ 256,058	$ 215,000	$ 200,935
273,982	237,091	203,500	176,099
273,982	217,514	192,000	152,429
273,982	197,740	180,500	130,272
273,982	178,144	669,000	434,987
	$1,086,547		$1,094,722

EXHIBIT 4
Option A – True Rate of Return

Year	Cash Flow	Consumption (10.7282%)	Reinvested	Interest Factor	Value at End of 1984
1980	$ 300,000	$ 107,282	$ 192,718	(1.08)(1.09(1.10)(1.11)	$ 277,005
1981	288,000	107,282	180,718	(1.09)(1.10)(1.11)	240,516
1982	272,000	107,282	164,718	(1.10)(1.11)	201,123
1983	252,000	107,282	144,718	(1.11)	160,638
1984	228,000	107,282	120,718	(1)	120,718
					$1,000,000

Ranking	Option	Terminal Value (IRR)	Present Value (NPV)	True Rate of Return
1	D	$ 1,683,657	$ 1,094,722	11.21%
2	C	1,671,085	1,086,547	11.00%
3	B	1,655,900	1,083,176	10.92%
4	E	1,657,020	1,077,401	10.77%
5	A	1,654,339	1,075,658	10.73%