

The Management of Marketing Profit: An Investment Perspective

Draft of Chapter 2: Understanding a Marketing Investment's Rates of Returns Ted Mitchell, July 17, 2015

Learning Objectives for Chapter 2

- 1) To understand the quadratic nature of the profit function for a marketing investment.
- 2) To know that a marketing investment has an average rate of return, AROR.
- 3) To understand how the AROR is derived from the marketing profit function.
- 4) To know the characteristics of the AROR and its general role in the theory of marketing management.
- 5) To know that a marketing investment has a marginal rate of return, MROR.
- 6) To understand how the MROR is derived from the marketing profit function.
- 7) To know the characteristics of the MROR and its general role in the theory of marketing management.
- 8) To compare and contrast the characteristics of the marketing investment's rates of return, AROR and MROR.
- 9) Given estimates of the constant's, a & b, in the marketing profit function calculate the average rate of return, the marginal rates of return and total marketing profit for given levels of investment.

Introduction

In chapter 1 we learned that marketing profit, Z, is a function of the amount of money, I, invested in the offering's value to the customer.

$$Z = f(I)$$

The functional relationship between a marketing investment, I, and the amount of profit, Z, generated by that relationship is best described using a quadratic equation,

$$\text{Marketing Profit Function, } Z = aI - bI^2$$

where the values of the constants, a & b, are determined through market research. The most salient feature of the quadratic relationship between investment size and profit is that there is an optimal level of investment, I^* , that maximizes marketing profit, Z. Amounts of investment that are too big or too small result in less than the maximum possible profit.

There are two things that must be understood prior to making the marketing profit function operational: 1) The characteristics that make a marketing investment different from a marketing expense must be identified and understood. 2) The two different rates of return that are associated with marketing investments must be known and understood.

The task of describing and defining a marketing investment and differentiating a marketing investment from a marketing expense is left for a future chapter. This

chapter is devoted to the task of exploring the two different rates of return associated with marketing investments.

Two Rates of Return for Marketing Investments

Marketing Investments have two different types of return rates:

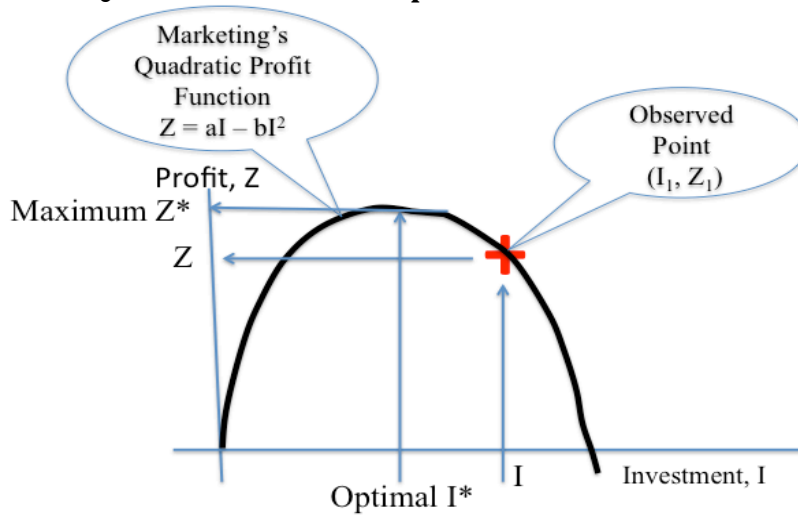
- 1) The **Average Rate of Return**, AROR, is the most common rate of return used in the analysis of marketing performance.
- 2) The **Marginal Rate Of Return**, MROR, is the most important rate of return for establishing optimal investment levels and hurdle rates.

Both rates of return are derived from the marketing profit function (Figure 2-1),

Marketing Profit Function, $Z = f(I)$

Marketing Profit Function, $Z = aI - bI^2$

Figure 2-1: Quadratic Relationship Between Investment and Profit



The Marketing Investment's Average Rate of Return, AROR

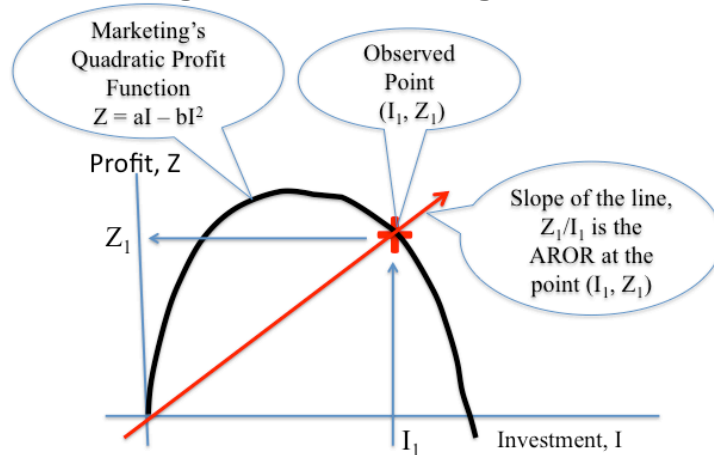
There are two different approaches for measuring a marketing investment's average rate of return.

- 1) The first involves a measurement of AROR from the observation of a single investment's performance.
- 2) The second involves the prediction of an investment's average rate of return, AROR, for any level of investment.

Measuring AROR at a Single Observed Performance

When the total amount of investment, I , and the total amount of marketing profit, Z , generated from that level of investment are observed, then the observation defines a single point (I, Z) on the marketing profit function. The slope of the line, Z/I , that connects the origin $(0, 0)$ to the point (I, Z) is the average rate of return for that particular performance (Figure 2-2). Marketing managers often track the average rate of performance, AROR, from a given level of investment from period to period on the marketing dashboard to warn of changes in the marketing environment.

Figure2-2 Measuring the AROR For a Single Performance



Measuring The AROR for Any Level of Investment.

It becomes obvious when given the concave shape of the profit function the value of the AROR (the slope of the line, Z/I) changes with every different level of investment (Figure 2-3). The task of predicting the average rate of return for any level of investment requires a complete description of the profit function, $Z = f(I)$. The average rate of return for any point on the profit function is defined as the profit function divided by the amount of investment,

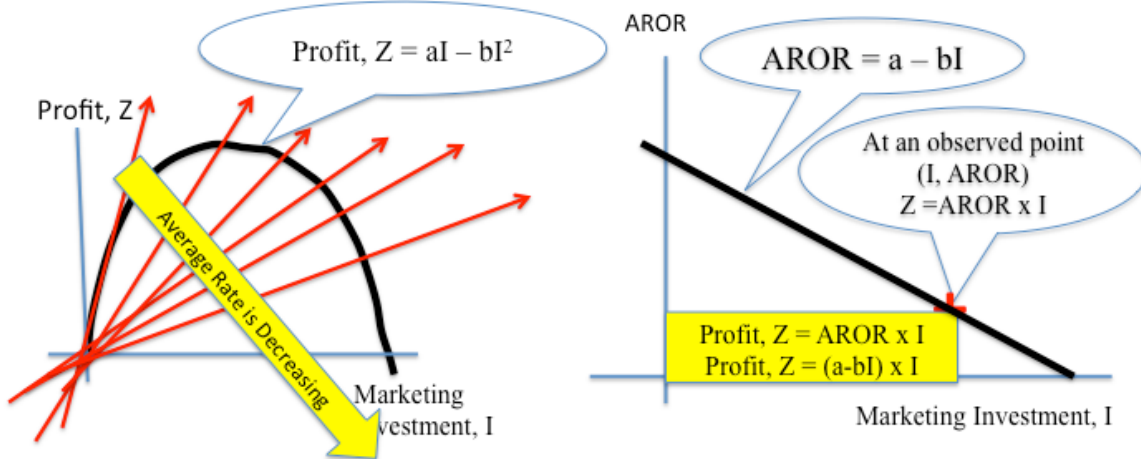
$$\text{Average Rate of Return, AROR} = f(I)/I$$

$$\text{Average Rate of Return, AROR} = (aI - bI^2) / I$$

$$\text{Average Rate of Return, AROR} = a - bI$$

Calculating the average rate of return at any point on the quadratic equation requires estimates of the values of the constants, a & b, in the marketing profit function.

Figure 2-3: Calculating the AROR for any Point on the Profit Function



Important Characteristics of AROR

A list of the most important characteristics of a marketing investment's average rate of return, AROR, include:

- 1) AROR is a function of the investment's size

$$\text{AROR} = f(I)$$

$$\text{AROR} = a - bI$$

This implies that the rate of return is not independent of the investment and that the rate of return depends on the size of the investment.

2) The average rate of return curve or function as illustrated in Figure 2-3 is a straight line. This implies that the amount of profit defined by the area (AROR x I) is small when the investment is small, increases as the investment becomes larger, and becomes small again when the investment is large.

3) The average rate of return curve or function as illustrated in Figure 2-3 is a straight line with a negative slope. The negative slope implies that the average rate at which profit is being returned is always slowing down as the size of the investment is increasing.

4) The highest AROR or fastest rate of return occurs when the amount of investment is smallest. This implies that a policy of seeking to maximize profit by maximizing the AROR is counterproductive.

5) The value of the AROR provides **NO CLUE** as to the optimal size of the investment.

The most important role for the average rate of return is the part that the AROR plays in the definition of marketing profit, Z, being the product of the marketing investment's AROR times the size of the marketing investment, I.

$$\text{Marketing Profit, } Z = \text{AROR} \times (\text{Investment, } I)$$

$$\text{Marketing Profit, } Z = (a - bI) \times (I)$$

$$\text{Marketing Profit Function, } Z = aI - bI^2$$

A Numerical Example of a Marketing Investment's AROR

For a simple example let us assume that a coffee shop has a quadratic relationship between profit and seller's investment in hiring servers to increase the service component of product quality. Market research has established that the amount of profit varies with the number of servers that are hired and relationship is described by the equation

$$\text{Marketing Profit Function, } Z = aS - bS^2$$

where S = the amount invested total servers hired

a = a constant value of 8 estimated by market research

b = a constant value of 0.002 estimated by market research

The amount of profit, Z, at any proposed level of service, S, at the coffee shop can be calculated with the equation

$$\text{Marketing Profit, } Z = 8S - 0.002S^2$$

For example, the total marketing profit generated for an investment in a service level of S = \$3,000 (Figure 2-4) is calculated as

$$\text{Marketing Profit, } Z = 8(\$3,000) - 0.002(\$3,000)^2$$

$$\text{Marketing Profit, } Z = \$24,000 - 0.002(\$9,000,000)$$

$$\text{Marketing Profit, } Z = \$24,000 - \$18,000 = \$6,000$$

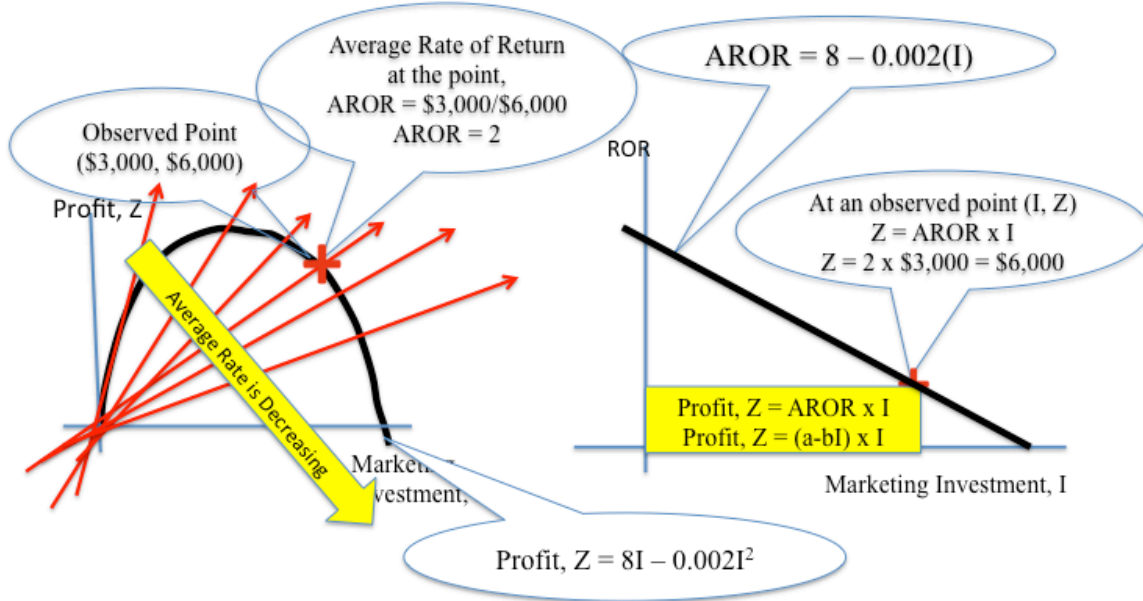
The quadratic equation for marketing profit decomposes into the product of the average rate of return, AROR, times the level of the service investment, S

$$\text{Marketing Profit, } Z = (8 - 0.002S) \times S$$

where the average rate of return, AROR, is a linear function of the amount spent on the service level,

$$\text{AROR} = 8 - 0.002(S)$$

Figure 2-4: A Numerical Example of AROR



The negative slope of the linear equation describing the average return on investment ensures that the magnitude of the AROR is always decreasing as the level of investment is increasing. For example, the magnitude of the AROR at an investment of level, $S = \$1,500$, is calculated as

$$\text{AROR} = 8 - 0.002(\$1,500) = 5 \text{ or } 500\%$$

The magnitude of the AROR at an investment of level, $I = \$3,000$, (Figure 2-4) is calculated as

$$\text{AROR} = 8 - 0.002(\$3,000) = 2 \text{ or } 200\%$$

The average speed (i.e., rate) at which profit is being generated becomes slower and slower as the seller's investment in service level gets larger and larger. The functional relationship in which the slope of the line representing the average rate of return is always decreasing (i.e., a shallower slope) as the level of investment is increasing is illustrated in Figure 2-7.

The functional relationship between the average rate of return and the investment size appears more dramatic when the investment's rate of return is plotted on the y-axis and the level of investment, I, is plotted on the x-axis. The linear equation that defines the average rate of return at any level of investment is a downward sloping line with the value of the y-intercept equal to the value of the constant, $a = 8$. The area defined as the product of the investment level, I^* , times the magnitude of the AROR* represents the amount of profit being generated. The reduction in the rate of return as a function of investment is the single most important point of differentiation between managing marketing investments and managing financial investments.

A Marketing Investment's Marginal Rate of Return, MROR

An investment's marginal rate of return, MROR, can be described as the rate at which profit is being generated by the last dollar invested. That is to say, the focus of the marginal rate of return is the incremental profit, ΔZ , generated by last increment made to the investment, ΔI . The marginal rate of return stands in sharp contrast to the investment's average rate of return.

The average rate of return at a single point on the profit function is the ratio of the total profit to the total investment; whereas the marginal rate of return, MROR, at a single point is the ratio, $\Delta Z/\Delta I$, of small change in the profit, ΔZ , to the last small change in the size of the investment, ΔI .

To Estimate the MROR at a Single Point

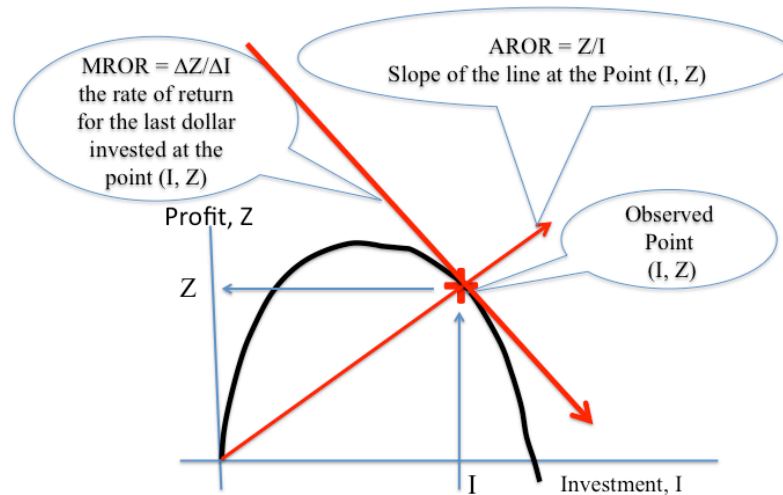
In order to estimate the MROR at a single point (I, Z) on the marketing profit function, it is necessary to have two observations of an investment's performance (I_1, Z_1) and (I_2, Z_2) as illustrated in Table 2-1. The estimate of the MROR at the point (I, Z) is the ratio of the $\Delta Z/\Delta I$ where $\Delta Z = Z_2 - Z_1$, and the $\Delta I = I_2 - I_1$.

Table 2-1: Estimating MROR at a Single Point

	Observation #1 (I_1, Z_1)	Observation #2 (I_2, Z_2)	$\Delta = \#2 - \#1$
Investment, I	I_1	I_2	$\Delta I = I_2 - I_1$
Rate of Return	$AROR = Z_1/I_1$		MROR = $\Delta Z/\Delta I$
Profit, Z	Z_1	Z_2	$\Delta Z = Z_2 - Z_1$

The estimate of the MROR is more accurate when the difference, $\Delta I = I_2 - I_1$, between the investment in observation 1 and the investment in observation 2 is very small. In more formal terms the MROR is the slope of the profit function $Z = f(I)$ at the point (I, Z) as illustrated in Figure 2-5. A curious feature of the marginal rate of return is that the marginal rate at a point can have a negative slope even though the average rate at the same point has a positive slope (Figure 2-5).

Figure 2-5: Comparing the Slopes of AROR and MROR at a Single Point



Predicting the Marginal Rate of Return For Any Size of Investment

The marginal rate at which profit is being returned at any point on the profit function can be calculated by finding the first derivative of the profit function with respect to the size of the marketing investment,

Marketing Profit Function, $Z = aI - bI^2$

First derivative of the Profit Function, $\Delta Z/\Delta I = a - 2bI$

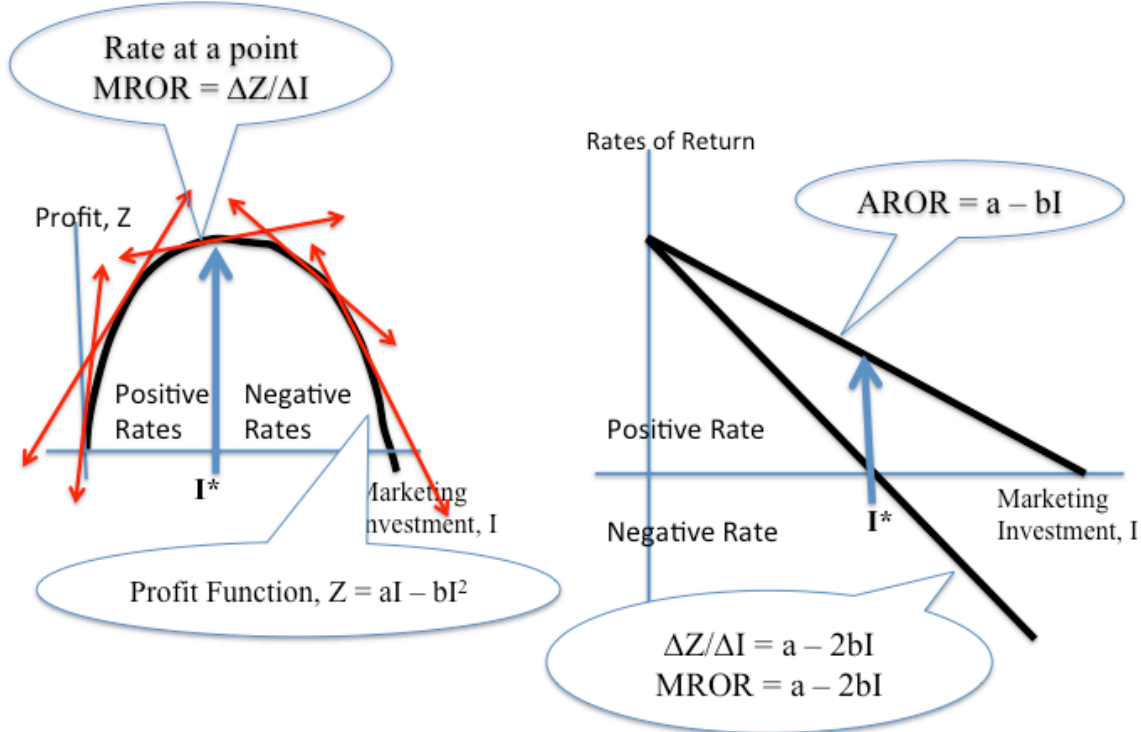
MROR, $\Delta Z/\Delta I = a - 2bI$

The marketing investment’s marginal rate of return, MROR has a number of important characteristics. These include the following:

- 1) MROR is a function of the investment’s size
 $MROR = f(I)$
 $MROR = a - 2bI$
- 2) The rate of return is not independent of the investment and the rate of return depends on the size of the investment.
- 3) The marginal rate of return curve or function is illustrated in Figure 2-6 has a straight line with a negative slope.
- 4) The negative slope implies that the marginal rate at which profit is being return is always slowing down as the size of the investment is increasing.
- 5) The MROR is positive when the size of the investment is small and the marginal rate becomes slower as the investment becomes larger. When the investment becomes larger than the optimal size, then the rate of return becomes negative.
- 6) The value of the MROR DOES provide a clue as to the optimal size of the investment. When the value of the MROR is equal to zero, $MROR = 0$, then the optimal level of the investment has been reached and the maximum amount of profit is being generated.

- 7) Total profit is decreased when the expenditure on an investment with a negative MROR is increased. Marketing managers seek to reduce their expenditures on investments that exhibit negative marginal returns.
- 8) A policy of maximizing the marginal rate of return in order to maximize profit is a counter productive strategy.

Figure 2-6: The MROR at Many Points and The MROR Curve



A Numerical Example of a Marginal Rate of Return

The coffee shop's performance reported in Table 2-2 provides a numerical example. When the level of investment is $I_1 = \$1,500$, then the profit is $Z_1 = \$7,500$. When the investment is increased by \$500 to $I_2 = \$2,000$, then the profit is increased by \$500 to $Z_2 = \$8,000$. The marginal rate of return, $\Delta Z/\Delta I$, at an investment of $I = \$1,500$ is estimated to have a positive value.

$$MROR = \Delta Z/\Delta I = \$500/\$500 = +100\%$$

Table 2-2: Estimating the MROR at a Single Point Takes Two Observations

	Observation #1	Observation #2	$\Delta = \#2 - \#1$
Observed Investment, I	$I_1 = \$1,500$	$I_2 = \$2,000$	$\Delta I = I_2 - I_1$ $\Delta I = \$2,000 - \$1,500$ $\Delta I = \$500$
Calculated Rate of Return	$AROR = Z_1/I_1$ $AROR =$ $\$7,500/\$1,500$ $AROR = 500\%$		$MROR = \Delta Z/\Delta I$ $MROR = \$500/\500 $MROR = 100\%$
Observed Profit, Z	$Z_1 = \$7,500$	$Z_2 = \$8,000$	$\Delta Z = Z_2 - Z_1$ $\Delta Z = \$8,000 - \$7,500$ $\Delta Z = \$500$

When the level of investment is increased from $I_2 = \$2,000$ to $I_3 = \$3,000$ then profit decreases from $Z_2 = \$8,000$ to $Z_3 = \$6,000$ as illustrated in Table 2-3. An increase in the level of investment, $\Delta I = \$1,000$, results in a decrease in the level of profit, $\Delta Z = -\$2,000$.

The marginal rate of return, $\Delta Z/\Delta I$, at an investment of $I_2 = \$2,000$ is estimated to have a negative value,

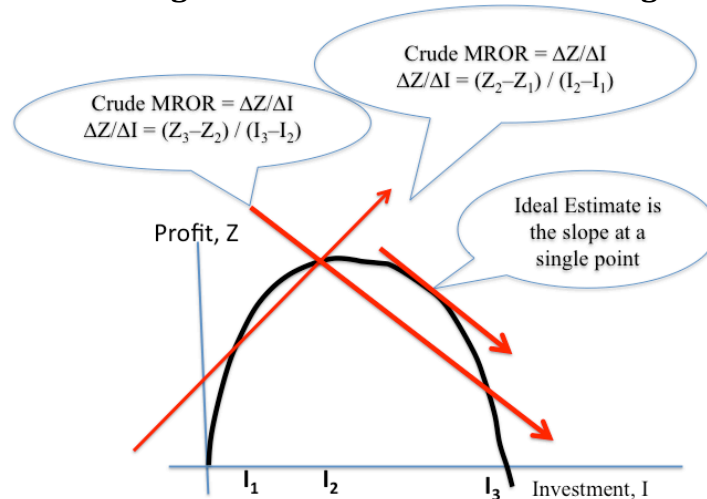
$$\text{MROR at } \$2,000 = \Delta Z/\Delta I = -\$2,000/\$1,000 = -200\%$$

Table 2-3: Finding a Negative MROR and a Positive AROR

	Observation #2	Observation #3	$\Delta = \#3 - \#2$
Observed Investment, I	$I_2 = \$2,000$	$I_3 = \$3,000$	$\Delta I = I_3 - I_2$ $\Delta I = \$3,000 - \$2,000$ $\Delta I = \$1,000$
Calculated Rate of Return	$\text{AROR} = Z_2/I_2$ $\text{AROR} =$ $\$8,000 / \$2,000$ AROR = 400%		$\text{MROR} = \Delta Z/\Delta I$ $\text{MROR} =$ $\$-2,000 / \$1,000$ MROR = -200%
Observed Profit, Z	$Z_1 = \$8,000$	$Z_2 = \$6,000$	$\Delta Z = Z_2 - Z_1$ $\Delta Z = \$6,000 - \$8,000$ $\Delta Z = -\$2,000$

However, an inspection of the profit function in Figure 2-7 demonstrates that the slope at the level of investment, $I_2 = \$2,000$ is positive rather than negative. Using large changes in the levels of investment, such as the changes in Table 2-3, lead to inaccurate estimates of an investment's marginal rate of return. Very small changes in the level of investment lead to more accurate estimates of the MROR. However, the most accurate estimate of an investment's marginal rates of return is calculated by taking the first derivative of the investment's fully articulated marketing profit function, $Z = aI - bI^2$.

Figure 2-7: Illustrating Crude Estimates of MROR Using Large Changes



Continuing with the numerical example of the Coffee Shop used above, we remember that the profit equation for the coffee shop's investment in servers and service level, S , was fully articulated when the values of the two constants, a & b , were provided by market research.

$$\text{Coffee Shop Profit Function, } Z = 8I - (0.002)I^2$$

The investment's marginal of return, $\Delta Z/\Delta I$, for any proposed level of investment in the coffee shop service is calculated using the first derivative of the profit function,

$$\text{MROR} = \Delta Z/\Delta I = 8 - 2(0.002)I$$

The marginal rate of return at an investment level of $I_1 = \$1,500$ is calculated as

$$\text{MROR for an investment of } \$1,500 = 8 - 2(0.002)(\$1,500)$$

$$\text{MROR for an investment of } \$1,500 = 8 - 6 = 2 \text{ or } +200\%$$

The marginal rate of return at an investment level of $I_3 = \$3,000$ is calculated as

$$\text{MROR for an investment of } \$3,000 = 8 - 2(0.002)(\$3,000)$$

$$\text{MROR for an investment of } \$3,000 = 8 - 12 = -4 \text{ or } -400\%$$

The two estimates of MROR using the first derivative of the marketing profit function are considerably more accurate than the ratio of the large differences used for the estimates in Tables 2-2 and 2-3. The marginal rate of return has many important applications in managing marketing investments. Some of the most important applications of the investment's MROR are in estimating the optimal level of marketing investment, I^* , and in measuring the elasticity of the investment's rate of return. These topics will be discussed in future chapters.

Comparing and Contrasting Marketing Investment's MROR and AROR

The two rates of return associated with marketing investments have several characteristics in common and several crucial differences. These include:

- 1) Both the MROR and the AROR are reported as percentage rates of return on the amount of money invested in the offering's value to the customer.
- 2) Both the MROR and the AROR are linear functions of the investment's size with a negative slope (Figure 2-6); however, the MROR decreases in speed twice as fast as the AROR.
- 3) A single observation of marketing investment's performance is sufficient to calculate the investment's AROR = Z/I at the point, (I, Z) : however it requires two observations of investment's performance, (I_1, Z_1) and (I_2, Z_2) , to estimate the investment's MROR = $\Delta Z/\Delta I$ at a point.
- 4) The AROR remains positive as the size of the investment increases, whereas the MROR can be positive or negative depending on the size of the investment.
- 5) The AROR provides no clue as to the optimal level of investment that maximizes profit, however when the MROR is equal to zero, then the optimal level of investment has been reached.
- 6) Both the MROR and the AROR become smaller (i.e., the rates become slower) as the size of the investment becomes larger.

7) Both MROR and AROR have their fastest rates of return when the marketing investment is smallest and both functions confirm that a policy of maximizing a rate of return to maximize profit is a counter productive policy (Figure 2-8).

