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Determination of a "Benchmark" Rate of Return for Regulated Small Telephone Utilities in the State of Michigan

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DETERMINATION OF A "BENCHMARK" RATE OF RETURN FOR REGULATED SMALL TELEPHONE UTILITIES IN THE STATE OF MICHIGAN

by

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DETERMINATION OF A "BENCHMARK" RATE OF RETURN FOR REGULATED SMALL TELEPHONE UTILITIES IN THE STATE OF MICHIGAN

Gondy Bhaskara Rao, D.P.A.

Western Michigan University, 1988

This study presents an approach that is consistent with regulatory standards of fairness, and enables the Public Service Commission staff to determining "benchmark" rates of return for Michigan's small telephone utilities. It applies only where they are either subsidiaries of holding companies or independently operating but whose securities are not publicly traded.

The methodology developed in this research is couched in the capital asset pricing framework and is powerful enough to capture the parent-subsidiary relationship to the ultimate determination of benchmark rates of return for utilities that have similar risks.

To evaluate the methodology for consistency with the regulatory standards, first, a set of descriptive examples was used; second, the approach was applied to the determination of return rates on equity capital of small and large telephone companies. The approach adopted in this research is general and can be applied to electric as well as natural gas utilities. In addition, tests of hypotheses between the expected, authorized, and earned rates of return were conducted using the student's _t_-test.

The major findings of the study are: (a) the traditional double leverage approach advocated by its proponents and the independent company approach advocated by its proponents are, in general, inconsistent with the regulatory standards of fairness; (b) if the unlevered beta of parent's capital structure is equal to the levered beta of parent's consolidated capital structure, it is immaterial whether one uses the parent's capital structure or parent's consolidated capital structure for the estimation of cost of equity capital of a subsidiary; (c) the study provides a method for estimating the subsidiary's beta even if its securities are not publicly traded; (d) the benchmark rate of return for 32 independently operating telephone companies, based on a benchmark capital structure, 60% and 40% equity, is found to be 13%; and (e) the null hypothesis that there is no difference between the means of earned and authorized rates for 32 companies is rejected at the 1% level of significance, whereas for the eight subsidiaries of holding companies, the null hypothesis is accepted.

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CHAPTER I

INTRODUCTION

Regulatory agencies are particularly concerned about the magnitude of resources utilized in rate case proceedings while resolving the controversies attendant with determination of fair rates of return. This concern applies particularly to utilities that are either subsidiaries of their holding company systems or independently operating, and whose securities are not publicly traded. There does not exist consensus so far on the indirect approaches adopted by different parties to arrive at a fair rate of return consistent with regulatory standards of fairness. To minimize the resources involved and to avoid the costly and time-consuming rate case proceedings, Commissions across the country are searching for administratively efficient procedures that would provide, on a timely basis, "benchmark" rates of return for the utilities that have common characteristics.

Purpose of Research

The purpose of this research is two-fold. First, it attempts to resolve the existing controversies relating to the methodologies commonly used for the determination of the cost of capital to the regulated utilities that are either subsidiaries of holding companies or independently operating, and whose securities are not publicly traded. Second, it develops an administratively efficient framework which would establish on a timely basis "benchmark" rates of return for utilities that have similar risk.

The study focuses on the following issues:

1. What approach or approaches are consistent with the generally accepted standards of public utility regulation?

2. Why is a particular method preferred to others for the determination of a benchmark rate of return for utilities that have similar risk?

3. Would the selected method provide a fair and equitable rate of return for benchmark purposes?

Limitations

The thrust of this research is limited to the determination of benchmark rates of return of small telephone companies that are either independently operating or subsidiaries of holding company systems, and which are regulated by the Michigan Public Service Commission. Further, the effects of diversification of an independently operating telephone utility or a public utility holding company into subsidiaries of unequal risk will not be addressed, although the analysis can readily be extended to identify the impact of diversification on the cost of capital of a holding company.

Summary of Findings

1. In general, the double leverage approach (parent unconsolidated capital structure approach), as traditionally practiced by its advocates, fails to satisfy the regulatory standards of fairness. The regulatory standards of fairness will be satisfied only if (a) both the parent and its subsidiary or subsidiaries maintain identical debt-to-equity ratios and (b) the levered betas of the subsidiaries, if they can be determined, are equal to the unlevered beta of the parent ($\beta^L_{si} = \beta^U_p$). The proof of this statement is provided in Appendix B (page 169).

2. The traditional consolidated capital structure approach to double leverage fails, in general, to satisfy the regulatory standards of fairness. It will satisfy the regulatory standards only if all the subsidiaries have the same debt-to-equity ratios as that of the consolidated system (page 80, and Appendix C, page 209).

3. If $\beta^L_c = \beta^U_p$, i.e., the levered beta of the consolidated system is equal to the unlevered beta of the parent, then both the parent capital structure approach and the consolidated capital structure approach will provide identical results for the cost of capital of a subsidiary. An example to illustrate this case is presented in Appendix C (pages 193-208).

4. The "benchmark" rate of return for 32 independently operating telephone companies, based on the benchmark capital structure,

60% debt and 40% equity, is 13% (Appendix C, page 193). The benchmark rate of return was derived from the relationship:

$$K_b^L = 10.81 + (1.4718)\ (\frac{D_S}{E_S})$$

5. The earned rates of return of 32 independent small telephone companies, as presented in Table 15 (pages 106-107), indicate that, on the average, the companies have earned about 5% more than their average authorized rates during 1982-1986.

6. The expected, authorized, earned rates of return of the eight telephone subsidiaries, as shown in Table 16 (page 109), indicate that the companies, on the average, have earned their authorized rates of return, whereas the earned rates of return of the large telephone companies were higher than their authorized rates of return.

7. The earned rates of return of the small independent telephone companies having debt ratios greater than 55% were almost 7% higher than their authorized rates of return during the period 1982-1986 (Table 21, pages 125-126). In contrast, the earned rates of return of these small telephone companies having debt ratios less than 55% were only 1% higher than their authorized rates (Table 22, page 128). The impact of higher leverage is evident in the case of the group of companies that have had debt ratios greater than 55%.

8. The null hypothesis that there is no difference between the means of the earned rates and authorized rates of return for the 32

independently operating small telephone companies was rejected at the 1% level of significance (Table 15, page 106 and page 123).

9. The null hypothesis that there is no difference between the means of the authorized and expected rates of return for the 32 independently operating companies was rejected at the 5% level of significance (Table 15, page 106 and page 124).

10. The null hypothesis that there is no correlation between the authorized and earned rates of return of the 32 independent telephone companies was rejected at the 1% level of significance (Table 15, page 106 and page 124).

11. The null hypothesis that there is no difference between the means of the authorized and earned rates of return of small telephone companies that have debt ratios greater than 55% was rejected at the 1% level of significance (Table 21, pages 125 and 126).

12. The null hypothesis that there is no difference between the means of the authorized and expected rates of return of small telephone companies having debt ratios greater than 55% was rejected at the 1% level of significance (Table 21, pages 125 and 127).

13. The null hypothesis that there is no difference between the means of the authorized and earned rates of return of small telephone companies that have debt ratios less than 55% was accepted (Table 22, pages 127 and 128).

14. The null hypothesis that there is no difference between the means of authorized and expected rates of return of small

telephone companies that have debt ratios less than 55% was rejected at the 1% level of significance (Table 22, pages 128 and 129).

15. The null hypothesis that there is no difference between the mean earned rates of return of Group A (having a debt ratio greater than 55%) and Group B (having a debt ratio less than 55%) was rejected at the 1% level of significance (Tables 21 and 22, pages 125, 128, and 129).

16. The null hypothesis that there is no difference between the means of the authorized and expected rates of return of the subsidiaries of holding companies was accepted (Table 16, page 109).

17. The null hypothesis that there is no difference between the mean earned rates of return of independently operating telephone companies and subsidiaries of holding companies was rejected (Tables 15 and 16, pages 106, 109, and 130).

18. There was a significant negative correlation at the 5% level between the authorized and earned rates of return of the subsidiaries of holding companies, in contrast to the significant positive correlation between the authorized and earned rate of return of independently operating telephone companies (Tables 15 and 16, pages 106, 109, and 131).

Conclusions

The theoretical results in this study indicate that the traditional double leverage methodologies cannot be applied under all circumstances. The appropriate application of a particular method--subsidiary pricing approach (the so-called independent company approach), parent unconsolidated capital structure approach, or parent consolidated capital structure approach--will depend on the institutional and the legal form of business organization under which a utility operates. The superiority of the methods advocated in this study over the traditionally practiced methods is argued on the basis of three major advantages. First, the methods try to remove the leverage effect at the parent level, consolidated system's level, or the comparable group level. Second, they utilize the capital structure ratios of the individual companies. Finally, they use the marginal cost rates on debt capital of the companies instead of their embedded cost rates, while determining the current return rates on the equity capital and the benchmark rates of return.

The advantages of these methodologies are assessed in terms of actual rate case examples of large as well as small telephone companies. The validity and effectiveness of these methodologies are much more clear in the case of small telephone companies that have had large portions of subsidized debt in their capital structures. For instance, on one hand, in the case of Chatham Telephone Company, a subsidiary of Telephone and Data Systems, the traditional consolidated capital structure approach would have authorized the company an equity return rate in excess of 25%. The methodology developed in this study, on the other hand, would provide a 14.4% return rate, which is significantly lower than 25% (see Appendix C, pages 209-217).

The empirical results--the "benchmark" rates of return that were derived using the methodologies--are consistent with the current financial market conditions. The power of the techniques lies in their ability to capture the riskiness of the parent's investment in the subsidiary after removing the parent's leverage effect while taking into account the regulated company's business and financial risks. In this way the costs to the ratepayer are minimized by eliminating the monopoly profits of the parent's investment in the subsidiary, even while awarding the proper return on the parent's investment in its subsidiary according to the risks to which the investment is exposed due to the presence of the leverage of the subsidiary. This is the only way the public interest can be maximized.

The study provides a rational basis for sound policy making in the area of rate-of-return regulation. Further, it will enable the Public Service Commission staff to determine the market-based "benchmark" rates of return for Michigan utilities on a timely basis, thereby minimizing, though not eliminating, the costly adversary rate case proceedings.

CHAPTER II

REVIEW OF THE LITERATURE

Public Interest Concerns of Regulators

The goal of a regulatory agency is to allow a rate of return to the utility that balances the legitimate interests of the utility's shareholders and its ultimate ratepayers. These interests generally provide certain "guideposts" for the determination of a fair and equitable return rate under given circumstances. At the same time, these standards must ensure a careful balance between the need for accuracy and a timely procedure that would enable commissions to exercise their expertise and discretion.

Regulatory commissions across the country have been searching for some time to find alternative ways for minimizing the resources that are expended in contested rate case proceedings. The "benchmark" rate of return approach is one of the alternatives to fully litigated adversarial proceedings. It is argued that the "benchmark" rate of return approach will mitigate the regulatory lag and market uncertainties and maximize the resources of the parties involved, i.e., the utility, commission, and all other parties appearing before the commission.

The development of a set of procedures for determining "benchmark" rates of return for regulated utilities whose securities are not publicly traded is a complex undertaking due to the nature of the utilities' operations as well as the legal forms of organization under which they operate. For instance, some utilities are part of their parent holding company structures, whereas others are independently operating utilities. Among the parent holding companies, some have their own debt in their capital structures and have diversified into related as well as unrelated businesses. The "benchmark" rate of return process will have to take these factors into consideration while determining the appropriate return rate to be authorized for a specific utility.

In particular, the determination of a "fair" rate of return on the parent's investment in its subsidiaries becomes complicated if the parent holding company and its subsidiaries simultaneously carry debt in their respective capital structures mainly because of double leverage.

In the context of capital structure theory, the word leverage means use of debt capital to enhance the earnings on common stock. Double leverage implies use of borrowed capital twice: first at the parent level and second at the subsidiary level. That is, the parent holding company and its subsidiary employ debt capital to increase the earnings on common stock.

Figure 1 shows that the parent and its subsidiary utilize debt capital. It also points out the way the parent and its subsidiary obtain the needed funds from external sources to purchase the assets that support the rate base. It depicts a single holding company

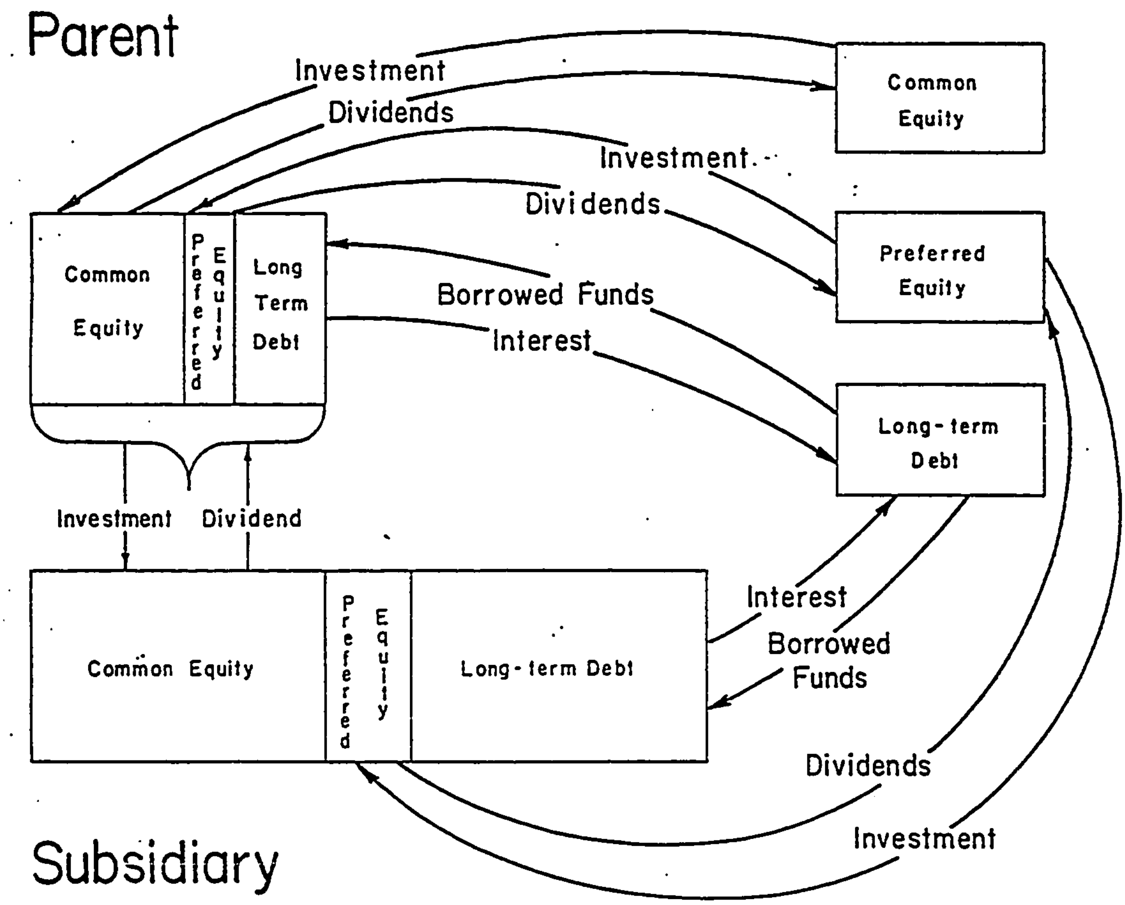


Figure 1. External Fund Sources.

Note. From Habr, D. S. (1987, February 24). The Role of Double Leverage in Determining the Cost of Capital for a Regulated Subsidiary of a Holding Company. Washington, DC: National Association of Regulatory Utility Commission Ad Hoc Committee on Diversification.

that owns 100% of its subsidiary's common equity. The parent and the subsidiary obtain their debt and preferred stock capital in the open market, but the subsidiary, on its own, cannot issue common stock. The parent issues the new common shares and sells them in the open market. The subsidiary's only source of common equity is to obtain it from its parent. If the subsidiary wants to have additional capital from its parent, the parent may supply the desired capital to its subsidiary by purchasing the new issues of its common stock. The parent may finance its purchase of the subsidiary's common stock with borrowed debt or preferred stock or allow the subsidiary to pay out less than 100% of its earnings as dividends. If the parent finances the subsidiary's new common stock issues with debt or preferred stock, it will magnify its earnings because debt and preferred stock cost less than the cost of common equity.

The implication of "double leverage" in the context of a holding company system is that the parent company attempts, either directly or indirectly, to earn a return in excess of its cost of capital at the expense of the ratepayer. Conventional regulation tries to curtail returns that are in excess of the parent's cost of capital.

Regulatory commissions are particularly concerned with the problem of determining a fair rate of return to a subsidiary they regulate, if a portion of the subsidiary's common stock is financed by the parent with borrowed debt. This is due to the fact that if the parent company borrows debt at a lower rate (since the cost rate on debt is generally lower than the cost rate on equity capital) and invests that money in the common stock of its regulated subsidiary, the return rate on the parent's investment in its subsidiary will be magnified. For instance, if the parent borrows money at 6% and purchases the common stock of its subsidiary, which is expected to earn a 16% return, the 10% differential represents the profit in excess of its cost. This phenomenon has important implications in the area of public utility regulation, especially to the telecommunications industry. It is argued by the proponents of double leverage that the veil of the holding company system allows its investors to earn more than their cost of capital by investing in utility operating companies.

Figure 2 is an extension of the existence of double leverage if the parent has two wholly owned subsidiaries, A and B. It shows that the parent uses its capital to buy the common stock of its subsidiaries in order to increase its earnings over and above its cost of capital. The parent invests its capital--debt and equity--on an equal basis in its subsidiaries.

Table 1 shows the balance sheets of the parent and its subsidiaries. It is assumed that the parent has invested its capital in the two subsidiaries in the same proportions as its capital structure.

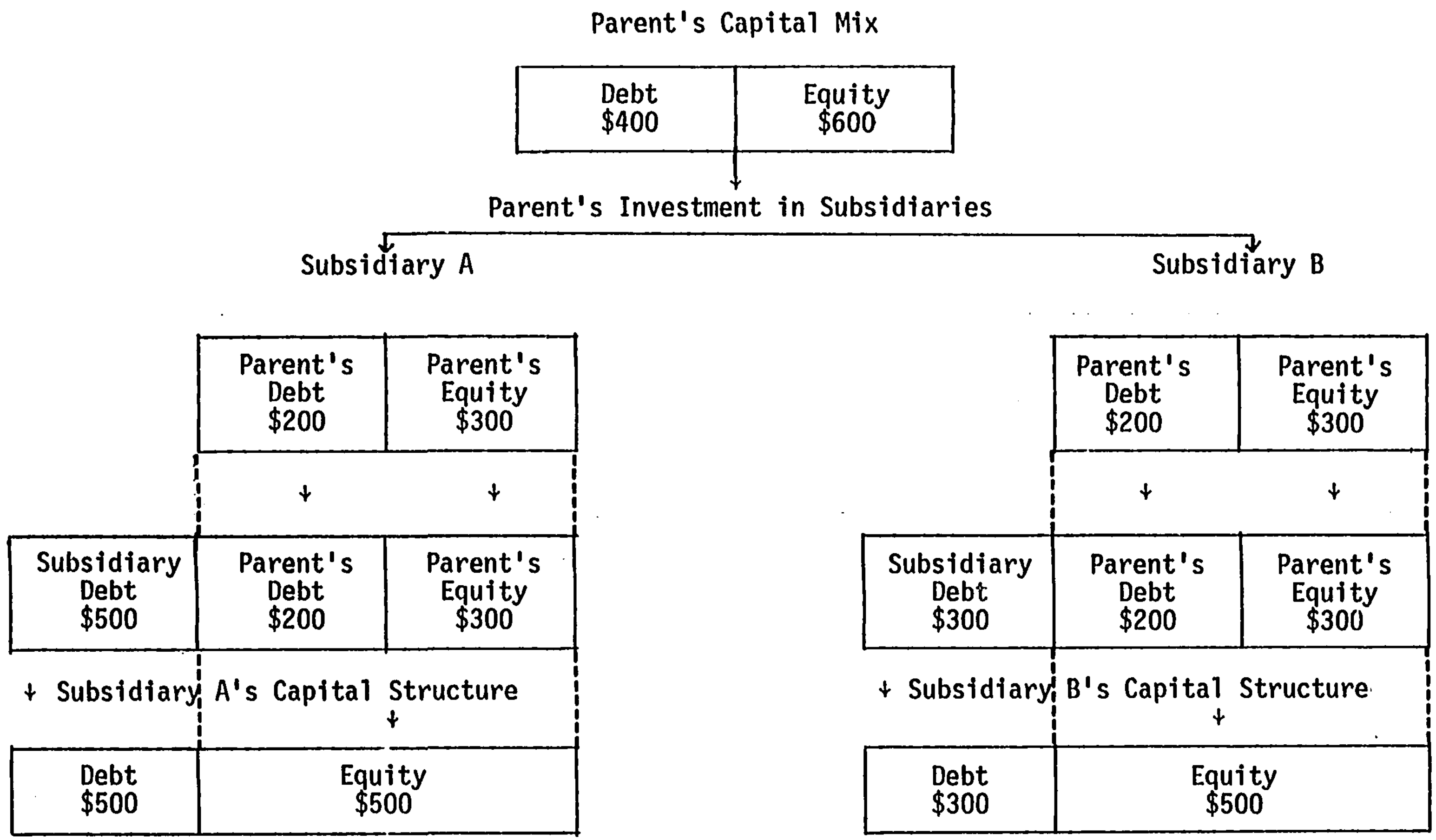


Figure 2. Implications of Double Leverage.

Table 1

Balance Sheets of Parent and Subsidiaries

Parent Company

Assets		Liabilities and Equity	
Sub. A Equity:	$ 500	Debt:	$ 400
Sub. B Equity:	$ 500	Equity:	$ 600
	$1000		$1000

Subsidiary A

Assets		Liabilities and Equity		
Plant:	$1000	Sub. Debt:		$ 500
		Sub. Equity:		$ 500
		Parent's Debt:	$200	
		Parent's Equity:	$300	
	$1000			$1000

Subsidiary B

Assets		Liabilities and Equity		
Plant:	$800	Sub. Debt:		$ 300
		Sub Equity:		$ 500
		Parent's Debt:	$200	
		Parent's Equity:	$300	
	$800			$ 800

Table 2 shows the cost of capital of the parent and its subsidiaries. It is assumed that the cost rate on debt and equity were 10% and 15%, respectively, and the equity holders pay their income taxes at a rate of 50%.

Table 2

Determination of Cost of Capital of Parent and Subsidiaries

Type	Amount	Cost Rate	Total Cost	Total Revenue Requirement
		1. Parent's Cost of Capital		
Debt	$ 400	10%	$ 40	$ 40
Equity	$ 600	15	$ 90	$180
Total	$1000		$130	$220
		2. Subsidiary A's Cost of Capital		
Debt	$ 500	10%	$ 50	$ 50
Equity	$ 500	15	$ 75	$150
Total	$1000		$125	$200
		3. Subsidiary B's Cost of Capital		
Debt	$ 300	10%	$ 30	$ 30
Equity	$ 500	15	$ 75	$150
Total	$ 800		$105	$180

The revenue requirements of the subsidiaries and the parent are:

Subsidiary's combined revenue requirement = $200 + $180 = $380

Return to parent is calculated as follows:

Total subsidiary's revenues	$380
Total system interest expense	- 120
Net operating income	$260
50% tax	- 130
Net income	$130

Return to parent = $130/$600 = 21.67%

The analysis reveals that the parent, by borrowing at a 10% interest rate and investing the same amount in the common stock of its subsidiaries, has been able to increase its equity return from 15% to 21.67%. The excess return, 6.67%, is attributable to the use of leverage at both the parent and subsidiary levels.

There has been considerable debate by some commissions on the adoption of double leverage methodologies for the determination of the required return rate on the parents' investment in its subsidiaries. This debate has not been satisfactorily resolved. There exist fundamental differences among the concerned parties. The proponents of double leverage theory, Backman and Kirsten (1972), Copeland (1977), Seeds (1978), Rozeff (1984), and Habr (1987), argue that under competitive economic conditions, the rules of capital budgeting require that firms should undertake investments until the internal rate of return of the last investment just equals the cost of capital to the firm. This standard, when applied to a holding company, would require that the parent company should be limited in its return from its investment in the subsidiaries to its weighted average cost of capital.

Opponents of double leverage methodologies, Brennan and Humphreys (1973), Lerner (1973), Brown (1974), Fitzpatrick (1977), Jones and O'Donnell (1978), and Pettway and Jordan (1983), maintain that the source of funds is not the relevant criterion for the assessment of proper returns to the parent. Rather, it is the ultimate risk to which a particular firm's investment is exposed. Their contention is that the application of double leverage theory is illogical and inconsistent with finance theory and, therefore, should be rejected.

In an attempt to determine the cost of equity capital for independently operating utilities whose securities are not publicly traded, and to minimize or eliminate the effect of double leverage in the parent-subsidiary relationship, regulatory commissions have in recent years adopted certain indirect approaches. These are: the (a) "independent company" (stand alone or subsidiary pricing) approach, (b) "double leverage" (parent capital structure) approach, and (c) "consolidated capital structure" approach.

Independent Company Approach

This approach considers the operating subsidiary as if it were an independent company and estimates its cost rate on equity capital as the rate on equity capital to firms of comparable risks. In other words, it would allow the parent's investment in the subsidiary to earn a return equal to the return on equity investments in those independently operating utility companies having comparable risk characteristics. In general, rate of return experts representing utility companies advocate this approach, but a large majority of analysts representing the regulatory commissions do not adopt this approach for the determination of cost rate on equity capital of a subsidiary of a parent holding company, because it completely ignores the parent-subsidiary relationship and its ultimate impact on the cost of equity capital to the subsidiary. This approach is valid for the determination of the cost rate on equity capital of independently operating utilities whose securities are not publicly traded, but it has to be modified in those cases where utilities have borrowed debt in their capital structures.

Double Leverage Approach

This approach is an alternative to the "independent company" approach. It attempts to eliminate the financial advantage accruing to the parent company in a holding company system. If the parent company has debt in its capital structure, then this approach sets the operating company's cost of equity capital as equal to the parent's unconsolidated weighted average cost of capital. In other words, this method argues that the overall cost of capital of the parent should be used as a measure of the cost of equity capital of the subsidiary. This approach is adopted by the regulatory commissions to eliminate the parent's returns on its investment in the subsidiary that are in excess of its actual costs. The commissions advocating this approach argue that the parent's stockholders will be adequately compensated for their actual costs if the parent's investment in its subsidiary earns its own weighted average cost of capital. The opponents disagree.

In practice, the application of the double leverage approach will depend on the way the parent company accounts the retained earnings of its subsidiaries. The subsidiaries generally pay a certain portion of their earnings in the form of dividends. The earnings that are not paid out are called retained earnings. Technically speaking, the retained earnings of the subsidiaries belong to the parent. The parent can account these retained earnings on its balance sheet in two ways, namely, the "equity method" of accounting and the "cost method" of accounting. In the equity method of accounting, the retained earnings of the subsidiaries will appear in both the balance sheets of the parent and its subsidiaries. Figure 3 provides an illustration of the equity method of accounting.

In the equity method of accounting, the total common equity of a subsidiary (if there is a single subsidiary) will equal the total capitalization of the parent. If there are several subsidiaries, the total common equity of all the subsidiaries will equal the total capitalization of the parent. The total common equity reported on the parent's balance sheet will be identical to the common equity of the consolidated balance sheet. Since the total common equity of the subsidiary or subsidiaries is identical to the total capital of the parent, the double leverage approach assigns the weighted average cost of capital of the parent to the equity capital of the subsidiary or subsidiaries. Table 23, Appendix A, provides an example of the equity method of accounting to the double leverage approach.

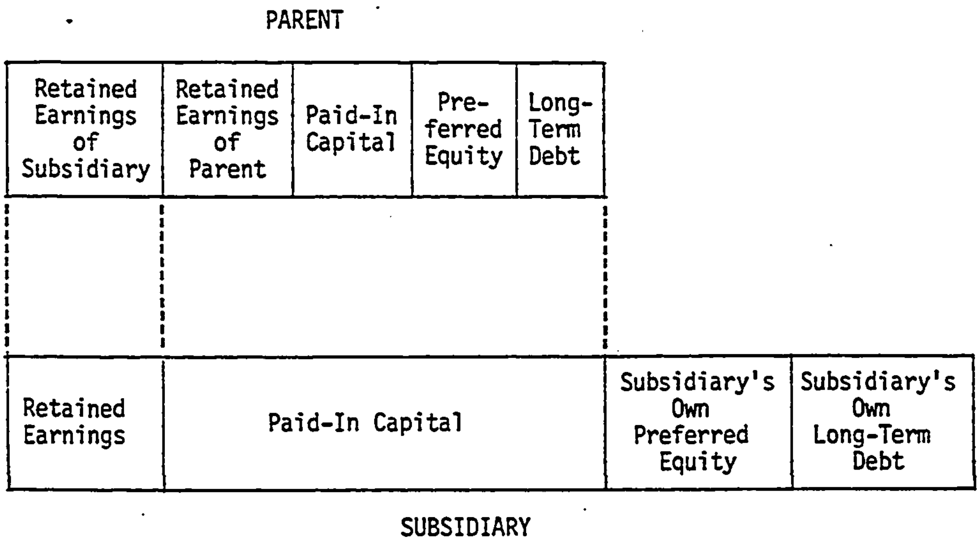


Figure 3. Equity Method of Accounting for Retained Earnings.

Note. From Habr, D. S. (1987, February 24). The Role of Double Leverage in Determining the Cost of Capital for a Regulated Subsidiary of a Holding Company. Washington, DC: National Association of Regulatory Utility Commission Ad Hoc Committee on Diversification.

In the cost method of accounting, the subsidiary's retained earnings do not appear on the parent's balance sheet. Under this approach, the parent's contribution will reflect the subsidiary's paid-in capital. Figure 4 provides an illustration of this approach.

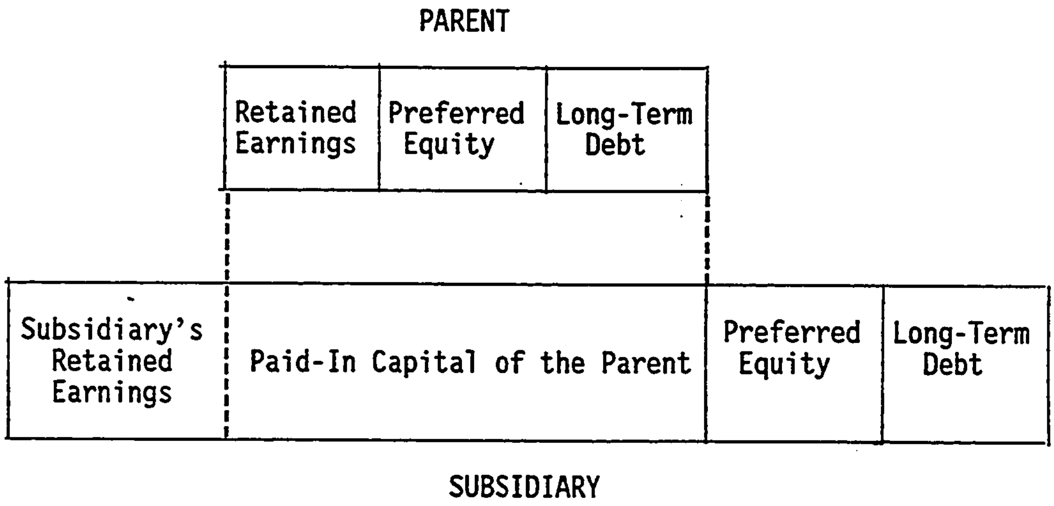


Figure 4. Cost Method of Accounting for Retained Earnings.

Note. From Habr, D. S. (1987, February 24). The Role of Double Leverage in Determining the Cost of Capital for a Regulated Subsidiary of a Holding Company. Washington, DC: National Association of Regulatory Utility Commission Ad Hoc Committee on Diversification.

In the cost method of accounting approach, the subsidiary's paid-in capital or parent's investment in the subsidiary will receive the parent's weighted average cost of capital, and the retained earnings of the subsidiary will receive the parent's common equity cost rate. Table 24, Appendix A, provides an example of the cost method of accounting to the double leverage approach. It should be noted that both the methods will provide the same overall rate of return to the subsidiary. Both the methods have been applied by the staff of the Michigan Public Service Commission to estimate the cost of capital of regulated utilities that are subsidiaries of parent holding company systems. The equity method of accounting to the double leverage approach was applied in Michigan Power Company Rate Case U-4788, in early 1976. The Michigan Public Service Commission elected not to accept the staff's position in U-4788 since the majority of the company's operations were in Wisconsin. The method was once again applied in the General Telephone Company of Michigan Case U-4996. The Commission rejected the use of double leverage but commented that the double leverage approach had merit in identifying the existence of leverage. The Commission also rejected the application of the equity method of accounting to the double leverage approach in the Hickory Telephone Company and in the Mid-Michigan Telephone Company cases. The Commission, however, accepted the cost method of accounting approach to double leverage in General Telephone Company of Michigan case U-6591.

Consolidated Capital Structure Approach

This approach attempts to combine the effects of leverage at the parent level, as well as at the subsidiary level, while estimating the cost of capital for the subsidiary. The consolidated capital structure approach limits the return of a utility holding company on its investments in its subsidiaries to an amount equal to the consolidated system's weighted average cost of capital (WACC). The consolidated capital structure approach to the double leverage problem is based on the premise that investors, in general, would make their investment decisions about the holding company by evaluating the parent's consolidated financial statements. This is because the consolidated capital structure reflects the net amounts of the total capitalization for both the parent and the subsidiary. The economic rationale of this approach is that it attempts to limit the return of a utility holding company, on its investments in its subsidiaries, to an amount equal to the consolidated system's weighted average cost of capital. This approach is based on the assumption that each subsidiary of the consolidated system will contribute its share of its earnings to the parent in accordance with its risks. In rate of return terminology, this implies that each subsidiary is expected to earn the weighted average cost of its consolidated system. There seems to be some agreement between the proponents and the opponents in regard to this approach. Many commissions adopt this approach, even though the company experts oppose its usage. Figure 5 provides an illustration of the consolidated capital structure approach.

Figure 5 shows that consolidation, in effect, substitutes the parent's capitalization for the subsidiary's paid-in capital. The consolidated capital structure makes clear the actual capitalization

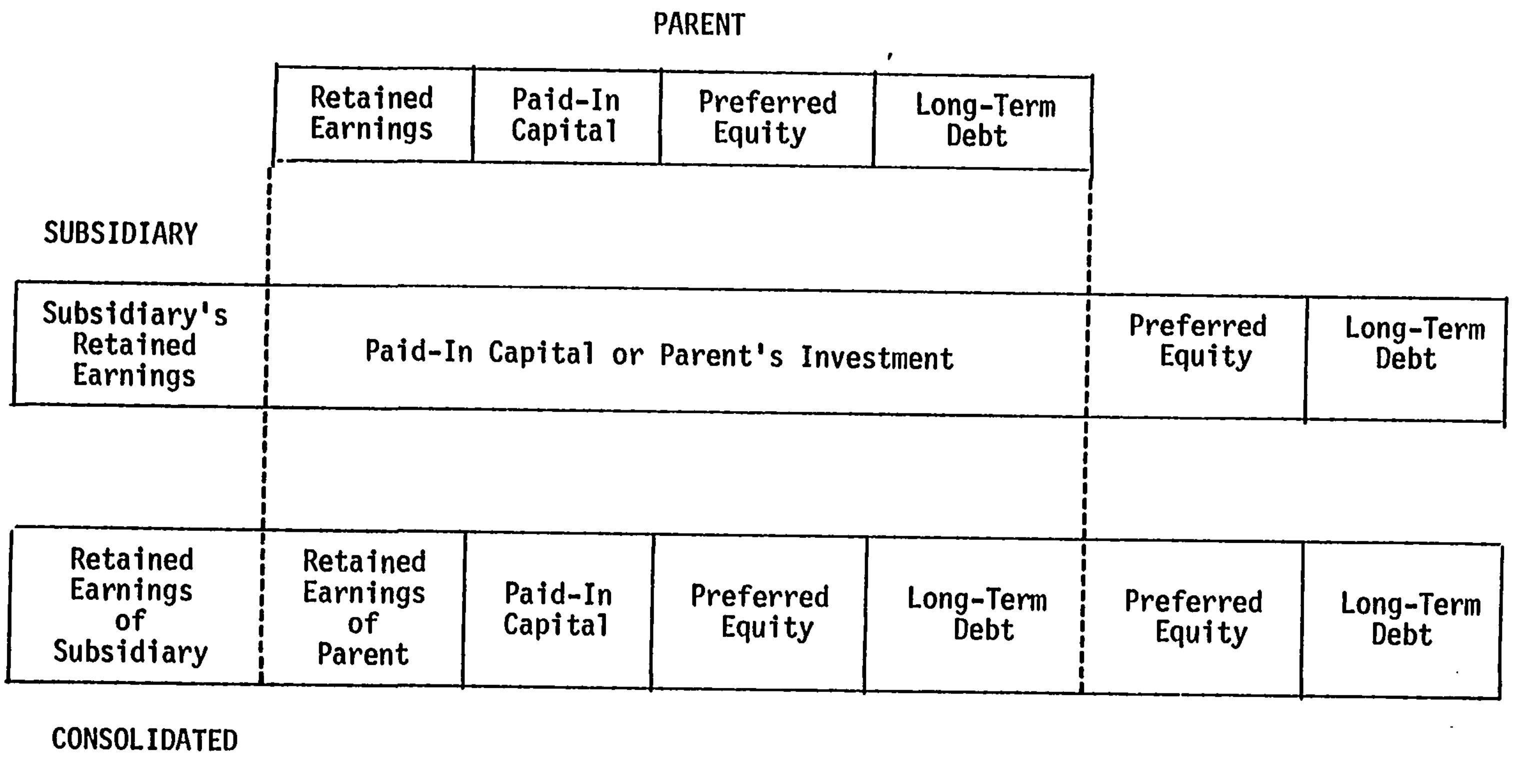


Figure 5. Consolidated Capital Structure Approach.

Note. From Habr, D. S. (1987, February 24). The Role of Double Leverage in Determining the Cost of Capital for a Regulated Subsidiary of a Holding Company. NARUC Ad Hoc Committee on Diversification.

used to support the utility operations. In the case of more than one subsidiary, consolidation assumes that all the subsidiaries will have the same capitalization ratios as that of the consolidated system. In this approach, the parent's cost of equity capital is applied to the entire common equity of the subsidiary. Table 25, Appendix A, provides an example for the determination of the overall rate of return of a subsidiary of the consolidated system. This approach has been adapted by the Michigan Public Service Commission staff in Michigan Bell Telephone Company Case U-7473.

Critics of the double leverage approaches point out that these approaches are invalid in general and that application of these methodologies will lead to cross-subsidization of some subsidiaries by others if the parent has more than one subsidiary.

Benchmark Rate of Return

With the exception of the classic study Stocks, Bonds, Bills and Inflation: The Past and the Future by Ibbotson and Sinquefield (1982), the literature on the "benchmark" rate of return is virtually nonexistent. Even the Ibbotson and Sinquefield study provides only historical benchmark risk premiums, not the benchmark rates of return. Many experts use the Ibbotson and Sinquefield study for the development of benchmark rates of return for utilities, without giving proper consideration to the legal and operating characteristics of the particular utilities.

Webster's New Collegiate Dictionary (1974, p. 103) defines "benchmark" as something that serves as a standard by which others may be measured. For instance, the long-term Treasury Bond is relatively risk free since its market risk, as represented by beta, is zero. Thus, the return rate on Treasury Bonds may be considered as one benchmark for the purpose of determining the return rate on the common stock of a utility that has a market risk (beta) greater than zero. Theory provides that the market risk (market beta) of New York Stock Exchange (NYSE) stocks (Dow Jones Industrials or the Standard and Poors 500 stocks) is close to unity. Thus there are two beta values that provide benchmarks for two categories of securities in relation to their risks: zero (Treasury Bonds) and unity (NYSE stocks). Suppose the return rate on long-term Treasury Bonds is 10% and the rate of return on NYSE stocks is 15%. Then the return on a security having beta = .75 would lie between 10% and 15%. The precise return for the security under consideration would depend on the actual business and financial risks of the company in question. This research will show how to establish benchmark rates of return for a set of telephone companies that are operating in Michigan.

Regulators are, thus, really concerned about the problem of double leverage, and there does not seem to be consensus among the experts. The controversy surrounding the application of double leverage methodology centers primarily on two areas: (a) risk and return, and (b) the identification of the subsidiaries' sources of equity capital. It is the opinion of this researcher that the approaches currently available are inadequate for determining a fair rate of return for (a) the subsidiary of a parent holding company and (b) the independently operating companies whose securities are not traded in the open market. The positions taken by the advocates and the critics seem to be logical as they are premised in the framework of economic as well as financial theories relating to the competitive markets. The fundamental question is: Are the positions taken by the parties consistent with the regulatory standards of fairness? What approaches are needed for the determination of proper and consistent benchmark rates of return for small telephone companies that are operating in Michigan? These questions are addressed in the next two chapters.

CHAPTER III

METHODOLOGY

Introduction

To address the issues raised in Chapter II, this chapter presents, first, the concepts of regulatory standards of fairness, fair rate of return, cost of equity capital, cost of capital approach, risk of investment, types of risk, concept of double leverage, risk and return, and risk premium, which are vital for proper understanding of the study as a whole; second, the generalized approaches for the determination of fair rates of return on the parent's investments in its subsidiaries and fair rates of return for independently operating utilities whose securities are not traded on the open market; and third, an approach for determining the "benchmark" rates of returns for telephone companies operating in Michigan.

The methodology advocated in this research is couched in the capital asset pricing framework developed by Sharpe (1964) and Lintner (1965). The general framework adopted here to evaluate the validity of the "double leverage" approach was developed by Pettway and Jordan (1983). It is this dissertation, however, that provides both a formal proof of their model, using the basic definition of the double leverage concept, and a general framework to support the consolidated capital structure approach for the double leverage problem. Appendix B provides formal proofs of these methodologies.

In their article, "Diversification, Double Leverage, and the Cost of Capital," Pettway and Jordan (1983) concluded that the double leverage approach is valid only if (a) the parent has a single subsidiary, (b) the levered betas of the subsidiaries are all identical and equal to the unleveraged beta of the parent holding company, and (c) all the subsidiaries have the same capital structure proportions as that of the parent's consolidated capital structure. If these conditions are not fulfilled, then the return rates obtained by utilizing the double leverage approach would violate the regulatory standards of fairness because of cross-subsidization of one subsidiary by the others. In general, they favor an independent company approach for the determination of cost of capital of a subsidiary of a holding company. Although Pettway and Jordan correctly define the regulatory standards of fairness, they misinterpret them in their analysis. Pettway and Jordan have, indeed, provided the conceptual foundation for the double leverage approach, but they have not gone far enough to circumvent the problem of double leverage while determining the fair rates of return on the parent's investment in its subsidiaries. This research provides a powerful, yet operationally simple, approach to resolve the complexities that are attendant with the double leverage problem and to estimate the return rates for regulated utilities, whether they are subsidiaries of holding company systems or independently operating companies whose securities are not publicly traded.

Although the approach adopted here is heavily influenced by the work of Pettway and Jordan (1983), it draws extensively on the seminal research done earlier by Modigliani and Miller (1958), Hamada (1972), Sharpe (1964), Lintner (1965), and Robicheck (1978). In fact, this research synthesizes their work. The approach adopted here does not assume the sources of a parent's capital that is invested in the subsidiaries. The uniqueness of this approach is that, first, it removes the effect of leverage at the parent level or at the consolidated level, and, second, it gives proper consideration to the effect of financial leverage of the subsidiary whose cost of capital is at issue, and then arrives at the utility's cost rate on its equity capital. The approach adopted in this research is consistent with the regulatory standards of fairness because it is based on the economic rationale that each subsidiary will contribute its proportional share to its parent in accordance with its risk and return.

Above all, the approach strikes a judicious balance between the positions taken by the proponents and opponents of double leverage. Recall that the proponents insist on the relevance of the source of the parent's capital, invested in its subsidiaries in order to bring the parent's return to its cost of capital, as required by competitive capital market conditions. The opponents maintain that it is practically impossible to trace dollar for dollar how much is invested in each of its subsidiaries. They, therefore, advocate an independent company approach that views the utility as if it were operating independently, not as part of the parent holding company system. Their approach requires a return to the subject utility equivalent to those returns of independently operating utilities having comparable risk. In this case, the return to the parent, generally, will be higher than the return based on competitive standards. The feud goes on. The approach adopted here does not require knowledge relating to the parent's sources of capital, which would please the opponents. If the parent has debt in its capital structure, the approach automatically applies the proper method (parent's capital structure or consolidated capital structure) to eliminate the effect of leverage, either at the parent unconsolidated or at the consolidated level, which would satisfy the proponents of double leverage. Thus, the approach adopted in this research provides a return on the parent's investment that would satisfy the public interest as well as standards of fairness.

Pettway and Jordan (1983) assume that regulatory standards of fairness will be satisfied only if the weighted average rate of the equity return contributed to the parent is equal to the individual equity return rates of the subsidiaries. This assumption, however, is highly restrictive and highly untenable if the subsidiaries of a holding company are located far apart, say, one in Michigan, a second in Texas, and a third in California, and if they face different business as well as financial risks. The arguments of

Pettway and Jordan (1983) may be illustrated by means of an example. Michigan Bell, Ohio Bell, Indiana Bell, Illinois Bell, and Wisconsin Bell are the subsidiaries of Ameritech, a holding company. Suppose Ameritech's weighted average cost of capital provides a 14% return on its common stock. This condition may require a 15% return from Michigan Bell, a 12% return from Ohio Bell, a 14% return from Wisconsin Bell, a 13% return from Indiana Bell, and a 16% return from Illinois Bell to meet an average required return of 14%. Pettway and Jordan argue that to satisfy the regulatory standards of fairness, every subsidiary must provide a return of 14% to its parent. If not, they say the regulatory standards of fairness will be violated because of cross-subsidization of some companies by others. In the present case, Michigan Bell and Illinois Bell are expected to cross-subsidize Ohio Bell and Indiana Bell, according to Pettway and Jordan. This may not happen all the time. The regulatory standards of fairness that are based on Bluefield (1923) and Hope (1944)--two landmark cases--and on economic and finance theory tacitly argue that returns must be commensurate with risks. The returns required by the stockholders from these companies are based on the business and financial risks to which the companies are exposed. Of course, if all the companies have similar risks, then they would contribute equally, which, in turn, would satisfy the regulatory standards in this one particular case among a set of possible outcomes in the real world. Pettway and Jordan consider only a particular and idealized event (the existence of equal risk among all subsidiaries) and ignore the real world altogether. In actuality, not all the subsidiaries located in different regions and facing different economic conditions, different social attitudes of the consumers, and the like, will have equal risks. They thus require dissimilar rates of return. This does not mean that some subsidiaries are being subsidized by the others to meet the return requirement of the parent's stockholders, as Pettway and Jordan contend. Therefore, this writer disagrees with the way they interpret the regulatory standards of fairness. The methodology presented in this research pays attention to the problem of double leverage whenever it occurs because, as Copeland (1977) put it,

> Double leverage is an issue that refuses to die precisely because a consistent application of the cost-of-capital standard demands that the effect of double leverage be given adequate consideration when determining the cost of capital for the subsidiary of a holding company. (p. 20)

Concept Development

Regulatory Standards of Fairness

Public interest policies, which epitomize societal equity and are based on legal precedent (Bluefield Water Works and Improvement Co. v. Public Service Commission of West Virginia, 1923; Federal Power Commission v. Hope Natural Gas Co., 1944) and economic and finance theories pertinent to public utility regulation (Bonbright, 1961; Gordon, 1974; Kahn, 1970; Phillips, 1969), have been instrumental to some extent in establishing certain guidelines for an allowable "fair" rate of return on a utility's investment. The universally accepted standards for judging an allowed rate of return on a utility's investment, as summarized by Pettway and Jordan (1983), are that the return must (a) be sufficiently low so as to eliminate the excess returns which are inordinately over and above its cost of capital (competitive norm), (b) be sufficiently high so as to attract capital when needed and to allocate the capital resources in a socially desirable fashion (the Bluefield case, 693), and (c) be able to reward equitably the utility's investors for the degree of their investment risk in the public utility (the Hope case, 603).

Fair Rate of Return

A rate of return on a utility's assets is said to be "fair" if it is consistent with the regulatory standards of fairness. Stated differently, it is that rate which provides a market-required return that is competitive with other financial securities of similar risk. It implies that the allowed rate of return, on a risk-adjusted basis, should be consistent with the returns that could be available to the companies that are not subject to regulations. "Just and reasonable" rates imply that one satisfies the interests of rate-payers and investors. From the standpoint of ratepayers, "just and reasonable rates" imply minimum operating expenses and minimum costs to service capital consistent with a given quality of service. From the investor's viewpoint, "just and reasonable rates" imply a rate of return comparable to those rates (opportunity costs) that could be attainable on alternative investments of similar risks in the nonregulated sector.

Cost of Equity Capital

The minimum rate of return that investors require in the market place for a firm's equity is said to be the cost of equity capital. It is the marginal yield that reflects the interaction of diverse investors as they bid on shares in the competitive capital market. When such a return on equity is employed in a computation of the firm's allowed rate of return on assets, it will provide the equity holder an expected return that is commensurate with returns on investments of corresponding risk.

Cost of Capital Approach

The cost of capital approach assesses a fair rate of return on the firm's assets by examining the returns required on the firm's capital structure components. It provides the weighted average cost of capital (overall rate of return) which satisfies the fundamental financial equality that the required rate of return on assets precisely equals the required rate of return on the firm's liabilities and equity. In other words, the required return on assets represents the weighted average cost of capital under competitive capital market conditions.

Return on Equity (ROE)

There are four types of returns on equity. These are:

1. Required: what investors must have as a return for investing their money. It is defined as the minimum return investors require, on the average, on their common stock as implied in the price that they are willing to pay to hold the stock.

2. Expected: what investors believe the investment will return.

3. Authorized (allowed): what regulators have determined to be the investor's required return in a rate case proceeding.

4. Actual (book): what the books of account reflect at the end of the accounting cycle, a historical perspective.

Risk of Investment

The risk of an investment in a firm is defined as the uncertainty that the expected returns on the investment may not be realized. It is the variability (measured by standard deviation) in the expected return around the average return. This variability is caused by factors that are both internal and external to the firm which jointly increase the probability that the expected returns may not be realized. The external factors include economic, technological, psychological, political, environmental, social, and regulatory conditions. The internal factors are unique to the firm and include the firm's product mix, its markets, its quality of management, its dependence on raw materials, customer class, labor problems, asset structure, accounting and financial policies, the degree of diversification, and the firm's responsiveness to changing market conditions.

Types of Risk

An operating firm may be affected by different categories of risk. These include business risk, financial risk, market risk, purchasing power risk, liquidity risk, interest rate risk, and regulatory risk. A detailed discussion of these risks is provided by Morin (1984). In the framework of efficient capital market theory, the above stated risks are classified into (a) systematic risk and (b) unsystematic risk. The systematic risk refers to the risk attributable to noncontrollable factors (both internal and external) that affect the firm. The unsystematic risk can be reduced or even eliminated through diversification of the firm. The systematic risk is measured by beta.

The business risk is the uncertainty in the expected earnings caused by the operating conditions of the firm. The financial risk is associated with the way in which a firm finances its operations. The presence of borrowed money in the capital structure of a firm creates additional risk to the investors because the debt holders have priority claims on the earnings as well as on the assets of the firm in the event of the firm's bankruptcy. Use of debt financing (financial leverage) has at least three important effects on common stock holders: (a) it increases the variability of their returns, (b) it affects their expectations, and (c) it increases the risk of being ruined. Thus, the presence of debt in a firm's capital structure will have an impact on the degree of risk borne by its shareholders. If the firm does not have debt in its capital structure, then it will have only the business risk. Financial risk is an additional risk, beyond business risk, introduced by corporate borrowing.

Concept of Double Leverage

Morin (1984) defines double leverage as a situation in which the parent holding company and its subsidiary employ debt in order to increase the earnings on the common stock. He states that:

> The expression "double leverage" stems from the situation where first there is leverage on the earnings of the operating company's common stock, and then additional leverage for the holding company's common stock to the extent that the holding company obtains part of the funds invested in the subsidiary's common stock from debt sources. (p. 294)

Risk and Return

The competitive nature of the capital market leads to a direct association between the degree of risk perceived by investors and the expected return that investments should offer to induce investors to bear the risk. Risk-averse investors, in general, would accept higher returns for higher risk.

The expected rate of return on a security is defined as the sum of two components: a risk-free rate and risk premium. The risk premium can be expressed as a product of three components, namely, nondiversifiable business risk premium, financial risk premium, and market risk premium, i.e.,

$$\text{Risk Premium} = \begin{pmatrix}\text{nondiversifiable} \\ \text{risk premium}\end{pmatrix} \begin{pmatrix}\text{financial} \\ \text{risk premium}\end{pmatrix} \begin{pmatrix}\text{market} \\ \text{risk premium}\end{pmatrix} \quad (1)$$

or

$$RP = (PBR)\ (PFR)\ (PMR), \quad (2)$$

Where: RP is the risk premium

PBR is the premium for business risk

PFR is the premium for financial risk

PMR is the premium for market risk

The market risk premium reflects the amount of premium required to compensate investors for uncertainties that affect all businesses due to broad economic fluctuations. It is the variability in return on most common stocks that is attributable to basic changes in investor expectations. The variability is caused by tangible factors, such as earnings, prices, and values, and intangible factors such as market psychology and investor perceptions. The market risk premium is defined as the difference between the market rate of return (the return, for example, on the Dow Jones Industrials or Standard and Poor's 500 common stocks) and risk-free rate (yield on long-term Treasury Bonds). If the product of nondiversifiable business risk premium times financial risk premiums is denoted by beta, Equation 2 becomes:

$$K_s = K_f + \beta_s (K_m - K_f) \qquad (3)$$

Where: K_s is the expected return on Stock S

K_f is the risk-free rate of return

K_m is the market return rate

β_s is the systematic risk of Stock S in relation to the market and measures the sensitivity or the volatility of the stock's return in relation to the market as a whole. A beta value of zero indicates that the return on Stock S is unaffected by the market. A beta value of unity shows that the return on a stock would be close to the return on the market as a whole.

Equation 3 is linear and is called the market line. It is nothing but the Sharp-Lintner version of the capital asset pricing model (CAPM). Its theoretical development is presented in Appendix B.

Advantages and Limitations of the Capital Asset Pricing Model (CAPM)

In an article entitled "Regulation and Modern Finance Theory," Robichek (1978) pointed out certain desirable features of the CAPM approach in order to address the controversial problems associated with the determination of "just and reasonable" rates. The principal advantages are as follows:

1. The CAPM approach provides a standard against which to measure the fairness of the rates of return to the equity holders. It avoids the problem of circularity by taking into consideration the nonregulated sector in comparing the subject utility's investment risk.

2. Questions regarding certain elements of rate making, such as "flow-through" or "normalization," and accounting issues, such as overcapitalization and interest charged during construction, would no longer be matters of great concern.

3. Controversial issues, such as what to include in or exclude from the rate base and what rate of return should be used on the rate base, will not pose serious threats because the allowed overall rate of return would be expected to provide for all proper operating expenses and taxes.

Despite these laudable features, the CAPM approach has its own limitations in addressing certain issues. For instance, it does not answer the following questions: How often should the commission adjust the benchmark rates? What is the appropriate mechanism (criterion) for selecting the comparable companies? How should the commissions resolve the problems relating to "excess capacity" and "plant under construction?" How can regulators compensate efficiency and penalize inefficiency? How should the regulators justify cross-subsidization of rates in terms of market efficiency? What is the most economically efficient way to specify the rates for different classes of subscribers?

Approaches for the Determination of Cost of Equity Capital

This section presents the approaches for the determination of cost of equity capital of utilities that have varying characteristics. The mathematical derivations of these formulas are provided in Appendix B.

1. Determination of cost rate on equity capital of a firm using an "independent" company approach:

a. Firm's securities are publicly traded.

If the firm is operating independently and its securities are publicly traded, then the expected rate of return on its equity capital can be obtained from the capital asset pricing model:

$$K^L = K_f + \beta^L (K_m - K_f) \quad (4)$$

Where: K^L is the levered cost rate on equity capital

K_f is the risk-free rate of return

K_m is the market return rate

β^L is the levered beta of the firm's securities

An equivalent form of Equation 4 is:

$$K^L = K^U + (K^U - K_f) (1 - t) (D/E) \quad (5)$$

Where: K^U is the unlevered cost rate on equity capital

t is the marginal tax rate of the firm

D is the market value of debt

E is the market value of equity

The derivation of Equation 5 from Equation 4 is presented in Appendix B.

b. Firm's securities are not publicly traded

If the firm is operating independently but its securities are not traded on the open market, the required rate of return on its equity is given by:

$$K^L = K^U + (K^U - K_f)\ (1 - t)\ (D/E) \qquad (6)$$

Where: K^U is the unlevered cost rate on the equity capital of a comparable risk class of utilities that are independently operating in the same industry

t is the marginal tax rate of the firm

D/E is the debt-to-equity ratio of the firm

Equation 6 has been adopted to derive the cost rate on equity capital for independently operating "small" telephone companies in Michigan.

2. Determination of cost rate on the equity capital of a subsidiary of a holding company:

a. Parent's unconsolidated capital structure approach.

If the parent and its subsidiary have debt in their capital structures, the required rate of return on the parent's investment in its subsidiary (same as cost rate on the equity capital of the subsidiary which is owned by the parent) can be estimated using the formula:

$$K_s^L = K_p^U + (K_p^U - K_{ds})\ (1 - t_s)\ (D_s/E_s) \qquad (7)$$

Where: K_s^L is the levered cost of the subsidiary's equity capital

K_p^U is the unlevered cost of the parent's equity capital

K_{ds} is the marginal cost rate on the subsidiary's debt

t_s is the marginal tax rate of the subsidiary

D_s/E_s is the debt-to-equity ratio of the subsidiary

The mathematical derivation of Equation 7 is provided in Appendix B. This approach assumes that the capital structure of the parent does not include the subsidiary's retained earnings, but it contains the retained earnings of the parent. This method can be applied only if the capital structure of the parent is known. Often, however, the capital structure of the parent is not generally available to the public in contrast to the consolidated capital structure. The advantage of this approach, in the double leverage context, is that it does not require knowledge of the sources of the parent's capital invested in the subsidiaries. Moreover, it does not limit the parent's return on its investments in the subsidiaries to its weighted average cost of capital. The approach, first, eliminates the effect of the parent's leverage and, second, gives proper consideration to the effect of the subsidiary's leverage on the parent's investment and appropriately assigns the return to the parent. In this way, it strikes a balance between the positions taken by the advocates and critics of double leverage

b. Parent's consolidated capital structure approach.

If the parent's capital structure is not known, but the parent's consolidated capital structure is readily available, an alternative approach for double leverage and for the determination of cost rate on equity capital of the subsidiary is the consolidated capital structure approach. The cost rate on equity capital of the subsidiary can then be obtained from:

$$K_S^L = K_C^U + (K_C^U - K_f)\ (1 - t)\ (D_S/E_S) \qquad (8)$$

Where: K_S^L is the levered cost rate on the subsidiary's equity

K_C^U is the unlevered cost of equity capital of the consolidated system

D_S/E_S is the debt-to-equity ratio of the subsidiary

In this approach, the consolidated capital structure includes the parent's debt, but it excludes the retained earnings of the parent. Most regulatory commissions adopt this approach to determine the cost rate on equity capital of the subject utility. The advantage of this approach is that because not all the subsidiaries of the consolidated system will have the same debt-to-equity ratio, it initially removes the effect of leverage at the system's level and then determines the cost rate on equity capital of each subsidiary, based on its own debt-to-equity ratio. This method is adopted in this research to determine the required rates of return on the common equity capital of the subsidiaries of holding company systems. There has been a general consensus of the parties in regard to the application of this approach. The basic advantage in estimating the unlevered cost rate on the equity capital of the parent's consolidated system and comparable companies is that it would provide the basis for the development of benchmark rates of return, the central theme of this research. As will be shown later, the parent's capital structure approach and the consolidated approach are consistent with the regulatory standards of fairness. In other words, each subsidiary of the system will contribute its share of its return in accordance with the risks to which the parent's investment is exposed while satisfying the parent's actual cost of capital, which is the minimum required rate of return that is expected under competitive capital market conditions.

Using Equation 8, a general formula for the consolidated capital structure approach that is developed in this research is:

$$K_s^L = K_c^U + [(K_p^U - K_f)/(1+D_c/E_c)]\ (\beta_c^L/\beta_p^U)\ (D_s/E_s) \quad (9)$$

The mathematical proof of Equation 9 is presented in Appendix B.

If $\beta_c^L = \beta_p^U$, it follows from Equation 9 that:

$$D_c/E_c = (\beta_p^U/\beta_c^U) - 1 \quad (10)$$

Relationship 10 shows that the debt-to-equity ratio of the consolidated system should be equal to the ratio of the unlevered beta of the parent to the unlevered beta of the system minus unity. This is important because it provides the condition under which both methods (the parent capital structure approach and consolidated capital structure approach) would provide identical results. If $\beta_c^L \neq \beta_p^U$, the consolidated capital structure will have to be adjusted.

This would resolve the conflicts that normally arise in rate case proceedings. An actual rate case example, illustrating how these two methods provide different results without such an adjustment and how the adjustment of consolidated capital structure would provide the same rate of return as would be provided by the parent capital structure, is presented in Appendix C.

Pettway and Jordan's Double Leverage Theory

The double leverage approach developed by Pettway and Jordan (1983) will be employed here to determine the required rate of return on the parent's investment in its subsidiary. The implications of this approach will then be discussed. Pettway and

Jordan have shown that the parent's investment in its subsidiary can be derived from:

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U) \tag{11}$$

Where: K_p^L is the required rate of return on the parent's investment in the equity capital of Subsidiary S

K_f is the risk-free rate of return

K_m is the market's required rate of return

β_s^L is the levered beta of Subsidiary S

β_p^L is the levered beta of the parent

β_p^U is the unlevered beta of the parent

The mathematical derivation of Equation 11 is presented in Appendix B.

Particular Cases

Case 1: If

$$\beta_{si}^L = \beta_p^U, \qquad \text{for } i = 1, 2, \ldots\ldots n$$

then Equation 11 reduces to:

$$K_p - K_f = (K_m - K_f)\ \beta_p^L \tag{12}$$

That is, if the risks of the subsidiaries are all equal to the business risk of the parent, the double leverage approach, as represented by Equation 11, and the independent company approach, as shown by Equation 12, will provide identical returns on the parent's investment in the subsidiaries.

Case 2: If

$$\beta_{si}^{L} \gtrless \beta_{p}^{U} , \tag{13}$$

then Pettway and Jordan (1983) conclude that the double leverage approach fails to satisfy regulatory standards of fairness because some companies will be subsidized by others, i.e., cross-subsidization. Since the levered beta of the subsidiary is not known, they suggest that a "proxy" beta representing a set of comparable companies may be used to determine the required rate of return on the parent's investment in its subsidiaries. Because of the "proxy" problem, they favor an independent company approach.

This researcher contends, however, that the cross-subsidization argument advanced by Pettway and Jordan (1983) for rejecting the double leverage theory is unwarranted. They misinterpret the regulatory standards of fairness. The differential returns provided by the subsidiaries to the parent are based on the relative risks to which the parent's investment is exposed.

Benchmark Rate of Return

Benchmark rates of return are the guideposts for those utilities having similar risks--business as well as financial. They establish a norm or standard by which others can be measured. The advantage of determining a "benchmark" rate of return for small telephone companies whose securities are not publicly traded is to reduce the resources that are expended in an adversarial rate case proceeding. For instance, the cost to a small telephone utility in such a proceeding would range between $15,000 and $20,000, depending on the number of contested parties that appear before the commission. These costs are a part of the utility's total revenue requirement, which would be borne by its customers. These expenditures can be reduced to between $3,000 and $4,000 if the utility, its intervenors, and the commission agree to a "benchmark" rate of return before a formal hearing. In fact, it will reduce the resources of all the parties involved. An agreement between the parties to a "benchmark" rate of return not only reduces the revenue requirement of the utility but also enables the utility to realize a part of the revenue shortfall without a regulatory lag. The customers gain the benefit of lower rates. Thus, a "benchmark" rate of return procedure provides benefits to all parties.

Methodology for the Determination of Benchmark Rates of Return

The determination of a "benchmark" rate of return for the utilities under consideration depends on (a) the average business risk of a comparable group of independently operating telephone companies whose securities are publicly traded and (b) the average debt-to-equity ratio of the group under consideration. In this research, the "benchmark" capital structure ratios established for different classes of A-rated telephone companies by the Standard and Poors (S&P) rating agency will be utilized.

The benchmark debt ratios established by S&P are 50% to 60% for a small, rural, metro, local exchange telephone company; 40% to 50% for a large, metro, suburban, local exchange company; and a 30% to 40% debt ratio for an inter-exchange (long-distance) telephone company. The benchmark rate of return also depends on the category to which a particular company belongs. There are some small telephone companies that do not have debt in their capital structures, while other small telephone companies are subsidiaries of holding company systems.

Benchmark Rate of Return Procedure for Independently Operating Small Telephone Companies

Case 1: If the utilities do not have debt in their capital structures, then they will have only business risk. In such cases, the required rate of return on their equity capital would be the same as the unlevered average cost rate on the equity capital of the comparable group of utilities. This unlevered cost of equity capital would provide a "benchmark" for those utilities that do not have debt.

Case 2: If the utilities have varying financial risks, as measured by their corresponding debt-to-equity ratios, then the benchmark rate of return will be obtained by using the average debt-to-equity ratio of the group in question, which in the formula:

$$K_S^L = 10.81 + 1.4718\ (D_S/E_S) \qquad (14)$$

is obtained from the following relationship and using the values $K_C^U = 10.81\%$, $K_{ds} = K_f = 8.58\%$, and t = tax rate = 34%:

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t)\ (D_S/E_S) \qquad (15)$$

Where: K_C^U is the unlevered cost rate on the equity capital of the comparable group.

Case 3: The "benchmark" rate of return for small telephone utilities that are subsidiaries of a holding company system can be obtained by averaging the rates of return for the subsidiaries, which are derived by using the relation:

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t_s)\ (D_s/E_s) \qquad (16)$$

Where: K_s^L is the cost-of-equity capital of Subsidiary S

K_c^U is the unlevered cost-of-equity capital of the consolidated system

$K_{ds} = K_f$ is the marginal cost rate on debt capital of the subsidiary

t_s is the marginal corporate tax rate of the subsidiary

D_s/E_s is the debt-to-equity rate of the subsidiary

The next section describes the empirical determination of the cost rate on the equity capital of a group of independently operating small telephone companies whose securities are publicly traded. These companies have risks comparable to those of small telephone companies operating in Michigan.

Empirical Determination of Unlevered Cost Rate on the Equity Capital of a Group of Independently Operating Telephone Companies That Have Risk Comparative to That of Small Telephone Companies

The following group of 10 independently operating telephone companies have been selected as the comparable group: Alltel Corporation, Central Corporation, Century Telephone Enterprises, Cincinnati Bell, Continental Bell, Rochester Bell, Southern New England Telephone, United Telephone, Telephone and Data Systems, and Lincoln Telephone Company. These are companies whose securities are publicly traded and whose betas are available. They were chosen on the basis of business risks that are expected to be similar to the business risks of the small telephone companies operating in Michigan. Since the business risks are assumed to be similar, the returns attributable to business risks must also be similar. In other words, the unlevered cost rate on the equity capital of the selected group of 10 independently operating telephone companies would be equivalent to the expected unlevered cost rate on the equity of all independently operating telephone companies in Michigan.

The levered cost rate on the equity capital of the selected group of companies will be estimated using the following steps. First, the average beta and the average capital structure ratios of the group will be calculated. Second, the market cost rate on the equity capital of 23 Dow Jones Industrials will be estimated using the discounted cash flow (DCF) method. Third, the risk-free rate of return will be computed by taking an average of the latest 12-month long-term Treasury Bond yields. Fourth, the Sharp-Lintner version of the capital asset pricing model will be used to estimate the unlevered cost rate on the equity capital of the comparable group using the relationship:

$$K_s^U = K_f + \beta^U (K_m - K_f) \qquad (17)$$

Where: K_s^U is the unlevered cost rate on equity capital

K_f is the risk-free rate

β^U is the unlevered beta

K_m is the market return rate

Tests of Hypotheses

The tests of hypotheses relating to double leverage methodologies will be presented through descriptive examples in order to see whether or not the double leverage approaches would satisfy the regulatory standards of fairness. Then, the tests of hypotheses pertinent to the expected rates of return, earned rates of return, and authorized rates of return will be conducted using student's _t_-tests.

CHAPTER IV

EVALUATION OF METHODOLOGIES

Introduction

This chapter will examine whether or not the required rates of return derived by using the "independent company" (subsidiary pricing) approach and "double leverage" (parent capital structure and consolidated capital structure) approach would be consistent with the regulatory standards of fairness. It will then recommend appropriate methods for (a) the determination of required rates of return for small telephone utilities whose securities are not publicly traded and (b) the development of "benchmark" rates of return. Tests for significance of rates of return will be conducted. To evaluate the methodologies, a descriptive balance sheet approach will be used. The balance sheet approach assumes certain values for the parameters pertinent to the marginal cost of debt, market return rate (K_m), tax rate (t), and levered beta (β_p^L) of the parent. Even if the values for the parameters are changed, the final conclusions will be unaffected. A particular set of values for the parameters is assumed for the purpose of illustrating the theory. To minimize the calculations, only debt and equity capital will be used.

Case 1: Determination of a Return Rate on the Equity Capital of an Independently Operating Company Whose Securities Are Publicly Traded.

Let the balance sheet of the company be as shown in Table 3.

Table 3

Balance Sheet of the Company

Assets	Liabilities & Equity	
\$200	Debt (D)	\$ 20
	Equity (E)	\$180
\$200		\$200

The expected rate of return on the common equity capital of the company can be obtained from the capital asset pricing model,

$$K^L = K_f + \beta^L (K_m - K_f) \tag{18}$$

Without loss of generality let K_f = 10%, K_m = 16.25%, t = 50%, and the levered beta of the company β^L be equal to .80.

Using Equation 18 and the assumed value for K_f, K_m, t, and β^L, the levered cost rate on equity capital of this company would be:

$$K^L = .10 + .80\ (.1625 - .10)$$
$$= 15\%$$

The unlevered cost rate (the rate that is expected without using debt in the company's capital structure) on the equity capital can be obtained from:

$$K^U = K_f + \beta^U (K_m - K_f) \tag{19}$$

If we know the unlevered beta (β^U), we can find the unlevered cost of capital of the company since we already know K_f = .10, K_m = .1625. Hamada (1972) has shown that

$$\beta^L = \beta^U [1 + (1 - t)(D/E)] \tag{20}$$

Therefore,

$$\begin{aligned} \beta^U &= \beta^L/[1 + (1 - t)(D/E)] \\ &= .80/[1 + (1 - .50)(\$20/\$180)] \\ &= .7579 \end{aligned}$$

Using Equation 19, the unlevered cost rate on the equity capital of the company would be:

$$\begin{aligned} K^U &= .10 + .7579 (.1625 - .10) \\ &= 14.74\% \end{aligned}$$

Assume now that the company acquires another company or sets up a subsidiary that has its own debt and uses its own capital to buy the stock of the subsidiary and becomes the parent-holding company. This situation is common in the telephone industry because the

Holding Company Act of 1935 excludes this industry. The allowance of debt at the parent level, and complete exclusion of the telephone companies from the Act, has posed problems as to the determination of a proper rate of return for a subsidiary of a holding company. Most court decisions have maintained that public service laws apply to public utilities but do not apply to holding companies even where the latter control the policies of their operating companies. In such cases, commissions have found it necessary to regulate the holding company indirectly (i.e., adopting indirect approaches to estimate the cost rate on the common equity capital of the subsidiary which is owned by the parent) through limitations on the earnings of the operating company.

Case 2: Determination of the Required Rate of Return on the Parent's Investment in Its Subsidiary: Implications of Pettway and Jordan Formula.

The balance sheets of the parent-holding company and the subsidiary are provided in Table 4. Where there was no subsidiary, the cost rate on the equity capital of the parent was 15% (Case 1). Because of the existence of the subsidiary's own debt ($100) over and above the debt of the parent ($20), the financial risk to the original stockholders has been increased, and, as such, they would require a higher return (greater than 15%) on their equity capital. This is a "double leverage" situation because the parent and the subsidiary both have debt in their capital structures.

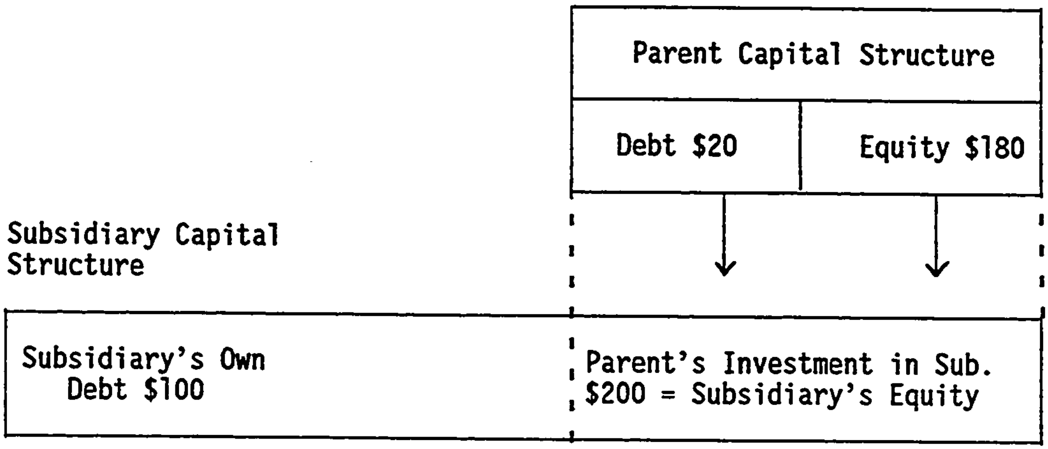
Table 4

Balance Sheet of the Parent and Subsidiary

Parent				Subsidiary			
Assets		Liabilities & Equity		Assets	Liabilities & Equity		
Eq	$200	Debt	$ 20	$300	Debt	$100	
		Equity	$180		Equity[a]	$200	
	$200		$200	$300		$300	

[a]Subsidiary equity = parent's debt ($20) + parent's equity ($180).

Figure 6 depicts the interrelationship between the parent and its subsidiary. The figure shows how the total capital of the parent was used to buy the stock of the subsidiary. The problem now is how to determine the required rate of return on the parent's investment in the subsidiary's equity. The double leverage approach instructs that the weighted average cost rate of the parent should be assigned to the common equity of the subsidiary. The determination of the parent's return on its investment in the subsidiary can be obtained by using either of the following two formulas: (1) Pettway and Jordan's (1983) formula or (2) the formula developed in this research.



Parent's Capital Structure		Subsidiary's Capital Structure	
Debt	$ 20	Debt	$100
Equity	$180	Equity	$200
Total:	$200		$300

Figure 6: Interrelationship Between the Parent and Its Subsidiary.

1. Pettway and Jordan's (1983) formula was developed by this writer using the very definition of the double leverage approach and is presented in Appendix B. If we denote K_s^L as the return rate on the equity capital of the subsidiary, then according to the double leverage approach, we would have:

$$K_s^L = [K_p^L (E_p) + K_d (1 - t) D_p]/[E_p + (1 - t) D_p] \qquad (21)$$

Simplifying Equation 21 and solving for K_p, we obtain:

$$K_p^L = K_s^L + (K_s^L - K_f)\ (1 - t)\ (D_p/E_p) \tag{22}$$

or

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U) \tag{23}$$

Formula 22 shows that the required rate of return on the parent's investment is the sum of two terms. The first term on the right-hand side represents the levered cost of equity capital of the subsidiary using its own debt; the second term represents the return required as a result of double leverage.

2. The second formula was developed by equating the weighted average cost rate of the parent (which is also equal to its unlevered cost rate of equity, K_p^U) to the weighted average cost rate of the subsidiary, i.e.:

$$K_p^U = [K_s^L\ E_s + (1 - t)\ D_s\ K_d]/[E_s + (1 - t)\ D_s] \tag{24}$$

Solving for K_s^L we derive:

$$K_s^L = K_p^U + (K_p^U - K_f)\ (1 - t)\ (D_s/E_s),\ \text{since}\ K_f = K_d. \tag{25}$$

The first term on the right-hand side of Equation 25 represents the weighted average cost rate on the equity capital of the parent, and the second term represents the return required as a result of the subsidiary's debt. Regulatory treatment ignores the second term. That is, the leverage effect of the subsidiary's own debt is ignored. Formulas 23 and 25 will provide the same result. But the implementation of Formula 25 is straightforward and does not require the knowledge of β_s^L, whereas Pettway and Jordan's (1983) Formula 23 would require the value for β_s^L in order to determine the required return on the parent's investment in the subsidiary.

Since $K_p^U = .1474$, $K_f = .10$, $t = .50$, $D_s = \$100$, and $E_s = 200$, the required rate of return on the parent's investment in the subsidiary can be obtained using Equation 25:

$$K_s^L = .1474 + (.1474 - .10)\ (1 - .5)\ (\$100/\$200)$$
$$= 15.93\%, \qquad (26)$$

which indicates that the parent's investment in the subsidiary would require 15.93%, as compared to a 15% return when there was no subsidiary's debt. Further, since Formulas 23 and 25 are expected to provide the same return requirement to the parent, it is possible to find the value of β_s^L by equating Equations 25 and 23 as follows:

$$.1593 = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U)$$
$$= .10 + (.1625 - .10)\ (.80)\ (\beta_s^L/.7579)$$
$$\beta_s^L = .8985 \qquad (27)$$

Since the value of β_s^L is known, using an independent company approach it is possible to find the required return on the subsidiary's equity as if the company were operating independently:

$$K_s^L = K_f + \beta_s^L\ (K_m - K_f) \qquad (28)$$
$$= .10 + .8985\ (.1625 - .10)$$
$$= .1562 \text{ or } 15.62\%$$

What this implies is that if the company were independent and its securities were traded publicly, it would have required a 15.62% return rate on its equity.

The weakness of Pettway and Jordan's (1983) formula, Equation 23, is that it does not readily provide the required rate of return on the parent's investment in the subsidiary because it requires the knowledge of β_s^L. Since β_s^L is not known, Pettway and Jordan suggest the use of a "proxy" beta representing the average of comparable risk companies.

Implications of the Pettway and Jordan (1983) formula,

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U) \tag{29}$$

are as follows:

1. If $\beta_s^L = \beta_p^U$, then the double leverage approach and the independent company approach (Case 1) would provide identical returns. If $\beta_s^L > \beta_p^U$, i.e., $\beta_s^L/\beta_p^U > 1$ (in the present case β_s^L = .8985 and β_p^U = .7579), then it follows that the return on the parent's investment provided by the double leverage approach would be greater than the return that would be expected from an independent company approach because of additional risk created by the subsidiary's leverage.

2. If $\beta_s^L < \beta_p^U$, i.e., $\beta_s^L/\beta_p^U < 1$, then the return on the parent's investment in the subsidiary would be lower than the return that would have been provided by an independent company approach.

Pettway and Jordan (1983) contend that the double leverage approach is valid in the case of a single subsidiary (or if the market risks of the subsidiaries are all equal to the business risk of the parent, i.e., $\beta^L_{si} = \beta^U_p$, for i = 1, 2, ... n) because in such an event the independent company approach and the double leverage approach will provide identical returns and cross-subsidization will not exist.

The following paragraphs analyze how the proponents would apply the double leverage theory to the example presented in Table 5, which involves parent-subsidiary relationships. The proponents argue that because it is not known how the parent has financed its investment in the subsidiary's stock, it should receive its weighted average cost of capital on its investment in the subsidiary. What this implies is that the parent should not receive more than its costs. This is the traditional double leverage approach advocated by its proponents. Assume that the marginal cost rate on debt, 10%, is the same for the parent and subsidiary and the cost rate on equity capital of the parent is 15%. The capital structures and the cost rates of the parent and subsidiary are presented in Table 5.

The weighted cost rate of the parent's investment in the subsidiary, using a 50% tax rate:

$$= [(\$180)\ (15\%) + (\$20)\ (10\%)\ (1 - .5)]/\$180 + (1 - .5)\ (\$20)$$

$$= [(\$27 + 1)/\$190] = \$28/\$190$$

$$= 14.74\%, \qquad (30)$$

which is the unlevered cost rate on the equity capital of the parent.

Table 5

Capital Structure of the Parent and the Subsidiary

	Parent				Subsidiary			
	Amount	Cost Rate	Tax Rate	Weighted Cost		Amount	Cost Rate	Tax Rate
Debt	$ 20	10%	1-t	$ 1	Debt	$100	10%	1-t
Equity	$180	15%	---	$27	Equity	$200	14.74%	
Total Capital:	$200			$28		$300		

It can be seen from Table 5 that for the subsidiary's equity capital, the weighted average cost rate (14.74%) of the parent has been assigned. By doing so, as argued by advocates of double leverage, the stockholders will be adequately compensated for their actual costs of the parent's investment in the subsidiary.

The actual costs of the parent are:

Cost of debt financing: (10%) ($20) (1 - t) = $ 1, for t = 50%

Cost of equity (15%) ($180) = $27

Total cost of financing = $28

Return to the parent's investment in the subsidiary = ($190) (14.74) = $28. Since the costs of financing and the return on investment are equal, it is argued that the parent's stockholders are exactly compensated.

This is the position taken by the advocates of double leverage. They maintain that unless the parent explicitly identifies the sources of its investment in the subsidiary, it is extremely difficult to identify the source and mix of funds by which the common stock of its subsidiary is financed by the parent. In such an event, there is a possibility that the parent might have financed the stock of its subsidiary with debt only or with the sale of common stock exclusively or a combination of both debt and common stock. Since the funds which the parent invests in the common stock of its subsidiary are commingled and are not clearly traceable with respect to their sources, it is argued that the most appropriate way to determine the cost of equity capital invested by the parent in its subsidiary is to assign its weighted average cost of capital. They hold the view that if the parent receives earnings at its own overall rate of return on its investment in its subsidiary, it will be able to service its debt and to obtain the earnings investors seek on the parent's common stock. This is due to the fact that the parent's investment in the subsidiary costs less because of the leverage afforded when the parent holding company obtains a portion of its funds by borrowing.

The proponents of double leverage methodology also contend that it is consistent with economic theory of competitive behavior. Thus, if the competitive market is in equilibrium, the marginal rate of return on investment must be equal to the costs of capital. In the theory of finance, for instance, the rules of capital budgeting explicitly state that the value of a firm will be maximized if the firm undertakes all those investments with positive net present values. In other words, the firm would continue to invest its capital until its internal rate of return on its marginal investment just equals its cost of capital. When these principles are applied to a holding company system, the parent should be constrained in its return from its investment in its subsidiary to its weighted average cost of capital rather than its anticipated return of ($200 x 15% = $30). Any reward to the parent in excess of its weighted average cost of capital ($30 - 28.0 = $2) would violate the competitive norm.

Opponents of the double leverage approach argue that awarding the costs of capital to the parent's investment in the subsidiary, $28.0, is inadequate to compensate for the additional risk to which the stockholders' investment is exposed due to the existence of the subsidiary's debt in its capital structure. They say that if it is not known how the parent financed its investment in its subsidiary, then the cost of equity capital of the parent invested in its subsidiary would have been 15.93%, which can be obtained from the subsidiary's capital structure as follows:

[[$200 + (.5) ($100)] 14.74% - ($100) (.5) (10%)]/$200 =

$31.85/$200 = 15.93%

The parent's return on its investment in the subsidiary would thus have been (15.93%) ($200) = $31.86 instead of $29.5 ($200 x 14.74%). The difference in return ($2.36) would be attributable to additional risk to which the equity holder is exposed due to the presence of debt in the subsidiary's capital structure. They point out that the additional reward ($2.36) is consistent at least with the fundamental principle of finance; that is, risk and reward are positively correlated. In other words, if the double leverage theory is a valid one, it should be consistent with reality. Since risk and return are linearly and positively associated according to finance theory, it would be appropriate to allow an additional compensation, $2.36, for additional risk undertaken by the shareholders on the criterion that the source of funds is not relevant; rather, the critical issue is the ultimate risk to which a particular firm is exposed.

The approach adopted in this research for the determination of a return rate on the parent's investment in the subsidiary and as represented by the relationship

$$K_s^L = K_p^U + (K_p^U - K_f)\ (1 - t)\ (D_s/E_s) \qquad (31)$$

would have provided a return rate of 15.93% to the parent. The return to the parent would have been a sum of $31.86 ($200 x 15.93%) as compared to a return of $29.5 ($200 x 14.74%) which would have been arrived at by using the traditional approach ignoring the leverage effect of the subsidiary's own debt. That is, the traditional approach does not consider the second term on the right-hand side of Equation 31. It should be noted, however, that the leverage effect of the subsidiary's own debt depends on the proportion of debt in its capital structure. If the proportion of debt is lower than the proportion of the parent's debt, then the return rate on the parent's investment would be lower than 15% and vice versa. If the debt ratio of the subsidiary is equal to the debt ratio of the parent, or if the debt ratio of the parent to its total capital is equal to the debt-to-equity ratio of the subsidiary, the return to the parent's investment will be unaffected.

<u>In sum, the present approach, as represented by Equation 31, is superior to the approach advocated by proponents of double leverage. This model recognizes the presence of the subsidiary's own debt in its capital structure and provides compensation to the stockholders for the additional risk, thereby satisfying the regulatory standards of fairness.</u>

The arguments presented here are vital for the analysis that follows, if the parent has two or more subsidiaries. The analysis is extended to the case where the parent holding company has two or more subsidiaries.

Case 3: Determination of the Expected Rates of Return on the Parent's Investment in Its Subsidiaries.

1. No debt in the capital structures of the parent and subsidiaries.

It is assumed that the parent holding company owns two subsidiaries, S_1 and S_2, that have similar business risks, and the parent and the subsidiaries do not have debt in their capital structures. Further, the parent is supposed to have invested its capital unequally in the two operating subsidiaries. In fact, this is a trivial case. The balance sheets of the parent and its subsidiaries are presented in Table 6.

Assumptions:

Let β_p^U = .7579, the unlevered beta of the parent

K_m = 16.25%, the market cost of equity capital

K_f = 10.0%, the risk-free rate of return

Parent's Cost Rate on Equity Capital (Unconsolidated)

Since the parent does not have debt in its capital structure, its unlevered (debt-free) cost of equity capital can be determined from:

$$K_p^U = K_f + \beta_p^U (K_m - K_f) \qquad (32)$$

$$= .10 + .7579 (.1625 - .10)$$

$$= .1474$$

$$= 14.74\%$$

Thus, the unlevered cost rate on the equity capital of the parent is 14.74%.

Table 6

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)		Parent Consolidated (P_c)	
Assets	Liabilities & Equity	Assets	Liabilities & Equity
Eq S_1: \$120 Eq S_2: \$ 80	Equity: \$200	S_1: \$120 S_2: \$ 80	Parent Eq: \$200
\$200	\$200	\$200	\$200

Subsidiary (S_1)		Subsidiary (S_2)	
Assets	Liabilities & Equity	Assets	Liabilities & Equity
\$120	Equity: \$120	\$ 80	Equity: \$80
\$120	\$120	\$ 80	\$80

Subsidiary S_1 Cost of Equity Capital

Using the "parent capital structure" approach, the cost rate on equity capital of S_1 can be obtained from the general formula:

$$K_s^L = K_p^U + (K_p^U - K_{ds})\ (1 - t)\ (D_s/E_s) \qquad (33)$$

Where:

K_s^L = levered cost of equity capital of Subsidiary S

K_{ds} = weighted average (marginal) cost of debt of Subsidiary S

t_s = corporate tax rate of Subsidiary S

D_s/E_s = debt-to-equity ratio of Subsidiary S measured in market values

Since there is no debt in the capital structures of S_1 and S_2, there will not be any tax advantages of debt, and as such $t_s = 0$. Then the unlevered cost of equity capital of Subsidiary S_1 would be:

$$K_{s1}^U = (.1474) + (.1474 - 0)\ (1 - 0)\ (0)$$
$$= .1474$$
$$= 14.74\%$$

which is the same as the unlevered cost of capital of the parent.

Subsidiary S_2 Cost of Equity Capital

Using the parent capital structure approach, the unlevered cost of equity capital of Subsidiary S_2 would be:

$$K_{s2}^U = (.1474) + (.1474 - 0)\ (0)$$
$$= .1474$$
$$= 14.74\%$$

which, again, is equivalent to the unlevered cost of the parent's equity capital. Further, we know that the parent's unlevered cost rate is its weighted average cost of capital.

The weighted average cost rate of the rates contributed by the two subsidiaries on parent's investment is:

$$\begin{aligned} WACC &= [(14.74\%)(\$120) + (14.74\%)(\$80)]/(\$120 + \$80) \\ &= (\$17.688 + \$11.792)/\$200 \\ &= 14.74\% \end{aligned}$$

which is equal to the weighted average cost rate on parent's equity capital.

The weighted average cost rate on equity capital, invested by the parent in its subsidiaries, is equal to the individual equity cost rates of subsidiaries. The double leverage approach, therefore, according to Pettway and Jordan (1983), would satisfy the regulatory standards of fairness since there is no cross-subsidization from one subsidiary to the other.

2. Debt in each subsidiary's capital structure and no debt in the parent capital structure.

This scenario is relevant and appropriate to electric and gas utilities and their holding companies. The operating natural gas and electric utilities are permitted to issue their own debt, which is guaranteed by their respective parent holding companies. The parent holding companies owning the operating utilities, however, cannot have their debt even though they can diversify into regulated and nonregulated areas of business that may have different levels of risk.

It is assumed that the marginal debt cost rates of the subsidiaries are the same as before and are equal to 10%, the unlevered cost of the parent's capital is assumed to be 14.74%, and the corporate tax rate "t" is 50%. Further, the parent's investments in each of the subsidiaries are unequal. The balance sheets of the parent and subsidiaries are shown in Table 7.

The objective here is to see whether or not the double leverage approach would satisfy the regulatory standards of fairness. The regulatory standards, according to Pettway and Jordan (1983), will be satisfied only if the parent's weighted average cost of capital is equivalent to each subsidiary's cost of equity capital.

Parent's Cost Rate on Its Equity Capital

Since there is no debt in the parent's capital structure, the required return rate on the parent's investment can be determined from the parent's consolidated capital structure.

The levered cost of the system's equity capital can be obtained from:

$$K_c^L = K_c^U + (K_c^U - K_{dc})\ (1 - t_c)\ (D_c/E_c) \qquad (34)$$

Where:

K_c^L = the levered cost of equity capital of consolidated system

K_c^U = the unlevered cost of equity capital of the system

K_{dc} = the marginal weighted cost rate of debt of the system

D_c/E_c = debt-to-equity ratio of the system

t_c = tax rate, which is assumed to be 50%

Table 7

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)

Assets	Liabilities & Equity
S_1: $120 S_2: $ 80	Equity: $200
$200	$200

Parent Consolidated (P_c)

Assets	Liabilities & Equity
Sub.S_1:$200 Sub.$S_2$ $200	Parent Eq: $200 Debt Sub.S1:$ 80 Debt Sub.S2:$120
$400	$400

Subsidiary (S_1)

Assets	Liabilities & Equity
$200	Debt: $ 80 Equity: $120
$200	$200

Subsidiary (S_2)

Assets	Liabilities & Equity
$200	Debt: $120 Equity: $ 80
$200	$200

Since the parent's unlevered cost of equity capital is equal to the parent's unlevered cost of equity capital of the consolidated capital structure (K_c^U), it follows that:

$$K_p^L = K_c^L .$$

Thus,

$$K_c^L = (.1474) + (.1474 - .10)\ (.5)\ (\$200/\$200) = .1711$$
$$= 17.11\%$$
$$= K_p^L$$

The weighted average cost of the parent is:

$$[K_p^L(E_p) + (K_{dp})\ (D_p)]/[E_p + (1 - t)\ D_p] =$$
$$(.1711)\ (\$200) + (.10)\ (0)/\$200\ = .1711$$
$$= 17.11\% = K_p^U$$

<u>Cost Rate on Equity Capital of Subsidiary S_1</u>

The cost rate on equity capital (parent's investment in S_1) of Subsidiary S_1 can be determined using the parent capital structure approach, i.e.,

$$K_{s1}^L = K_p^U + (K_p^U - K_{ds1})\ (1 - t_{s1})\ (D_{s1}/E_{s1})$$
$$= .1474 + (.1474 - .10)\ (1 - .5)\ (\$120/\$80)$$
$$= .1632$$
$$= 16.32\%$$

Cost Rate on Equity Capital of Subsidiary S_2

Using the parent capital structure approach again, the cost rate on equity capital of S_2 can be obtained from:

$$K_{s2}^{L} = K_{p}^{U} + (K_{p}^{U} - K_{ds2})(1 - t_{s2})(D_{s2}/E_{s2})$$

$$= .1474 + (.1474 - .10)(1 - .5)(\$120/\$80)$$

$$= .1830$$

$$= 18.30\%$$

Thus, the total revenue contributed by the two subsidiaries to the parent's investment would be:

$$(\$120 \times 16.32\%) + (\$80 \times 18.30\%) = \$34.226$$

The weighted average cost of equity capital of the parent invested in the subsidiaries would then be 17.11% (34.226/200), which is also the weighted average cost of equity capital of the parent.

Although the parent's return requirements from the subsidiaries are different, the parent's weighted average cost rate is equal to the weighted average of the individual cost rates on the equity of the parent's investment in its subsidiaries. Because the weighted average cost rate of the parent (17.11%) is not equal to the individual cost rates contributed by the subsidiaries to the parent (S_1's rate is 16.32%, S_2's rate is 18.30%), Pettway and Jordan (1983) argue that the double leverage theory violates the regulatory standards of fairness. This is due to the fact that one subsidiary subsidizes the other.

This researcher argues that since the debt ratios of the subsidiaries are different from the debt ratios of the consolidated system, the subsidiaries' individual contribution to the parent's investment will differ. The contributions will depend on the risks to which the parent's investment is exposed in each of the subsidiaries. Therefore, it is logical to expect differential contributions by the subsidiaries to the parent while satisfying the parent's weighted average cost of capital constraint. The individual contributions of the subsidiaries would be equal to the parent's weighted average cost of capital if the capital structure ratios of the subsidiaries are exactly equal to the capital structure ratios of the consolidated system.

In the case of Subsidiary S_1, for instance, the debt and equity were \$80 and \$120, respectively. If they were to be \$100 debt and \$100 equity, then its levered cost of equity capital would have been:

$$K_{s1}^{L} = K_p^U + (K_p^U - K_{ds1})\ (1 - t_{s1}\ (D_{s1}/E_{s1})$$
$$= .1474 + (14.74 - .10)(1 - .5)\ (\$100/\$100)$$
$$= .1711$$
$$= 17.11\%$$

which is exactly equal to the weighted average cost of capital of the parent, but greater than 16.32%. The higher return (17.11%) is attributable to an increase in debt from $80 to $100, and, as such, investor's capital was exposed to additional risk than before.

In the same way, Subsidiary S_2 would have its cost of equity capital reduced from 18.30% to 17.11% due to the decrease in its debt from $120 to $100. In this case, the risk to owner's investment in Subsidiary S_2 was reduced from its previous level, and, as such, investors were paid accordingly. But, overall, investors were compensated relative to their risks on their investments in the subsidiaries. As long as the investors are rewarded commensurately with the risks, there will not be any problem in attracting the capital.

The above analysis shows that Pettway and Jordan's (1983) condition that each subsidiary's contribution must be equal to the parent's weighted average cost of capital completely ignores the relative risks of the subsidiaries. For instance, subsidiaries of a holding company (Telephone & Data Systems) are located in different parts of the country and possess debt-to-equity ratios that are different from their consolidated system's debt-to-equity ratios.

3. Debt in the parent capital structure and debt in the subsidiaries' capital structures.

This scenario is typical of the telephone utilities and their corresponding holding companies. The operating utilities and their respective parent holding companies now have debt in their capital structures. This means the existence of double leverage--leverage (use of debt) at the subsidiary level and leverage at the parent level. The parent's required rate of return on its investments in the subsidiaries will be determined by the application of "double leverage" methodology.

Assumptions:

1. Parent holding company and its subsidiary have debt.

2. The capital ratios of the parent's investment in the subsidiaries are the same as those of the parent. That is, the equity of the subsidiary, \$200, is made up of \$100 of the parent's debt (50% of \$200) and \$100 of the parent's equity.

3. Cost of equity capital of the parent is assumed to be 15%.

4. The weighted average cost rates (or marginal cost rates) of debt capital of the parent and its subsidiaries are assumed to be, though not necessarily, the same--say, 10%.

The capital structures of the parent and subsidiaries and their weighted cost rates are shown in Table 8.

It is further assumed that the parent's debt is utilized to purchase the stock of the subsidiaries. As before, we shall assume the market cost rate of equity capital, K_m, is equal to 16.25%.

According to the "double leverage" approach, the cost rate on equity capital of each subsidiary must be equal to the weighted average cost of the parent. Given the systematic risk (.80), market cost rate (16.25%), and the risk-free rate (10%), the cost of equity capital of the parent using CAPM would be:

Table 8

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)

Assets	Liabilities & Equity
Eq.S_1:$120	Debt: $20
Eq.S_2:$ 80	Equity: $180
$200	$200

Parent Consolidated (P_c)

Assets	Liabilities & Equity
Sub.S_1:$200	Parent Eq: $180
Sub.S_2 $200	Parent Debt: $ 20
	Sub.S_1 Debt: $ 80
	Sub.S_2 Debt: $120
$400	$400

Subsidiary (S_1)

Assets	Liabilities & Equity
$200	Parent Eq: $108
	Parent Debt: $ 12
	Sub. Equity: $120
	Sub. Debt: $ 80
$200	$200

Subsidiary (S_2)

Assets	Liabilities & Equity
$200	Parent Eq.: $ 72
	Parent Debt: $ 8
	Sub. Equity: $ 80
	Sub. Debt: $120
$200	$200

$$K_p^L = K_f + \beta_p^L (K_m - K_f) \qquad (35)$$
$$= .10 + .80\ (.1625 - .10)$$
$$= .10 + .05$$
$$= .15 \text{ or } 15\%$$

The parent's unlevered cost of equity capital can be derived using:

$$K_p^U = K_f + \beta_p^U (K_m - K_f) \qquad (36)$$

Where:

$$\beta_p^U = \beta^L/[1 + (1 - t)\ (D_p/E_p)]$$
$$= .80/[1 + (.5)\ (\$20)/\$180)]$$
$$= .81/1.0555$$
$$= .7579$$

$$K_p^U = (.10) + (.7579)\ (.1625 - .10)$$
$$= (.10) + (.7579)\ (.0625)$$
$$= .10 + .0474$$
$$= .1474 \text{ or } 14.74\%$$

The weighted average cost of the parent would then be:

$$\text{WACC } (P_u) = [(K_p^L)\ (E_p) + (1 - t)\ (D_p\ K_d]/[E_p + (1 - t)\ D_p]$$
$$= [(.15)\ (\$180) + (.5)\ (\$20)\ (.10)]/[(\$180) + (.5)\ (\$20)$$
$$= \$28/\$190 = 14.74\%$$

Thus, the parent's weighted average cost of capital is equal to the parent's unlevered cost rate on equity capital. Then, the cost of equity capital of the parent invested in Subsidiary S_1 is given by:

$$K_{s1}^{L} = K_{p}^{U} + (K_{p}^{U} - K_{ds1})\ (1 - t_{s1})\ (D_{s1}/E_{s1})$$
$$= .1474 + (.1474 - .10)\ (.5)\ (\$80/\$120)$$
$$= .1474 + (.0474)\ (.5)\ (.6667)$$
$$= .1474 + .0158$$
$$= .1632 \text{ or } 16.32\%$$

Similarly, the cost rate on the parent's equity capital invested in Subsidiary S_2 can be obtained by using:

$$K_{s2}^{L} = K_{p}^{U} + (K_{p}^{U} - K_{ds2})\ (1 - t_{s2})\ (D_{s2}/E_{s2})$$
$$= (.1474) + (.1474 - .10)\ (.5)\ (\$120/\$80)$$
$$= (.1474) + (.0356)$$
$$= 18.30\%$$

Thus, the weighted average cost of the parent's equity capital invested in the subsidiaries would be:

$$[(\$108)\ (.1632) + (\$72)\ (.1830)/(\$108 + \$72) = 17.11\%$$

Pettway and Jordan (1983) would say that, on one hand, allocation of 17.11% to each utility will violate the regulatory standards of fairness because Subsidiary S_1 will be awarded a higher return, 17.11%, than is required, 16.32%, and Subsidiary S_2 will be awarded 17.11%, which is lower than the required 18.30%. In other words, they maintain that Subsidiary S_1 is being subsidized by Subsidiary S_2. <u>But this researcher argues that the return required by the parent from each of the subsidiaries would depend on the risk to which the parent's investment is exposed. As long as the weighted average cost of capital of the parent is satisfied by the relative contributions of the subsidiaries in accordance with their risks and returns, the regulatory standards of fairness will be satisfied. Therefore, the parent's capital structure approach to the double leverage problem is valid even if there are two or more subsidiaries</u>.

Parent's Consolidated Capital Structure Approach to the Double Leverage Problem

The consolidated capital structure approach limits the return to a utility holding company on its investment in its subsidiaries to an amount equal to the consolidated system's weighted average cost of capital. A general framework for the resolution of the problem is presented in Appendix B. The objective here is to see whether or not this approach would satisfy the regulatory standards of fairness and to assess whether or not the parent's capital invested in the subsidiaries will have been rewarded, at the same time eliminating monopoly returns which could be attributable to double leverage. An evaluation of the parent's consolidated capital structure will be performed using descriptive examples.

Case 1: No Debt in the Capital Structure of Parent and Subsidiaries.

It is assumed that there are two subsidiaries, S_1 and S_2, and the unlevered cost of equity capital of the parent is 14.74%. The balance sheets of the parent and the subsidiaries are presented in Table 9.

Table 9

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)

Assets	Liabilities & Equity
Eq.S_1:\$108 Eq.S_2:\$ 72	Equity: \$180
\$180	\$180

Parent Consolidated (P_c)

Assets	Liabilities & Equity
Sub.S_1:\$108 Sub.S_2 \$ 72	Equity S_1: \$108 Equity S_2: \$ 72
\$180	\$180

Subsidiary (S_1)

Assets	Liabilities & Equity
\$108	Equity: \$108
\$108	\$108

Subsidiary (S_2)

Assets	Liabilities & Equity
\$ 72	Equity: \$ 72
\$ 72	\$ 72

Since there is no debt in the capital structures of the subsidiaries and the parent, the system's weighted average cost rate is identical to the cost of capital of either of the subsidiaries. This can be seen from the following results:

The cost of capital of the system can be determined from:

$$K_c^L = K_c^U + (K_c^U - K_{dc})\ (D_c/E_c)\ (1 - t) \qquad (37)$$

Where:

K_c^L = the levered cost of equity capital of the system

D_c = debt of the system, including parent's debt

E_c = equity of the system

K_{dc} = weighted debt cost of the system

t_c = tax rate

Since there is no debt in the capital structure of the consolidated system, it follows from Equation 37 that:

$$K_c^L = K_c^U = 14.74\% \qquad (38)$$

which is also the weighted average cost of capital of the system.

The cost rate of the parent's equity capital invested in Subsidiary S_1 is obtained by equating the weighted average cost of capital of the system to the overall cost of capital of the subsidiary. This is obtained by solving the equation:

$$K_c^U = \text{WACC (system)}$$
$$= [K_{s1}^L\ E_{s1} + K_{ds1}\ (1 - t_{s1})\ D_{s1}]/[E_{s1} + (1 - t_{s1})\ D_{s1}]$$

i.e.,

$$K_{s1}^{L} = K_{c}^{U} + (K_{c}^{U} - K_{ds1})\ (1 - t_{s1})\ (D_{s1}/E_{s1}) \qquad (39)$$

Since

$$D_{s1} = 0,\ \text{then}\ K_{s1}^{L} = K_{s1}^{U} = K_{c}^{U}$$

That is, in the absence of debt, the subsidiary's cost rate on equity is equal to the unlevered cost rate on equity of the system. The same conclusion is valid for all the subsidiaries whether they are regulated on unregulated and diversified or not. That is:

$$K_{c}^{U} = 14.74 = K_{s1}^{L} = K_{s2}^{L}$$

In other words, the weighted average cost of capital of the consolidated system is equal to the individual cost rates of the subsidiaries. In such an event, Pettway and Jordan (1983) would say that all the regulatory standards of fairness will be satisfied. That is, the individual contributions of the subsidiaries to the parent revenue requirements would be exactly satisfied. The weighted average return rate of the two subsidiaries would be:

$$[(\$108)\ (.1474) + (\$72)\ (.1474)]/\$180 = \$26.5320/\$180$$
$$= 14.74\%$$

which is exactly the same as the weighted average cost of the parent. The two subsidiaries would have their rates of return exactly identical to the weighted average cost of capital of the parent's system.

Case 2: No Debt in the Capital Structure of the Parent But Existence of Debt in the Capital Structures of the Subsidiaries.

Let the parent's unlevered beta be .7579 and t = 50%. The balance sheets of the parent consolidated and unconsolidated capital structures and the subsidiaries are presented in Table 10.

Table 10

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)

Assets	Liabilities & Equity
Eq.S_1:$108	Equity: $180
Eq.S_2:$ 72	
$180	$180

Parent Consolidated (P_c)

Assets	Liabilities & Equity
Sub.S_1:$188	Sub.S_1 Debt: $ 80
Sub.S_2 $192	Sub.S_2 Debt: $120
	Sub.S_1 Equity: $108
	Sub.S_2 Equity: $ 72
$380	$380

Subsidiary (S_1)

Assets	Liabilities & Equity
$188	Debt: $ 80
	Equity: $108
$188	$188

Subsidiary (S_2)

Assets	Liabilities & Equity
$192	Debt: $120
	Equity: $ 72
$192	$192

The levered cost of equity capital of the system can be determined using an independent company approach:

$$K_c^L = K_c^U + (K_c^U - K_{dc})\ (1 - t)\ (D_c/E_c) \qquad (40)$$

or

$$K_c^L = K_f + \beta_c^L\ (K_m - K_f)$$
$$= (.10) + (.80)\ (.1625) - .10)$$
$$= 15\%$$

In order to use Equation 40, the value of K^U is needed because

$$K_c^U = K_f + \beta_c^U\ (K_m - K_f) \qquad (41)$$

but

$$\beta_c^U = \beta_c^L/[1 + (1 - t_c)\ (D_c/E_c)]$$
$$= .80/[1 + (.5)\ (\$200/\$180)]$$
$$= .5143$$

Therefore,

$$K_c^U = (.10) + (.5143)\ (.1625 - .10)$$
$$= .1321$$
$$= 13.21\%$$

$$K_c^L = K_c^U + (K_c^U - K_{dc})\ (1 - t_c)\ (D_c/E_c)$$
$$= (.1321) + (.1321 - .10)\ (.5)\ (\$200/\$180)$$
$$= 15\%,$$

which is the same as before.

The weighted average cost rate of the system would be:

$$\text{WACC(S)} = [(\$180)\ (.15) + (\$200)\ (.10)\ (1 - .5)]/(\$180 + \$100)$$
$$= (\$27 + \$10)/\$280$$
$$= 13.21\%,$$

which is also equal to the unlevered cost of equity capital of the system.

The cost of equity capital of the parent invested in Subsidiary S_1 could be determined using the consolidated capital structure approach:

$$K_{s1}^L = K_c^U + (K_c^U - K_{ds1})\ (1 - t_{s1})\ (D_{s1}/E_{s1}) \qquad (42)$$
$$= (.1321) + (.1321 - .10)\ (.5)\ (\$80/\$108)$$
$$= 14.4\%$$

Similarly, the cost of the parent's equity capital invested in Subsidiary S_2 would be:

$$K_{s2}^L = K_c^U + (K_c^U - K_{ds2})\ (1 - t_{s2})\ (D_{s2}/E_{s2}) \qquad (43)$$
$$= (.1321) + (.1321 - .10)\ (.5)\ (\$120/\$72)$$
$$= 15.89\%$$

The weighted average cost of equity capital contributed by the two subsidiaries to the parent's investment would then be:

$$\text{WACC } (S_1 \text{ and } S_2) = [(\$108)\ (.144) + (\$72)\ (.1589)]/\$180$$
$$= \$27/\$180$$
$$= 15\%,$$

which is the parent's cost of equity capital and $27 ($180 x 15%) is the parent's revenue requirement.

Assignment of the weighted average cost of the system (15%) to each subsidiary has led to different cost rates on the equity capital of the parent's investment in the subsidiaries. For S_1, it is 14.4%, and for S_2, it is 15.89%, according to the risk of each subsidiary while providing on an average basis the parent's required return of 15%. Thus, the consolidated capital structure approach also prices the parent's investment in each subsidiary in proportion to its risk and would enable each subsidiary to contribute its share to the parent's total revenue requirement.

Case 3: Debt in the Parent's Capital Structure and Debt in the Subsidiaries' Capital Structure.

It is assumed that the parent borrows debt and invests in the two subsidiaries in the same proportions of its capital structure. The balance sheets of the parent unconsolidated, parent consolidated, and the subsidiaries are provided in Table 11.

Table 11

Balance Sheets of Parent and Subsidiaries

Parent Unconsolidated (P_u)

Assets	Liabilities & Equity
Eq.S_1:$120	Equity: $ 20
Eq.S_2:$ 80	180
$200	$200

Parent Consolidated (P_c)

Assets	Liabilities & Equity
Sub.S_1:$200	Parent Debt: $ 20
Sub.S_2 $200	Sub.S_1Debt: $ 80
	Sub.S_2 Debt: $120
	Total Debt: $220
	Sub.S_1 Equity:$108
	Sub S_2 Equity:$ 72
$400	$400

Subsidiary (S_1)

Assets	Liabilities & Equity
$200	Debt: $ 80
	Parent Debt: $ 12
	Parent Equity: $108
	Equity: $120
$200	$200

Subsidiary (S_2)

Assets	Liabilities & Equity
$200	Debt: $120
	Parent Debt: $ 8
	Parent Equity: $72
	Equity: $80
$200	$200

Assumptions:

$\beta_p^L = .80 = \beta_c^L$

$t = 50\%$

$K_f = 10\%$

$K_m = 16.25\%$

and the marginal cost of debt of the system and subsidiaries is assumed to be the same, i.e., 10%.

The levered cost rate on the parent's equity capital in accord with CAPM would be:

$$K_p^L = K_f + \beta_p^L (K_m - K_f) \quad (44)$$
$$= .10 + (.80)(.1625 - .10)$$
$$= 15\%$$

The levered cost rate on equity capital of the parent's consolidated capital structure is also 15% since:

$$K_c^L = K_f + \beta_c^L (K_m - K_f) \quad (45)$$
$$= .10 + (.80)(.1625 - .10)$$
$$= 15\%$$

or it can also be shown from:

$$K_c^L = K_c^U + (K_c^U - K_{dc})(1 - t_c)(D_c/E_c) \quad (46)$$

But to use Equation 46, the knowledge of K_c^U is required, and to evaluate K_c^U, the value of β_c^U must be known in advance. Since:

$$\beta_c^U = \beta_c^L/[1 - t_c)\ (D_c/E_c)]$$
$$= .80/[1 + (.5)\ (\$220/\$180)]$$
$$= .4966$$

$$K_c^U = K_f + \beta_c^U\ (K_m - K_f)$$
$$= .10 + .49666\ (.1625 - .10)$$
$$= .10 + .0310$$
$$= 13.10\%$$

$$K_c^L = .1310 + (.1310 - .10)\ (.5)\ (\$220/\$180)$$
$$= 15\%$$

The weighted average cost of the system would be:

$$\text{WACC (System)} = [(\$180)\ (.15) + (\$220)\ (.10)\ (1 - .5)]/[(\$180) + (\$220)\ (1 - .5)]$$
$$= \$38/\$290$$
$$= 13.10\%,$$

which is the same as the unlevered cost of equity capital of the system. The levered cost rate on the parent's equity capital invested in Subsidiary S_1 would then be:

$$K_{s1}^L = K_c^U + (K_c^U - K_{ds1})\ (1 - t_{s1})\ (D_{s1}/E_{s1}) \qquad (47)$$
$$= (.1310) + (.1310 - .10)\ (.5)\ (\$92/\$108)$$
$$= 14.42\%$$

Similarly, the levered cost rate on the parent's equity capital invested in Subsidiary S_2 would be:

$$K^L_{s2} = K^U_c + (K^U_c - K_{ds2})\ (1 - t_{s2})\ (D_{s2}/E_{s2})$$
$$= (.1310) + (.1310 - .10)\ (.5)\ (\$128/\$72)$$
$$= 15.86\%$$

The weighted average cost of the parent's equity capital invested in the subsidiaries would then be:

$$\text{WACC (Parent)} = [(\$108)\ (.1442) + (\$72)\ (.1586)]/\$180$$
$$= 15\%$$

The parent's return requirement

$$= (\$180)\ (15\%) + (\$20)\ (10\%)$$
$$= \$29,$$

which is exactly satisfied by pricing the equity portion of the subsidiaries according to the risks involved and simultaneously eliminating the monopoly rent of $1 ($200 x 15% - $29).

Determination of Expected Rates of Return on Equity Capital of Large Telephone Companies

This section presents an empirical determination of required return rates on equity capital of small and large telephone companies that are operating in Michigan, using the methodologies that were presented in Chapter III. Michigan Bell Telephone Company

(MBT) is the largest regulated utility, having gross operating revenues in excess of $500 million in the year 1985. General Telephone Company of Michigan (GTM) comes under the category of medium size, with operating revenues in the range of $50 to $500 million. In addition, there are 40 small investor-owned operating telephone companies which had operating revenues of less than $50 million in 1985. Of these 40 telephone companies, 32 are independently operating, whereas the remaining 8 companies are subsidiaries of their respective parent-holding companies. Augusta Telephone, Chatham Telephone, Clayton Telephone, Hickory Telephone, and Shiawassee are the subsidiaries of Telephone and Data Systems (T&DS). Century Telephone Company of Michigan and Central Telephone Company are the subsidiaries of Century Telephone Enterprises, and Alltel of Michigan is the subsidiary of Alltel Corporation.

The determination of expected return rates on the equity capital of the 32 independently operating companies is accomplished using the "subsidiary pricing" approach. For the remaining eight small telephone companies that are subsidiaries of parent-holding companies, the "consolidated capital structure" approach is applied to arrive at the expected rates of return on common equity capital. For General Telephone Company of Michigan, the "parent capital structure" approach is utilized. For Michigan Bell, the "consolidated capital structure" approach is applied to determine its required rate of return.

Subsidiary Pricing Approach to the Determination of Required Rates on Equity Capital of Independently Operating Small Telephone Companies in Michigan

Under this approach, the cost rate on equity capital of a group of independently operating telephone companies that have an average risk comparable to the utility in question is determined using the Sharp-Lintner version of the CAPM. Then, the unlevered cost rate on the equity capital of the comparable group is calculated. Finally, the cost rate on equity capital of the utility in question is determined, using the unlevered cost rate on equity capital of the comparable group, the utility's debt-to-equity ratio, and its tax rate. To arrive at the equity return rates, the current marginal cost rate on the debt capital is used instead of the embedded average cost rates of debt of the companies. This is due to the fact that CAPM is valid only if the marginal cost rate of debt is equal to the risk-free rate of return. The process of determining the expected return rates on equity capital of small telephone utilities is presented in the following steps.

Step 1: Determination of Average Market Risk and Average Capital Structure Ratios of Comparable Group.

The average market risk and the capital structure ratios are presented in Table 12. It shows that the average market risk of the comparable group was .75, and the group's average capital structure had about 52% debt, 3% preferred stock, and a 45% equity.

Table 12

Market Risk and Capital Structure Ratios of Comparable Group

Company Name	Beta	Long-Term Debt (%)	Preferred Stock (%)	Equity (%)
Alltel Corp.	.65	55.2	4.4	40.4
Central Corp.	.75	47.4	2.3	50.3
Century Tel. Ent.	.65	84.0	5.3	10.7
Cincinnati Bell	.45	34.7	--	65.3
Continental Tel.	.80	56.5	1.7	41.8
Rochester Tel.	.75	37.9	4.7	57.4
So. New Eng. Tel.	.70	37.9	4.2	57.9
United Tel.	.95	54.1	1.9	44.0
Tel. & Data Systems	1.01	72.0	3.0	25.0
Lincoln Tel.	.75	42.5	--	57.5
Mean	.75	52.2	2.8	45.0

Note. From Value Line Investment Survey (weekly). (1986). New York: Value Line; and Moody's Public Utilities Manual (annual). (1986). New York: Moody's Investor's Service.

Step 2: Determination of Market Return Rate on Equity Capital of the Dow Jones Industrials.

The market cost rates on equity capital for 23 Dow Jones Industrials were determined using DCF methodology. These results are provided in Table 13.

Table 13

Market Cost of Capital for Dow Jones Industrials

Company Name	Market Risk (β)	Cost of Equity Capital (DCF Estimate)
Allied Signal	1.00	8.93%
Aluminum Company	1.15	10.34
American Can	.95	14.68
American Express	1.50	13.30
AT&T	.85	14.25
DuPont	1.15	11.25
Eastman Kodak	.80	12.51
Exxon	.80	11.00
General Electric	1.05	15.71
General Motors	1.15	12.47
Goodyear	1.10	9.60
IBM	1.05	17.65
International Paper	1.10	10.22
McDonald's	1.10	20.82
Merck	.90	17.63
Minnesota Mining	1.05	11.09
Owens Illinois	.90	16.56
Phillip Morris	.95	21.98
Proctor & Gamble	.75	11.40

Table 13--Continued

Company Name	Market Risk (β)	Cost of Equity Capital (DCF Estimate)
Sears Roebuck	1.25	15.12
United Technologies	1.15	14.30
Westinghouse Electric	1.30	16.88
Woolworth	1.00	14.72
Market Average	1.04	14.02%

Note. Market risk figures from Value Line Investment Survey. (1986). New York: Value Line.

Step 3: Determination of Risk-Free Rate of Return.

The risk-free rate of return is computed by taking the average of the latest 12-month long-term (10 years and above) Treasury Bond yields and is presented in Table 14.

Step 4: Determination of the Cost Rates on Equity Capital of a Comparable Group of Telephone Companies Having Average Market Risk (β) Equal to .75.

The cost rate on equity capital of the comparable group is estimated by using the capital asset pricing model:

$$K^L = K_f + \beta^L (K_m - K_f) \quad (48)$$

$$= (\text{Risk-Free Rate}) + (\text{Risk Premium})$$

Table 14

Yields on Long-Term Treasury Bonds
(October 1985-September 1986)

Month	Yield (%)
October 1985	10.56
November	10.58
December	9.60
January 1986	9.51
February	9.07
March	8.16
April	7.59
May	8.02
June	8.23
July	7.26
August	7.33
September	7.61
12-Month Average	8.58%

Note. From Federal Reserve Bulletin (monthly). (1986, 1987). Washington, DC: Board of Governors of the Federal Reserve System; and Economic Week. (1985, 1986). New York: City Corporation.

Where:

K_f = 8.58%, the risk-free rate of return

K_m = 14.02%, the market return rate on equity capital

β^L = .75, average market risk of comparable companies

$$K^L = 8.58\% + .75\ (14.02 - 8.58)$$
$$= 8.58\% + 4.08\%$$
$$= 12.66\% \qquad (49)$$

The required rate of return on equity capital of the comparable companies, on the average, is estimated at 12.66%. It should be noted that the risk premium from Equation 49 is:

$$\beta^L\ (K_m - K_f) = 4.08\%$$

Step 5: Determination of Unlevered Market Risk and Unlevered Cost Rates on Equity Capital of the Comparable Group.

The unlevered beta of the comparable group is estimated using:

$$\beta^L = \beta^U\ [1 + (1 - t)\ (D/E) + (P/E)] \qquad (50)$$

Where:

D = 52%, the average debt of the comparable group

E = 45%, the average equity of the comparable group

P = 3%, the average preferred stock of the comparable group

t = 34%, the expected corporate tax rate

β^L = .75, the average market risk of the comparable group

Substituting the values in Equation 50, the unlevered beta can be obtained:

$$\beta^L = \beta^U [1 + (.66)(52/45) + 3/45)]$$

$$.75 = \beta^U (1.8293)$$

$$\beta^U = .75/1.8293$$

$$= .410$$

The unlevered cost rate on equity capital of the comparable group of utilities can be determined from:

$$K^U = K_f + \beta^U (K_m - K_f) \quad (51)$$

$$= 8.58\% + .410 (14.02 - 8.58\%)$$

$$= 8.58\% + 2.23\%$$

$$= 10.81\%$$

Step 6: Determination of Expected Rates of Return on Equity Capital of 32 Independent Telephone Companies in Michigan.

The expected rates of return were estimated using the relationship:

$$K^L = K^U + (K^U - K_f)(1 - t)(D_S/E_S) \quad (52)$$

where D_S/E_S is the debt-to-equity ratio of individual telephone companies. These expected rates of return on equity capital are presented in Table 15.

Table 15

Rates of Return on Common Equity Capital of Michigan's Independent Small Telephone Companies

Company Name	Expected (%)	Authorized (%)	Earned 1982-86 (%)	Debt (%)	Equity 1982-86 (%)
Ace Telephone	15.47	13.50	16.3	76	24
Allendale Tel.	11.33	13.00	18.5	26	74
AuGres Tel.	12.54	12.15	-2.6	54	46
Baraga Tel.	13.67	11.48	15.1	59	41
Barry Tel.	13.67	13.50	22.9	66	34
Blanchard Tel.	14.09	10.60	24.5	69	31
Bloomingdale Tel.	14.09	12.75	16.5	55	45
Carr Tel.	20.66	13.75	28.0	87	13
Chippewa Tel.	30.36	13.50	33.0	93	7
Climax Tel.	13.02	13.25	32.5	60	40
C,C & S Tel.	12.93	13.00	12.5	59	41
Deerfield Farmers	11.92	13.50	15.7	43	57
Drenthen Tel.	10.94	13.00	14.3	8	92
Farmers Mutual	10.81	13.00	11.8	0	100
Hadley Tel.	12.76	13.00	21.9	57	43
Hiawatha Tel.	13.84	12.00	21.9	74	36
Island Tel.	11.07	13.00	18.4	15	85
Kaleva Tel.	11.41	13.00	14.6	19	71
Kingsley Tel.	16.70	13.50	18.8	80	20

Table 15--Continued

Company Name	Expected (%)	Authorized (%)	Earned 1982-86 (%)	Debt (%)	Equity 1982-86 (%)
Lennon Tel.	11.67	13.25	15.6	37	63
Midway Tel.	15.23	13.00	25.4	75	25
Ogden Tel.	10.94	12.10	15.0	8	92
Ontonagan Tel.	14.60	13.50	11.6	72	28
Peninsula Tel.	15.74	13.00	16.7	77	23
Pigeon Tel.	19.85	13.25	17.8	86	14
Sandcreek Tel.	11.26	11.86	10.7	19	81
Springport Tel.	13.02	13.00	12.3	60	40
Upper Peninsula	15.23	14.00	26.7	75	25
Waldron Tel.	18.00	12.75	26.9	83	17
Westphalia Tel.	14.79	13.25	13.3	73	27
Winn Tel.	11.01	13.00	16.1	12	88
Wolverine Tel.	16.35	13.50	12.4	79	21
Mean	14.34%	12.94%	18.0%	55%	45%
SD	3.8%	.71%	7.1%	27%	27%

Note. Earned rates of return, debt and equity ratios are 5-year averages (1982-86).

Consolidated Capital Structure Approach for the Determination of the Required Rates of Return on Equity Capital for the Subsidiaries of Parent-Holding Companies

The required rates of return for the remaining eight companies which are subsidiaries of parent-holding companies are calculated using their respective parents' consolidated capital structures. There are two basic steps for the determination of the required rates of return on equity capital of the subsidiaries. These are:

Step 1: Determination of the Unlevered Cost Rate on Equity Capital of the Parent's Consolidated Capital Structure.

That is:

$$K_c^U = K_f + \beta_c^U (K_m - K_f). \tag{53}$$

Step 2: Determination of Unlevered Cost Rates on Equity Capital of Subsidiaries of Holding Companies.

This is achieved by using the relationship:

$$K_s^L = K_c^U + (K_c^U - K_{ds}) (1 - t) (D_s/E_s) \tag{54}$$

The required rates of return of the eight small telephone companies are presented in Table 16.

Development of "Benchmark" Rates of Return for Small and Independent Telephone Companies

Benchmark rates of return are the guideposts for those utilities having similar risks--business as well as financial. If

Table 16

Michigan Telephone Companies That Are Subsidiaries of Parent-Holding-Company Systems

Company Name	Expected	Authorized	Earned	Debt	Equity	Parent Company
		Small Telephone Subsidiaries				
Augusta Tel.	11.59%	13.50%	8.0%	36%	64%	T&DS
Chatham Tel.	14.38	13.25	11.9	77	23	T&DS
Clayton Tel.	12.17	12.00	13.7	60	40	T&DS
Hickory Tel.	13.96	13.50	12.6	75	25	T&DS
Shiawassee	11.36	13.50	11.2	45	55	T&DS
Alltel of MI	11.78	12.80	15.7	55	45	Cont
Century Tel.	11.35	12.26	16.6	51	49	Cent
Central Tel.	10.78	13.00	13.9	34	66	Cent
Mean	12.17	12.98	12.95	54	46	
SD	1.30	0.59	2.7	16	16	
		Large Telephone Subsidiaries				
Michigan Bell	13.10	13.83	14.2	41	59	Ameritech
General Tel.	15.42	12.40	15.6	49	51	GTE
Mean	14.26	13.12	14.9	45	55	
SD	1.64	1.01	1.0	6	6	

the utilities do not have debt in their capital structures, then they will have only business risks. In such a case the required return on their equity capital would be the same as the unlevered cost rate on the equity capital of the comparable group of utilities. This unlevered cost of equity capital would provide a "benchmark" for such utilities. If the utilities, on the other hand, have varying financial risks, as represented by their corresponding debt-equity ratios, then the benchmark rate of return, at any point in time, will be given by the following relationship:

$$K_s^L = 10.81\% + 1.4718\ (D_s/E_s) \qquad (55)$$

The benchmark rate of return relationship (55) is obtained from the following:

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t)\ (D_s/E_s) \qquad (56)$$

where K^U is the unlevered cost rate on equity capital of the comparable group. Substituting the values that are derived earlier for risk-free rate of return, unlevered cost of capital and the assumed tax rate, that is:

$$K_c^U = 10.81\%,\ K_{ds} = K_f = 8.58\%,\ t = 34\%$$

in Equation 56, Equation 55 is derived, that is:

$$K_s^L = 10.81\% + 1.4718\ (D_s/E_s)$$

Using Relationship 55, the return rates on equity capital of any company can be found. Table 15 provides expected return rates for given debt-to-equity ratios.

Determination of "Benchmark" Capital Structure for Small Telephone Companies

The determination of a "benchmark" rate of return depends on a benchmark capital structure. The question is: What should be the appropriate capital structure which is close enough to the experience of small telephone companies that are operating in Michigan? or Is it possible to determine an "optimal" capital structure that reflects the ideal combination of long-term debt and equity capital, taking into consideration the industry's experience as a whole within which the small telephone companies operate? An optimal capital structure is defined as that capital structure which minimizes the cost of capital while maximizing the value of the firm. Fairly extensive research has been conducted to find an optimal capital structure of a firm, but the empirical evidence so far has been disappointing or inconclusive. Although no completely satisfactory theory has been found to explain the existence of optimal capital structure, casual empiricism suggests that firms behave as though it does exist. Firms do not choose a capital structure in isolation. Firms having the similarity in characteristics generally follow or adopt their group norms. Therefore, it is fair to assume that firms in an industry strive to maintain capital structures close to their group's standard, and, as such, the capital structure of a firm will be close to the group's average capital structure. Thus, the average capital structure of a group which has similar operating risks to that of the company in question may be taken as the "benchmark" capital structure for all practical purposes, other things being equal. Substantial deviations from an optimal capital structure, associated with either too small or too large long-term debt, will not minimize the firm's overall cost of capital. Since debt costs less than equity and interest expense is tax deductible, some amount of debt is valuable to the firm. In contrast, if the firm has debt in excess of its optimal debt ratio, it will cause substantial increase in the cost of long-term debt and equity funds because of concern over whether the firm will be able to meet its interest and principal payments as they come due. Excessive use of debt will show up in the assignment of lower bond quality ratings by rating agencies, such as Standard and Poors, Moody's Investors Services, and others. For instance, Table 17 provides the latest (1985) Standard and Poors revised benchmarks for debt capital for the utility industry.

If the firms in industries exhibit minor operating fluctuations in earnings over the business cycle, it is rather advantageous to use greater portions of debt capital than the firms that are subject to wide swings over the business cycle. Utility companies that have stable operating revenues can capitalize to a larger extent through borrowed capital than do most industrial companies.

Table 17

Standard and Poor's Benchmarks for Debt Capital for
the Utility Industry

Utility Industry	AAA	AA	A	BBB
Electric	Under 45%	42-47%	45-55%	Over 53%
Gas & Gas Dist.	--	Under 45%	45-50%	Over 50%
Gas Pipelines	--	Under 40%	40-50%	Over 50%
Telephone	Under 40%	40-48%	48-50%	58-64%

Standard and Poor's Revised Benchmark Debt Ratios
for Telephone Industry

Category	AAA	AA	A	BBB	BB
Class 1	45% or less	45-50%	50-60%	60-70%	70% or more
Class 2	40% or less	40-45%	45-55%	55-65%	65% or more
Class 3	35% or less	35-40%	40-50%	50-60%	60% or more
Class 4	25% or less	25-35%	30-40%	40-50%	50% or more

Class 1: Small to medium rural and small metro local exchange companies

Class 2: Medium to large rural-suburban and small metro local exchange companies

Class 3: Large metro and suburban local exchange companies

Class 4: Interexchange companies

The average capital structure, 55% debt and 45% equity, as shown in Table 15, for Michigan's independent small telephone companies may be taken as the "benchmark" capital structure. In fact, the 55% average debt ratio is very close to the midpoint of the benchmark debt ratio range which was established by Standard and Poor's for an "A"-rated utility (Table 17). Since an "A" rating is quite adequate from the viewpoints of both regulators and the utility, it is desirable to set the benchmark capital structure at 55% debt and 45% equity. Thus, the benchmark rate of return for small independent telephone companies can be derived using Equation 55, i.e.,

$$K_b^L = 10.81\% + 1.4718\ (D_S/E_S)$$

Since

$$D_S = 55\% \text{ and } E_S = 45\%$$

$$K_b^L = 10.81\% + 1.4718\ (55/45)$$

$$= 12.61\%$$

Thus, the "benchmark" rate of return for small independent telephone companies is 12.61%. Because the cost rate on debt for small telephone companies is lower than the corresponding rate for large telephone companies, due to subsidization by the Rural Electric Administration (REA), the appropriate "benchmark" capital structure may be set at 60% debt and 40% equity. The benchmark return rate would then be:

$$K_b^L = 10.81\% + 1.4718\ (60/40)$$
$$= 13.0\%$$

Based on empirical evidence and pragmatic judgment, the benchmark capital structure for Michigan's small telephone companies would probably have a 55% to 60% debt and a 45% to 40% equity. The corresponding benchmark rate-of-return range for small telephone companies would then be 12.61% to 13.0%. It should be noted, however, that these benchmark rates of return will change as the equilibrium conditions in the financial markets change.

In the case of large telephone companies, the benchmark capital structure will have a 40% debt and a 60% equity. The historical capital ratios of large telephone companies are provided in Table 18.

Table 18

Historical Capital Ratios of Large Telephone Companies

Type of Capital	1982	1983	1984	1985	1986
Long-term debt	43.0	43.8	42.0	40.8	40.8
Preferred stock	3.6	2.4	3.7	3.6	2.9
Common equity	53.4	53.8	54.3	55.6	56.3

Note. From The Value Line Investment Survey. (1987, October). New York: Value Line.

Determination of Cost of Equity Capital of Michigan Bell Telephone Company and General Telephone Company of Michigan

Michigan Bell Telephone Company (MBT) is the largest telephone company and is a subsidiary of AMERITECH. General Telephone Company (GTM) of Michigan is a subsidiary of General Telephone and Electronics Corporation (GTE). To determine the cost rates of equity capital of MBT and GTM, the methods developed in this study are applied. For MBT, the consolidated capital structure approach is applied. The results indicate that, for MBT, the current cost rate on equity capital is 13.1%, whereas for GTM it is 15.4%. These results are consistent with their respective capital structures and the current financial market conditions. It should be noted, however, that the return rates for the current period may change as the financial market equilibrium conditions change over time.

Michigan Bell Telephone Company Market Cost of Equity Capital as of October 15, 1986

Since Michigan Bell is a subsidiary of AMERITECH, the consolidated capital structure approach is used to estimate the current cost rate on equity capital of Michigan Bell. The estimate is also valid for at least 1 year.

Step 1: Cost of Equity Capital of AMERITECH.

AMERITECH beta = .80 (value line)

Debt ratio = 37.5%

Equity ratio = 62.5%

The cost rate on equity capital of AMERITECH is obtained using:

$$K_c^L = K_f + \beta_c^L (K_m - K_f)$$

Where:

K_f = 8.58%

K_m = 14.02%

β_c^L = .80

Cost of equity capital would be:

$$K_c^L = 8.58\% + .80\ (14.02 - 8.58)$$
$$= 8.58 + 4.52$$
$$= 12.932\%$$

Step 2: Determination of Unlevered Beta of AMERITECH.

$$\beta_c^L = \beta_c^U\ [1 + (1 - t)\ (D_c/E_c)]$$
$$= \beta_c^U\ [1 + (.66)\ (37.5/62.5)]$$
$$= (1.396)\ \beta_c^U$$
$$\beta_c^U = .80/1.396$$
$$= .5731$$

Step 3: Determination of Unlevered Cost of Equity Capital of AMERITECH.

$$K_c^U = K_f + \beta_c^U (K_m - K_f)$$
$$= 8.58 + .5731\ (14.02 - 8.58)$$
$$= 8.58 + 3.1177$$
$$= 11.6977\%$$

Step 4: Determination of Cost of Equity Capital of Michigan Bell.

Debt = 39.79%

Equity = 60.21%

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t)\ (D_s/E_s)$$
$$= 11.6977 + (11.6977 - 8.58)\ (.66)\ (39.79/60.21)$$
$$= 11.6977 + 1.3598$$
$$= 13.0575\%$$

Authorized Rate of Return was:	13.84%
Current Cost of Equity Capital:	13.06
Excess:	.78%

The current cost of equity capital is about .78 basis points lower than authorized.

The cost of equity capital of Michigan Bell, based on its current capital structure and embedded debt cost rate, would be 13.59%. This cost is shown in Table 19.

Table 19

Capital Structure and Cost Rates of AMERITECH and Michigan Bell

Type of Capital	Percent	Cost Rate	Weighted Cost Rate
		AMERITECH	
Debt	37.75%	9.34%	3.53%
Equity	62.25	12.93	8.05
Total	100.00%		11.58%
		Michigan Bell	
Debt	39.79%	8.55%	3.40%
Equity	60.21	13.59	8.18
Total	100.00%		11.58%

The cost rate on equity capital of Michigan Bell, using its embedded debt cost rate, is 13.59%, which is higher than its current cost of capital, i.e., 13.06%. If we use the marginal cost rate on debt for both the parent and the subsidiary, the cost of equity capital for Michigan Bell would be exactly 13.06%, as can be seen in Table 20.

Table 20

Capital Structure and Cost Rates of AMERITECH and Michigan Bell

Type of Capital	Percent	Cost Rate	Weighted Cost Rate
		AMERITECH	
Debt	37.75%	8.58%	3.20%
Equity	62.25	12.93	8.05
Total	100.00%		11.25%
		Michigan Bell	
Debt	39.79%	8.58%	3.41%
Equity	60.21	13.02	7.84
Total	100.00%		11.25%

General Telephone Company of Michigan Market Cost of Equity Capital as of October 15, 1986

To derive the market cost of equity capital of GTM, the parent's unconsolidated capital structure is utilized.

Step 1: Determine the Parent's Cost of Equity Capital.

$$K_p^L = K_f + \beta_p^L (K_m - K_f)$$

$$= 8.58 + .91\ (14.02 - 8.58)$$

$$= 13.53\%$$

Step 2: Determine the Parent's Unlevered Beta.

$$\beta_p^L = \beta_p^U [1 + (1 - t)(D_p/E_p) + (P_p/E_p)]$$

$$= \beta_p^U [1 + (.66)(18.84/76.62) + (4.54/76.62)]$$

$$.91 = \beta_p^U [1 + .1623 + .0593]$$

$$= (1.2216)\ \beta_p^U$$

$$\beta_p^U = .91/1.2216$$

$$= .7449$$

Step 3: Determine the Parent's Unlevered Cost of Equity Capital.

$$K_p^U = K_f + \beta_p^U (K_m - K_f)$$

$$= 8.58 + .7449\ (14.01 - 8.58)$$

$$= 12.63\%$$

Step 4: Determine the Cost of Equity Capital of General Telephone Company of Michigan.

$$K_s^L = K_p^U + (K_p^U - K_{ds})(1 - t)(D_s/E_s)$$

$$= 12.63 + (12.63 - 8.58)(.66)(51.06/48.94)$$

$$= 15.42\%$$

For an assumed debt-to-equity ratio of 40%/60%, the cost rate on the equity capital of the subsidiary would then be 14.42%.

The market cost of equity capital of GTM currently is 15.42%, which is higher than its parent's cost of equity capital. This is due to the fact that the parent's investment in the subsidiary is exposed to higher risk, since GTM's capital structure contains 51% of debt as compared to about 19% of the parent's debt in its capital structure.

The authorized rate of return on GTM's equity was 12.40% in 1981. If we use the embedded average cost rate on debt and preferred stock of the company, the cost of common equity capital would be:

$$K_S^L = 12.63 + (12.65 - 7.86)\ (.66)\ (51.06/48.94)$$
$$= 15.91\%$$

which is higher than the current market cost of capital, 15.42%.

Tests of Significance

This section presents tests of hypotheses relating to earned, authorized, and expected rates of return for small telephone companies. The small telephone companies of Michigan are assumed to have been drawn from a national population of 1,400 small telephone companies and will have operating characteristics similar to those of the population. The tests of hypotheses will be carried out, first, for 32 independently operating companies; second, the 32 independent companies will be divided into two groups using the benchmark capital structure debt ratio, 55%, as the benchmark. Companies having debt ratios greater than the benchmark debt ratio, 55%, will be classified into Group A, whereas companies having debt ratios lower than 55% will be classified as Group B. Then tests of hypotheses will be conducted for both groups. Finally, the same tests will be performed for the subsidiaries of parent-holding companies. When the sample size is greater than 30, normal distribution tests will be used. For small sample sizes, the student's t-distribution test will be employed to test for significant differences. The data for conducting the tests of hypotheses are presented in Tables 15, 16, 21, and 22.

1. To test whether there exists a significant difference between authorized and earned mean rates of return for 32 independent telephone companies that are presented in Table 15.

Null Hypothesis, H_0: $\mu_a = \mu_e$

Alternative Hypothesis, H_1: $\mu_a \neq \mu_e$

Since $N = 32$ is larger a two-tailed normal test is used.

$$Z = (\bar{X}_e - \bar{X}_a)/\sqrt{[(S_e^2/N_1) + (S_a^2/N_2)]}$$

$$Z = (18.0 - 12.94)/\sqrt{[(50.41/32) + (.5041/32)]}$$

$$= 4.01$$

Since the Z-value is greater than 3, the difference between the means is significant at the 1% level. In other words, the null hypothesis is rejected. The authorized and the earned rates of return will have come from two different normal populations.

2. To test for significant difference between expected and authorized mean rates of return (Table 15).

Null Hypothesis, H_0: $\mu_{ex} = \mu_a$

Alternative Hypothesis, H_1: $\mu_{ex} \neq \mu_a$

$$Z = (14.34 - 12.94)/\sqrt{(15.0544/32) + (.5041/32)} = 2.008$$

The $\underline{Z}$ value is significant at the 5% level since it is slightly greater than 2. This indicates that the null hypothesis--that is, no difference between the expected rates of return and the authorized rates of return--is rejected.

3. To test whether there exists a significant correlation between the earned and authorized rates of return (Table 15).

Null Hypothesis, H_0: $\rho = 0$

Alternative Hypothesis, H_1: $\rho \neq 0$

Test: $\underline{t}$-test

$$r = .4578,\ t = (r/\sqrt{1 - r^2})\ (\sqrt{N - 2}) = 2.82$$

$$t_{.05,30} = 1.697$$

$$t_{.01,30} = 2.457$$

The observed value of $\underline{t}$ is significant at the 1% level, which indicates that there exists a positive correlation between the authorized rates and the earned rates of return.

4. To test for a significant difference between the means relating to earned and authorized rates of return of small telephone

companies that have debt ratios greater than 55% (Group A) (Table 21).

Table 21

Rates of Return on Common Equity Capital of Michigan's Small Independent Telephone Companies Having Debt Ratios Greater Than 55%--Group A

Company Name	Expected (%)	Authorized (%)	Earned[a] (%)	Debt[a] (%)	Equity[a] (%)
Ace Telephone Co.	15.47	13.50	16.3	76	24
Baraga Tel. Co.	13.67	11.48	15.1	59	41
Barry Tel.	13.67	13.50	22.9	66	34
Blanchard Tel.	14.09	10.60	24.5	69	31
Carr Tel.	20.66	13.75	28.0	87	13
Chippewa Tel.	30.36	13.50	33.0	93	7
Climax Tel.	13.02	13.25	32.5	60	40
C, C & S Tel.	12.93	13.00	12.5	59	41
Hadley Tel.	12.76	13.00	21.9	57	43
Hiawatha Tel.	13.84	12.00	21.9	74	36
Kingsley Tel.	16.70	13.50	18.8	80	20
Midway Tel.	15.23	13.00	25.4	75	25
Ontonagan Tel.	14.60	13.50	11.6	72	28
Peninsula Tel.	15.74	13.00	16.7	77	23
Pigeon Tel.	19.85	13.25	17.8	86	14

Table 21--Continued

Company Name	Expected (%)	Authorized (%)	Earned[a] (%)	Debt[a] (%)	Equity[a] (%)
Springport Tel.	13.02	13.00	12.3	60	40
U.P. Tel.	15.23	14.00	26.7	75	25
Waldron Tel.	18.00	12.75	26.9	83	17
Westphalia Tel.	14.79	13.25	13.3	73	27
Wolverine Tel.	16.35	13.50	12.4	79	21
Mean	16.00%	13.02%	20.5%	73%	27%
SD	4.03%	0.81%	6.8%	10.4%	10.4%

[a]Average for 5-year period (1982 through 1986).

Null Hypothesis, H_0: $\mu_e = \mu_a$

Alternative Hypothesis, H_1: $\mu_e \neq \mu_a$

The t-test is used with degrees of freedom obtained using Dixon and Massey's (1951) formula.

$$t = (20.5 - 13.02)/\sqrt{(6.8^2/20) + (.81^2/20)]}$$
$$= 4.9668 \text{ (D.O.F. = 20)}$$

Since the observed t-value is significant at the 1% level, the null hypothesis is rejected.

5. To test for a significant difference between the means relating to expected and authorized rates of return of small

telephone companies that have debt ratios greater than 55% (Group A, Table 21).

Null Hypothesis, H_0: $\mu_{ex} = \mu_a$

Alternative Hypothesis, H_1: $\mu_{ex} \neq \mu_a$

$$t = (16.0 - 13.01)/\sqrt{[(4.03^2/20) + (0.81^2/20)]}$$

$$= 3.242 \text{ (D.O.F. = 15)}$$

$$t_{.05,15} = 1.7553, \quad t_{.01,15} = 2.602$$

Since the observed t-value is significant at the 1% level, the null hypothesis of equal means is rejected.

6. To test whether there is a significant difference between the means of earned and authorized rates of return of small telephone companies which have debt ratios less than 55% (Group B, Table 22).

Null Hypothesis, H_0: $\mu_e = \mu_a$

Alternative Hypothesis, H_1: $\mu_e \neq \mu_a$

$$t = (13.7 - 12.80)/\sqrt{2.6133 + .0208}$$

$$= .5545 \text{ (D.O.F. = 12)}$$

$$t_{.05,12} = 1.782, \quad t_{.01,12} = 2.681$$

The observed value of t is not significant at the 5% level; hence the null hypothesis is accepted. In other words, the earned and authorized rates of return might have come from the same population.

Table 22

Rates of Return on Common Equity Capital of Michigan's Small Independent Telephone Companies Having Debt Ratios Less Than 55%--Group B

Company Name	Expected (%)	Authorized (%)	Earned[a] (%)	Debt[a] (%)	Equity[a] (%)
Allendale Tel.	11.33	13.00	18.5	26	74
AuGres Tel.	12.54	12.15	-2.6	54	46
Bloomingdale Tel.	14.09	12.75	16.5	55	45
Deerfield Tel.	11.92	13.50	15.7	43	57
Drenthen Tel.	10.94	13.00	14.3	8	92
Farmers Mutual	10.81	13.00	11.8	0	100
Island Tel.	11.07	13.00	18.4	15	85
Keleva Tel.	11.41	13.00	14.6	29	71
Lennon Tel.	11.67	13.25	15.6	37	63
Ogden Tel.	10.94	12.10	15.0	8	92
Sandcreek Tel.	11.16	11.86	10.7	19	81
Winn Tel.	11.01	13.00	16.1	12	88
Mean	12.00%	12.80%	13.7%	26%	74%
SD	0.93%	0.50%	5.6%	18%	18%

[a]Average for 5-year period, 1982 through 1986.

7. To test for a significant difference between the authorized and expected mean rates of return of companies having debt ratios less than 55% (Group B, Table 22).

Null Hypothesis, H_o: $\mu_{ex} = \mu_a$

Alternative Hypothesis, H_1: $\mu_{ex} \neq \mu_a$

$t = (12.80 - 12.00)/\sqrt{.0208 + .07208}$

$= 2.625$ (D.O.F. = 18)

$t_{.05,18} = 1.734$, $t_{.01,18} = 2.552$

Since the observed t-value is significant at the 1% level, the null hypothesis of equal means is rejected.

8. To test for a significant difference between the mean earned rates of Group A (Table 21) and Group B (Table 22).

Null Hypothesis, H_o: $\mu_{ea} = \mu_{eb}$

Alternative Hypothesis, H_1: $\mu_{ea} \neq \mu_{eb}$

$t = [(X_a - X_b)/\sigma] \sqrt{[N_a N_b/(N_a + N_b)]}$

$N_a = 20$, $N_b = 12$

$t = [(20.5 - 13.8)/6.4093]$ (2.7386)

$= 2.9292$ (D.O.F. = 30)

$t_{.05,30} = 1.697$, $t_{.01,30} = 2.457$

Since the observed $t = 2.9292$, the probability of such a t occurring is less than 1%. It is clear that the difference between X_a and X_b is significant, and the null hypothesis is rejected.

9. To test for significance between the mean earned rates of independent telephone companies (Table 15) and subsidiaries of the holding companies (Table 16).

Null Hypothesis, H_0: $\mu_i = \mu_h$

Alternative Hypothesis, H_1: $\mu_i \neq \mu_h$

$$t = (18 - 12.95)/\sqrt{(7.1^2/32) + (2.7^2/8)}$$

$$= 3.2025 \text{ (D.O.F. = 37)}$$

$t_{.05,37} = 1.687$, $t_{.01,37} = 2.423$

Since the observed $\underline{t}$ = 3.2025 is significant at the 1% level, the null hypothesis is rejected.

10. To test for a significant difference between the earned and authorized mean rates of return of the subsidiaries of the holding companies (Table 16).

Null Hypothesis, H_0: $\mu_a = \mu_e$

Alternative Hypothesis, H_1: $\mu_a \neq \mu_e$

$$t = (12.98 - 12.17)/\sqrt{(.59^2/8) + (1.30^2/8)}$$

$$= 1.62 \text{ (D.O.F. = 11)}$$

$t_{.05,11} = 1.796$, $t_{.01,11} = 2.718$

Since the observed value of $\underline{t}$ = 1.62 is not significant, the null hypothesis is accepted.

11. To test whether there exists a significant correlation between the authorized and earned rates of return of the subsidiaries of holding companies (Table 16).

Null Hypothesis, H_0: $\rho = 0$

Alternative Hypothesis, H_1: $\rho \neq 0$

t-test is used, D.O.F N - 2

$r = -.69765$

$t = r/\sqrt{(1 - r^2)/(N - 2)}$

$= 2.38525$

$t_{.05,6} = 2.015$, $t_{.01,6} = 3.365$

Since the observed t-value is significant at the 5% level, the null hypothesis is rejected at the 5% level of significance.

Summary

This chapter presented an evaluation of (a) the traditional (proponents) approach to double leverage, (b) the independent company (opponents) approach, (c) Pettway and Jordan's (1983) double leverage theory, and (d) the approaches that are adopted in this research--subsidiary pricing approach, parent unconsolidated capital structure approach, and parent consolidated capital structure approach. It has been shown through the analysis of descriptive examples that the approaches adopted by the proponents and opponents for the determination of required rates of return for those companies which are either subsidiaries of parent-holding companies or independently operating but whose securities are not publicly traded are inconsistent with the regulatory standards of fairness. The approaches adopted in this research are consistent with the regulatory standards of fairness. The analysis indicates that the parent capital structure approach and the consolidated capital structure approach to the double leverage are valid even if the parent-holding company has more than one subsidiary. Finally, the benchmark rates of return determined for the companies are consistent with the current financial market conditions.

CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study presents a unified, consistent, and comprehensive approach to resolving the highly intriguing and controversial problem of analyzing "double leverage" and its implications for rate setting of a subsidiary in a holding-company system. It provides a methodology for the determination of benchmark rates of return, on a periodic basis, for small and regulated utilities whose securities are not publicly traded in the capital markets.

The study starts with the complex nature of the problem faced by utility regulators and presents a review of "double leverage" methodologies. It then delineates the conflicting positions of the proponents and opponents of double leverage approaches that are advocated for the determination of a fair and equitable return rate on the common equity capital of the subsidiaries of the utility holding companies. The study then develops the theoretical foundations for the double leverage process, describes the operating methodologies using the capital asset pricing framework, and evaluates the methodologies developed for consistency with the regulatory standards of fairness. The techniques developed are then applied to determine the "benchmark" rates of return for the

subsidiaries of holding companies as well as for the independently operated telephone companies under the jurisdiction of the Michigan Public Service Commission.

Findings

1. In general, the double leverage approach (parent unconsolidated capital structure approach), as traditionally practiced by its advocates, fails to satisfy the regulatory standards of fairness. The regulatory standards will be satisfied only if (a) both the parent and its subsidiary or subsidiaries maintain identical debt-to-equity ratios and (b) the levered betas of the subsidiaries are equal to the unlevered beta of the parent ($\beta^L_{si} = \beta^U_p$). The proof of this statement is provided in Appendix B.

2. Regulatory standards of fairness imply that each subsidiary will contribute to its parent in accordance with the risks to which the parent's investment is exposed. Unequal contributions by the subsidiaries to the parent do not necessarily imply cross-subsidization of some of the subsidiaries by others. In fact, if $\beta^L_{si} \gtrless \beta^U_p$, or if the debt-to-equity ratios of the subsidiaries and the parent are unequal, the returns on the parent's investment would be different because of the relative risks to which the parent's investment is exposed. It therefore does not imply cross-subsidization, as was argued by Pettway and Jordan (1983). The regulatory standards of fairness will be satisfied if the weighted average cost rate of equity capital of the subsidiary or

subsidiaries, applied to the parent's equity capital, satisfies the parent's cost of capital.

3. The approach adopted in this research eliminates the leverage effect at the parent level, as is required by regulation, and gives proper consideration to the leverage effect at the subsidiary's level, while determining the cost rate on the equity capital of the subsidiary. In contrast, the traditional approach, advocated by the proponents, completely ignores the presence of leverage at the subsidiary level, as well as at the parent level, since the parent's investment in the subsidiary will receive a return equivalent to its weighted average cost of capital, that is, the parent's unlevered cost rate (K_p^U). This can be seen from Equation 57, which was developed in this research (see Equation 31) and which reflects the levered cost rate on the subsidiary's equity capital (which is the same as the return on the parent's investment in the subsidiary since the parent owns the common stock of the subsidiary).

$$K_s^L = K_p^U + (K_p^U - K_f)\ (1 - t)\ (D_s/E_s) \qquad (57)$$

If $D_s/E_s = 0$, Equation 57 reduces to:

$$K_s^L = K_p^U \qquad (58)$$

Equation 58 implies that the cost rate on the subsidiary's equity capital is equal to the parent's unlevered (weighted average) cost rate. In fact, Equation 58 reflects the position of the proponents of double leverage since it ignores the effect of leverage at both the parent and subsidiary levels. Thus, traditional regulation authorizes a rate of return to the subsidiary which is equivalent to the parent's cost of capital (parent's weighted average cost) because of the fungible nature of the parent's investment in the subsidiary and no more. It ignores the return to the parent that is attributable to the risk to which the parent's investment is exposed due to the presence of the subsidiary's own debt.

The proponents further argue that because the parent's cost of capital reflects the risks of all its subsidiaries, there is no need to consider the leverage effect of the subsidiaries separately. This writer contends that the proponents argument is valid if, and only if, the parent and its subsidiaries have the same capital structure ratios and the levered betas of the subsidiaries are all equal to the unlevered beta of the parent, i.e., $D_p/E_p = D_S/E_S$ and $\beta_S^L = \beta_p^U$. The market, in fact, assumes these conditions. Thus, the traditional double leverage approach, in general, fails to satisfy the regulatory standards of fairness. The arguments of the opponents in favor of authorizing the market rate of return of the parent's equity cost rate to its subsidiaries' equity are not valid when assessed in terms of regulatory standards of fairness. This can be seen by considering the equation reflecting the double leverage approach, i.e.,

$$K_p^L = K_s^L + (K_s^L - K_f)\ (1 - t)\ (D_s/E_s) \quad (59)$$

If $D_s/E_s = 0$, then it follows from Equation 59 that

$$K_p^L = K_s^L \quad (60)$$

Equation 60 implies that the cost rate on equity capital of the subsidiary will be identical to the equity cost rate of its parent. This approach ignores the effect of the subsidiary's leverage as well; it considers only the parent's leverage effect. Because of the relationship, as expressed in Equation 60, the opponents of double leverage contend that every subsidiary should return on the parent's investment the same rate of return as that of the parent. This is in contrast to the position of the advocates, which maintains that all the subsidiaries should contribute equally to the parent's weighted average cost of capital.

In sum, the positions of the proponents and the opponents are valid only under specific conditions, but, in general, they fail to satisfy the regulatory standards of fairness. The position of this research is, first, to eliminate the effect of leverage at the parent level and, second, to give consideration to the effect of the subsidiaries' leverage to determine the cost rate on equity capital of the parent's investment in the subsidiaries. This is achieved by using the following equations:

$$K_s^L = K_p^U + (K_p^U - K_f)\ (1 - t)\ (D_s/E_s) \quad (61)$$

or

$$K_p^L = K_f + (K_m - K_f)\ (\beta_p^L)(\beta_s^L/\beta_p^U) \tag{62}$$

if β_s^L is known.

4. Under ideal conditions, Equations 61 and 62 provide the same rates of return on the parent's investment. Equating 61 and 62, it is possible to find the value of β_s^L, which is unknown, and then find the expected cost of the subsidiary's equity capital as if it were operating independently. This will eliminate the use of a "proxy" beta of comparable-risk companies. Pettway and Jordan (1983) suggested the use of a "proxy" beta since they were unable to determine the value of β_s^L. Because of the "proxy" beta problem, they advocated an independent company approach. The present research would enable one to find the value for β_s^L.

5. The traditional consolidated capital structure approach to double leverage fails, in general, to satisfy the regulatory standards of fairness. It will satisfy the regulatory standards only if all the subsidiaries have the same debt-to-equity ratios as that of the consolidated system. The consolidated capital structure approach to double leverage, adopted in this research, prices the parent's investment in each subsidiary in proportion to its risks and would enable the subsidiary to contribute its share to the parent's total revenues. The required rates of return of the subsidiaries can be obtained from the relationship:

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t)\ (D_s/E_s) \tag{63}$$

Then, the weighted average cost rate of the subsidiaries' equity rate, when applied to the parent's equity, would provide the required return to the parent. In this way, the consolidated capital structure approach, as represented by Equation 63, will satisfy the regulatory standards of fairness because the approach recognizes the effect of the subsidiary's leverage while eliminating the leverage effect of the consolidated system.

6. An alternative formula for Equation 63 is:

$$K_S^L = K_C^U + [(K_p^U - K_f)]/[1 + (D_C/E_C)] \; (\beta_C^L/\beta_p^U) \; (D_S/E_S) \qquad (64)$$

if $\beta_C^L = \beta_p^U$, then it follows:

$$(D_C/E_C) = (\beta_p^U/\beta_C^U) - 1 \qquad (65)$$

Equation 65 implies that the debt-to-equity ratio of the consolidated system should equal the ratio of the parent's unlevered beta to the unlevered beta of the system, minus unity.

7. If $\beta_C^L = \beta_p^U$, then both the parent capital structure approach and the consolidated capital structure approach will provide identical results for the cost of capital of the subsidiary. An example to illustrate this case is presented in Appendix C.

8. The "benchmark" rate of return for 32 independently operating telephone companies, based on the "benchmark" capital structure, 60% debt and 40% equity, is 13%. The benchmark rate of return was derived from the relationship:

$$K_D^L = 10.81 + (1.4718)\ (D_S/E_S) \qquad (66)$$

9. The expected, authorized, and earned rates of return and the debt and equity ratios of 32 independent telephone companies are presented in Table 15. On the average, the companies have earned about 5% more than their average authorized rates during 1982 through 1986.

10. The expected, authorized, and earned rates of return of the eight telephone subsidiaries, as shown in Table 16, indicate that the companies, on the average, have earned their authorized rates of return, whereas the earned rates of return of the large telephone companies were higher than their authorized rates of return (Table 16).

11. The earned rates of return of the small independent telephone companies having debt ratios greater than 55% were almost 7% higher than their authorized rates of return during the period 1982 through 1986 (Table 21). In contrast, the earned rates of return of those small telephone companies having debt ratios less than 55% were only 1% higher than their authorized rates (Table 22). The impact of higher leverage is evident in the case of the group of companies that has had debt ratios greater than 55%.

Tests of Hypotheses: Independent Telephone Companies

12. The null hypothesis that there is no difference between the means of the earned rates and authorized rates of return for the

32 independently operating companies (Table 15) is rejected at the 1% level of significance (page 123).

13. The null hypothesis that there is no difference between the means of the authorized and expected rates of return for the 32 independently operating companies (Table 15) is rejected at the 5% level of significance (page 124).

14. The null hypothesis that there is no correlation between the authorized and earned rates of return of the 32 independent telephone companies is rejected (Table 15) at the 1% level of significance (page 124).

15. The null hypothesis that there is no difference between the means of the authorized and earned rates of return of small telephone companies that have debt ratios greater than 55% is rejected (Table 21) at the 1% level of significance (page 126).

16. The null hypothesis that there is no difference between the means of the authorized and expected rates of return of small telephone companies having debt ratios greater than 55% is rejected (Table 21) at the 1% level of significance (page 127).

17. The null hypothesis that there is no difference between the means of the authorized and earned rates of return of small telephone companies that have debt ratios less than 55% is accepted (Table 22 and page 127).

18. The null hypothesis that there is no difference between the means of authorized and expected rates of return of small

telephone companies that have debt ratios less than 55% is rejected (Table 22) at the 1% level of significance (page 129).

19. The null hypothesis that there is no difference between the mean earned rates of return of Group A (having a debt ratio greater than 55%) and Group B (having a debt ratio less than 55%) is rejected (Tables 21 and 22) at the 1% level of significance (page 129).

Tests of Hypotheses: Subsidiaries of Holding Companies

20. The null hypothesis that there is no difference between the means of the authorized and expected rates of return of the subsidiaries of holding companies is accepted (Table 16, page 130).

21. The null hypothesis that there is no difference between the mean earned rates of return of the independently operating telephone companies and the subsidiaries of holding companies is rejected (Tables 15 and 16) at the 1% level of significance (page 130).

22. There was a significant negative correlation at the 5% level between the authorized and earned rates of return of the subsidiaries of holding companies, in contrast to the significant positive correlation between the authorized and earned rate of return of independently operating telephone companies (Tables 15 and 16 and page 131).

Conclusions

The theoretical results in this study indicate that the traditional double leverage methodologies cannot be applied under all circumstances. The appropriate application of a particular method--subsidiary pricing approach (the so-called independent company approach), parent unconsolidated capital structure approach, or parent consolidated capital structure approach--will depend on the institutional and the legal form of business organization under which a utility operates. The superiority of the methods advocated in this study over the traditionally practiced methods is argued on the basis of three major advantages. First, the methods try to remove the leverage effect at the parent level, consolidated system's level, or the comparable group level. Second, they utilize the capital structure ratios of the individual companies. Finally, they use the marginal cost rates on debt capital of the companies instead of their embedded cost rates, while determining the current return rates on the equity capital and the benchmark rates of return.

The advantages of these methodologies are assessed in terms of actual rate case examples of large as well as small telephone companies. The validity and effectiveness of these methodologies are much more clear in the case of small telephone companies that have had large portions of subsidized debt in their capital structures. For example, on one hand, in the case of Chatham

Telephone Company, a subsidiary of Telephone and Data System, the traditional consolidated capital structure approach would have authorized the company an equity return rate in excess of 25%. The methodology developed in this study, on the other hand, would provide a 14.4% return rate, which is significantly lower than 25% (see Appendix C).

The empirical results--the "benchmark" rates of return that were derived using the methodologies--are consistent with the current financial market conditions. The power of the techniques lies in their ability to capture the riskiness of the parent's investment in the subsidiary after removing the parent's leverage effect while placing emphasis on the regulated company's business and financial risks. In this way, the costs to the ratepayer are minimized by eliminating the monopoly profits of the parent's investment in the subsidiary. At the same time, it awards the proper return on the parent's investment in its subsidiary according to the risks to which the investment is exposed due to the presence of the leverage of the subsidiary. This is the only way the public interest can be maximized.

The study provides a rational and logical basis for sound policy making in the area of rate-of-return regulation. Further, it will enable the Public Service Commission staff to determine the market-based "benchmark" rates of return for Michigan utilities on a timely basis, thereby minimizing, though not eliminating, the costly adversary rate case proceedings.

Recommendations

This researcher recommends the following approaches for the determination of cost of equity capital of regulated utilities that are either subsidiaries of their parent-holding companies or independently operating but the securities of which are not publicly traded.

1. If the company stands alone but its securities are not publicly traded, the expected rate of return on the common equity capital can be estimated by using:

$$K^L = K_c^U + (K_c^U - K_d)\ (1 - t)\ (D/E)$$

Where:

K^L is the return rate on the equity capital of the company involved

K_c^U is the unlevered cost rate on the equity capital of a set of comparable companies

K_d is the marginal cost of debt

t is the marginal tax rate

D/E is the debt-to-equity ratio of the subsidiary

2. If the company is a subsidiary of the parent-holding company system and the parent capital structure is readily available, the expected return rate on the parent's investment in the subsidiary can be obtained by using:

$$K_s^L = K_p^U + (K_p^U - K_{ds}) (1 - t_s) (D_s/E_s)$$

Where:

K_p^U is the unlevered return rate on the parent's equity capital

3. If the company is a subsidiary of the parent-holding company system and if the parent's capital structure is unavailable, the expected return rate on the subsidiary's equity capital can be obtained by using:

$$K_s^L = K_c^U + (K_c - K_{ds}) (1 - t_s) (D_s/E_s)$$

Where:

K_c^U is the unlevered cost rate on the equity capital of the consolidated system

Suggestions for Further Research

1. Even though the methodologies developed in this research can be applied to electric and natural gas utilities, empirical evaluation of the approaches is needed to see whether the results will be consistent with the regulatory standards of fairness.

2. To determine the expected rates of return on equity capital, this research uses the book values for debt and equity despite the fact that the capital asset pricing approach requires the use of market values for debt and equity. This is because the market return rates are, in fact, applied to the book values by the

regulators. In the case of small telephone companies, the market values for stock are not available since they are not traded on the open market. For holding companies, such as AMERITECH, GTE, and T&DS, the market values are available. If the stock, on one hand, is traded at or near the book value, there will not be serious distortion in estimated returns; if the stock, on the other hand, is traded far away from its book value, there will be a serious distortion in the expected returns on common equity. As Morin (1984) points out, "the problem is largely academic since, in practice, book value capital structures do not often deviate significantly from market value capital structures" (p. 282). Further research is needed to identify the impact on the expected rates of return if a company's stock is traded far above or below the book values.

3. Further research is also needed to determine the business and financial risks attributable to the regulated portion of either an independently operating company or a parent-holding company that has diversified operations.

4. Theoretical as well as empirical analyses are needed to identify precisely a "benchmark" capital structure for a specific class of utilities--small telephone utilities, medium telephone companies, and large telephone companies.

APPENDIX A

APPLICATION OF DOUBLE LEVERAGE METHODOLOGY

Application of Double Leverage Methodology for Equity Method of Accounting

If the parent has a single subsidiary, the common equity of the subsidiary is equal to the total capitalization of the parent. If the parent has more than one subsidiary, the total common equity of the subsidiaries will equal the total capitalization of the parent. Table 23 provides an example for the assignment of cost rates to the retained earnings of a subsidiary under double leverage methodology. The cost rates on debt and preferred stock of the parent are assumed to be different from those of the subsidiary. The double leverage methodology, in this case, assigns the weighted average cost of capital of the parent to the equity capital of the subsidiary. The cost rate on equity capital of the parent is assumed to be 15%.

Application of Double Leverage Methodology for Cost Method of Accounting

Under the cost method of accounting, the retained earnings of the subsidiary do not appear in the capital structure of the parent. The equity capital of the subsidiary is the sum of the subsidiary's retained earnings and paid-in capital or the total capital of the parent. The double leverage approach, in this case, assigns the weighted average cost of capital of the parent to its investment in the subsidiary and parent's equity return rate to the retained earnings of the subsidiary. Table 24 provides an illustration of the cost method of accounting for the treatment of subsidiary's retained earnings. It should be noted that both methods provide the same overall cost of capital of the subsidiary, i.e., 11.60%.

Table 23

Weighted Average Cost of Capital of Parent and Subsidiary

Type (1)	Amount (2)	% (3)	Cost Rate (4)	Weighted Cost Rate (5)=(3)(4)
Parent's Unconsolidated Capital Structure & Weighted Cost Rate				
Long-term debt	$ 3,000	30%	10%	3.00%
Preferred stock	1,000	10	8	.80
Common equity				
Paid-in capital	4,000	40	15	6.00
Parent's retained earnings	500	5	15	.75
Subsidiary retained earnings	1,500	15	15	2.25
Total	$10,000	100%		12.80%
Subsidiary Capital Structure & Weighted Cost Rate				
Long-term debt	$ 7,000	35.0%	11.00%	3.85%
Preferred stock	3,000	15.0	9.00	1.35
Common equity				
Parent's investment	8,500	42.5	12.80	5.44
Subsidiary retained earnings	1,500	7.5	12.80	.96
Total capital	$20,000	100.0%		11.60%

Table 24

Weighted Average Cost of Capital of Parent and Subsidiary

Type (1)	Amount (2)	% (3)	Cost Rate (4)	Weighted Cost Rate (5)=(3)(4)
Parent's Unconsolidated Capital Structure & Weighted Average Cost Rate				
Long-term debt	$ 3,000	35.2%	10%	3.52%
Preferred stock	1,000	11.8	8	.94
Common equity				
Paid-in capital	4,000	47.1	15	7.07
Retained earnings	500	5.9	15	.88
Total	$ 8,500	100.0%		12.41%
Subsidiary Capital Structure & Weighted Average Cost Rate				
Long-term debt	$ 7,000	35.0%	11.00%	3.85%
Preferred stock	3,000	15.0	9.00	1.35
Common equity				
Parent's investment	8,500	42.5	12.41	5.27
Subsidiary retained earnings	1,500	7.5	15.00	1.13
Total capital	$20,000			11.60%

The Parent's Consolidated Weighted Cost of Capital

Recall that the equity capital of the parent's consolidated capital structure is the same as the equity capital of the parent's unconsolidated capital structure under equity method of accounting. This is due to the fact that the double leverage approach derives its source from the equity method of accounting since the parent's overall rate of return is applied to the equity capital of the subsidiary. Table 25 shows that the consolidated weighted average cost rate will also be equal to the subsidiary's weighted average cost rate of capital, as determined under cost method of accounting or equity method of accounting.

Thus, the parent's consolidated weighted average cost rate of capital is equal to the weighted average cost rate of capital of the subsidiary under equity method of accounting or cost method of accounting.

Table 25

Parent's Consolidated Weighted Cost of Capital

Type	Amount	%	Cost Rate	Weighted Cost Rate
Long-term debt				
Parent	$ 3,000	15.0%	10%	1.500%
Subsidiary	7,000	35.0	11	3.850
	10,000	50.0		5.350
Preferred stock				
Parent	1,000	5.0	8	.400
Subsidiary	3,000	15.0	9	1.350
	4,000	20.0		1.750
Common equity				
Parent paid-in capital	4,000	20.0	15	3.000
Parent retained earnings	500	2.5	15	.375
Subsidiary retained earnings	1,500	7.5	15	1.125
	6,000	30.0		4.500
Total	$20,000	100.0%		11.600%

APPENDIX B

MATHEMATICAL DERIVATION FOR THE METHODOLOGIES ADOPTED IN THIS STUDY

Sharpe-Lintner Version of the Capital Asset Pricing Model (CAPM)

The Sharpe-Lintner CAPM hypothesizes that there exists a direct proportional relationship between risk premiums of securities and their respective betas relative to the market portfolio of all risky assets (including real estate, gold, gems, and works of art). In other words,

(Risk Premium of ith security) = (Beta)(Risk Premium of Market
Say, AT&T Portfolio of all Risky Assets)

Risk premium of a security (portfolio) is defined as the difference between the expected market return of a security (portfolio) and risk-free interest rate (say, 90-day Treasury Bill rate or interest rate on a 20-year Treasury Bond).

Let $E\,(R_i)$ = Expected return rate on security "i"

$E\,(R_m)$ = Expected return rate on market portfolio of all risky assets

R_f = Risk-free interest rate

Then the Sharpe-Lintner hypothesis implies that:

$$E\,(R_i) - R_f = (\beta)\,[E\,(R_m) - R_f]$$

or

$$E\,(R_i) = R_f + \beta\,[E\,(R_m) - R_f] \quad (67)$$

where the beta coefficient measures the relationship between changes in the rate of return on a particular risky asset and changes in the rate of return on the market portfolio. Suppose a particular security's (say AT&T) beta is .84. What it implies is that, on the average, the rate of return on the security in question (AT&T) is expected to increase or decrease by 84 basis points for a 1% (100 basis points) change in the rate of return for the market portfolio of all risky assets. Beta represents the market risk of a security. The total risk of a security can be divided into two components, namely, systematic risk and unsystematic (random) risk. The unsystematic risk can be eliminated by proper diversification, whereas the systematic risk, which moves with the trends in the market, cannot be reduced by proper diversification. The risk of a security is measured by its volatility in its rate of return, i.e., by its standard deviation, $\sigma(R_i)$. Similarly, the risk of a market portfolio is measured by its standard deviation, i.e., $\sigma(R_m)$. A security's systematic risk is equal to the product of the security's beta and the risk of the market portfolio; i.e., $\beta_i \times \sigma(R_m)$, where beta, β_i, is defined is the covariance between the security's return (R_i) and market return (R_m); i.e.,

$$\beta_i = \frac{E\,[R_i - E\,(R_i)]\,[R_m - E\,(R_m)]}{E\,[(R_m - E(R_m)]^2} \tag{68}$$

The value of beta may vary from positive to negative. By definition, the market beta is unity. This can be seen by substituting $R_i = R_m$, and $E\,(R_i) = E\,(R_m)$ in Equation 68, i.e.,

$$\beta_i = \frac{E\,[R_m - E\,(R_m)]\,[R_m - E\,(R_m)]}{E\,[R_m - E\,(R_m)]^2}$$

$$= \frac{E\,[R_m - E\,(R_m)]^2}{E\,[R_m - E\,(R_m)]^2}$$

$$= 1$$

The beta value of unity is generally called average risk of the market portfolio of stocks. If a particular stock's beta is, say, .84, it would mean that the security's market risk is relatively lower than the market as a whole and vice versa.

Equation 67 is called the Sharpe Lintner version (some call it the original and others refer to it as the "standard") of the capital asset pricing model (SLCAPM). This model, as shown below,

$$E\,(R_i) = R_f + \beta_i\,[E\,(R_m) - R_f],$$

states that the expected market rate of return on a security is equal to the sum of (a) the risk-free rate (R_f) plus (b) a risk premium for the particular security that is arrived at by multiplying the risk premium for the market portfolio of all risky assets by the individual security's beta coefficient.

A distinctive feature of the SLCAPM is that it uses a specific, quantitative measure of risk, the beta coefficient, to estimate the magnitude of the appropriate risk premium for any given security.

The Sharpe-Lintner CAPM is based on the following assumptions:

1. Investors are risk averse and would like to have an expected rate of return.

2. Investors agree on the magnitude of expected rate of return and standard deviations on rates of return on all portfolios.

3. A riskless asset exists.

4. All assets are marketable.

5. There are no transaction costs, and fractional shares are traded.

6. There are no personal taxes.

7. Investors are able to borrow in unrestricted amounts at the riskless interest rate.

Given the aforementioned conditions, it is possible to represent the portfolio opportunities of an investor graphically. Figure 7 shows the various combinations of portfolios as represented by crosses and their expected returns and their corresponding risk.

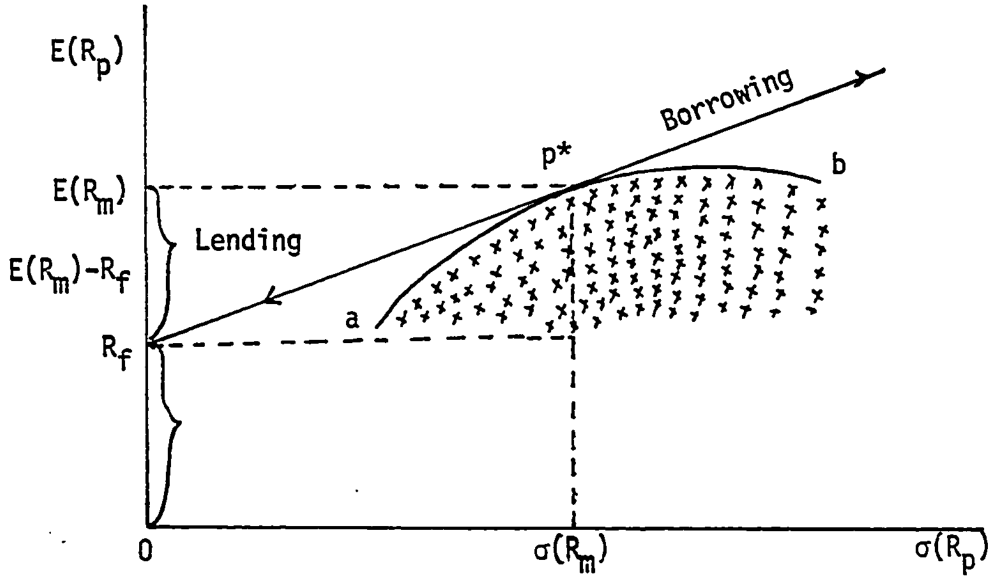


Figure 7. Portfolio Opportunities of an Investor.

The crosses in Figure 7 represent possible portfolios of risky securities. The efficiency frontier (a-b) represents possible portfolios of risky securities that offer the highest expected rate of return for any level of risk. If investors are risk averse and like expected returns, they would select portfolios on the efficiency frontier. Further, if investors are able to borrow and lend at a constant interest rate, they would choose portfolio p*, which offers them highest return for corresponding risk. Investors with less risk aversion can borrow on margin and invest more than their net worth in portfolio p*, whereas highly risk averse investors would divide their net worth between riskless bonds and risky security portfolio p*. In capital market equilibrium all securities must be held by someone. Therefore, since all investors desire the same risky security portfolio, prices would have to adjust until the market portfolio of all risky securities is the best portfolio for all investors. When this occurs, the market portfolio is the best risky portfolio for all investors. The Sharpe-Lintner CAPM implies that p* is the optimal portfolio and the market will be in equilibrium. In such a case the slope of the line at p* to the efficiency frontier provides the risk premium per unit of portfolio risk that is required by the investors,

i.e., $$\frac{E\,(R_m) - R_f}{\sigma\,(R_m)}$$

The Sharpe-Lintner CAPM predicts that the risk premium on the ith security is equal to the product of the risk premium that investors require per unit of portfolio risk and its systematic risk.

i.e., $$E(R_i) - R_f = \frac{[E(R_m) - R_f]}{[\sigma(R_m)]} \beta_i \sigma(R_m)$$

$$E(R_i) - R_f = [E(R_m) - R_f] \beta_i$$

or $$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

Where $E(R_i)$ is the expected rate of return on security "i."

The problem with the Sharpe-Lintner version, in practice, is that it assumes that investors are able to borrow unlimited amounts of money at the risk-free rate of interest and that an index of NYSE stocks is a good surrogate for all risky assets. It views that the risk premium on a stock, for all practical purposes, is equal to the product of the risk premium on the NYSE index and the stock's beta coefficient.

Determination of Required Rate of Return of a Firm Using an Independent Company Approach

The required rate of return on common equity shares of a corporation or a firm as a function of its corporate leverage was initially stated by Modigliani and Miller (1958) in their Proposition 11, which in the tax-corrected form states:

$$K^L = r + (r - K_d)\ (1 - t)\ D/E \quad (69)$$

Proof:

Let "V" be the value of a corporation and "r" be its overall cost of capital. In symbolic form we have

$$r = (1 - t)\ K_d\ (D/V) + K^L\ (E/V) \quad (70)$$

Or $$Vr = (1 - t)\ K_d\ (D) + K^L\ (E) \quad (71)$$

Where $V = (1 - t)\ D + E$

Substituting the value of "V" in Equation 71 gets

$$[E + (1 - t)\ D]\ r = D\ (1 - t)\ K_d + EK^L$$

or $$EK^L = rE + (r - K_d)\ (1 - t)\ D$$

or $$K^L = r + (r - K_d)\ (1 - t)\ D/E \quad (72)$$

If the firm has no debt in its capital structure, i.e., D = 0, then Equation 72 reduces to

$$K^L = r = K^U \quad (73)$$

Equation 73 implies that the overall cost of capital of a firm, in the context of leverage, will be equivalent to its unlevered cost of equity capital. If we replace the value of "r" for K^U on the right-hand side of Equation 72, we get:

$$K^L = K^U + (K^U - K_d)\ (1 - t)\ D/E \quad (74)$$

Determination of the Required Rate of Return on Parent's Investment in Its Subsidiaries Using the Parent Capital Structure Approach

It is assumed that the parent holding company and its subsidiaries have debt in their capital structures. The basic steps involved in the determination of the cost rate on the parent's equity capital invested in the subsidiaries are as follows: First, determine the unlevered cost rate on the parent's equity capital using the CAPM. Second, assign same as a constraint to the weighted average cost of the subsidiary's capital concerned and then derive the levered cost rate on the subsidiary's equity capital. The equity return rate of the subsidiary is given by

$$K_s^L = K_p^U + (K_p^U - K_{ds})\ (1 - t_s)\ (D_s/E_s) \qquad (75)$$

Where:

K_s^L is the levered cost rate on the equity capital of a Subsidiary s,

K_p^U is the unlevered cost rate on the equity capital of the parent,

K_{ds} is the marginal cost rate on subsidiary's debt,

t_s is the subsidiary's tax rate, and

D_s/E_s is the subsidiary's debt/equity ratio

Proof:

By definition of the weighted average cost of a subsidiary, we have

$$r_s = K_s^L (E_s/V_s) + K_{ds} (1 - t_s) D_s/V_s \tag{76}$$

Where:

V_s is the value of the Subsidiary s, and

r_s is the weighted average cost of capital of the Subsidiary s.

If K_p^L is the levered cost rate on the parent's equity capital, then the parent's unlevered cost rate K_p^U will represent its weighted average. The required rate of return on the parent's investment will be obtained by equating r_s and K_p^U since the weighted average cost of capital of the subsidiary is equal to the unlevered cost rate of the parent.

Substituting $r_s = K_p^U$ in Equation 76 and solving for K_s^L, we get

$$K^U{}_p = K_s^L (E_s/V_s) + (1 - t_s) K_{ds} (D_s/V_s) \tag{77}$$

or $(V_s) (K_p^U) = K_s^L (E_s) + (1 - t_s) K_{ds} (D_s)$

or $K_s^L (E_s) = (V_s) (K_p^U) - (1 - t_s) (K_{ds}) (D_s)$

But $V_s = E_s + (1 - t_s) D_s$

$$(E_s) (K_s^L) = [E_s + (1 - t_s) D_s] (K_p^U) - (1 - t_s) (K_{ds}) (D_s)$$

Simplifying further we get

$$K_s^L = K_p^U + (K_p^U - K_{ds})\ (1 - t_s)\ (D_s/E_s).$$

Theoretical Framework for the Double Leverage Approach and a Relative Comparison of the Double Leverage Approach With the Independent Company Approach

At the outset, a theoretical framework for the double leverage problem will be presented using the Sharpe-Lintner version of the capital asset pricing model. Then an evaluation of the two approaches in terms of the three standards of rate of return regulation will be highlighted.

Under the double leverage approach, the parent holding company, in general, is allowed to earn its weighted average cost of capital on its investment in each of its subsidiaries. It is assumed that the investment in each of its subsidiaries is financed by the parent's debt and equity in the same ratio of its capital structure. The independent company approach,[1] on the other hand, would consider the parent's subsidiary as if it were standing alone and then determine the cost of equity capital using a set of similarly situated and publicly traded operating public utilities that have risk characteristics comparable to the subsidiary in question.

Using a double leverage approach, the required rate of return on the parent's total investment in its subsidiary is given by

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[1]Or the so-called subsidiary pricing approach.

$$K_p^L = K_f + (K_m - K_f)\ \beta_s^L\ (1 + D_p/E_p) \tag{78}$$

or $$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U) \tag{79}$$

Where:

K_p^L is the required rate of return of the parent's investment in the equity capital of its Subsidiary s

K_p^L is the parent's cost of equity capital

K_f is the risk-free rate of return

K_m is the market's required rate of return

β_s^L is the levered beta of Subsidiary s

β_p^L is the levered beta of the parent

β_p^U is the unlevered beta of the parent

D_p/E_p is the debt/equity ratio of the parent, and where D_p and E_p are evaluated at their market values.

Proof:

According to the double leverage approach, the weighted average cost of capital of the parent, ignoring taxes, is equal to the required rate of return on equity component of the subsidiary, that is,

$$K_s^L = \frac{(E_p)\ (K_p^L) + (D_p)\ (K_d)}{(E_p + D_p)} \tag{80}$$

where K_s^L is the required rate of return on subsidiary's equity component which is owned by the parent and the right-hand side of

Equation 80 represents the parent's weighted average cost of capital.

Also, under CAPM, the marginal cost of debt (K_d) must equal the risk-free rate (K_f), that is $K_d = K_f$.

Substituting the value of K_d for K_f in Equation 80 we get

$$K_s^L = \frac{(E_p)\ (K_p^L) + (K_f)\ D_p}{(E_p + D_p)} \tag{81}$$

$$= \frac{K_p^L + (K_f)\ (D_p/E_p)}{(1 + D_p/E_p)}$$

or $(K_s^L)\ (1 + D_p/E_p) = K_p^L + (K_f)\ (D_p/E_p)$

$$K_s^L + K_s^L\ (D_p/E_p) = K_p^L + (K_f)\ (D_p/E_p)$$

$$K_p^L = K_s^L + (K_s^L - K_f)\ (D_p/E_p) \tag{82}$$

Using an independent company approach to the subsidiary, the required rate of return on subsidiary's equity is given by

$$K_s^L = K_f + \beta_s^L\ (K_m - K_f) \tag{83}$$

Substituting the value of K_s^L in the second element on the right-hand side of Equation 82 we get

$$K_p^L = K_s^L + [K_f + \beta_s^L\ (K_m - K_f) - K_f]\ (D_p/E_p)$$

$$= K_s^L + (K_m - K_f)\ \beta_s^L\ (D_p/E_p) \tag{84}$$

Equation 84 shows that the required rate of return on the parent's investment in the subsidiary equals the levered cost of subsidiary's equity capital as a result of its own leverage in its capital structure plus a return on its investment due to double leverage, that is, use of the subsidiary's own debt and parent's debt invested in the subsidiary's equity simultaneously.

If there is no debt in the parent's capital structure, then $D_p = 0$, in which case Equation 84 reduces to

$$K_p^L = K_s^L = K_p^U \tag{85}$$

That is, the unlevered cost of the parent's equity capital would equal the subsidiary's levered cost of equity capital.

Replacing the value of K_s^L by $K_f + \beta_s^L (K_m - K_f)$ in Equation 85, we get

$$K_p^L = K_f + \beta_s^L (K_m - K_f) + (K_m - K_f)\, \beta_s^L (D_p/E_p) \tag{86}$$

Converting Equation 86 into risk premium format, we obtain that

$$(K_p^L - K_f) = (K_m - K_f)\, \beta_s^L + (K_m - K_f)\, \beta_s^L (D_p/E_p),$$

which indicates that the parent's total risk premium is equal to the subsidiary's risk premium plus the premium required as a result of double leverage. Equation 86 can also be written as:

$$K_p^L = K_f + (K_m - K_f)\, \beta_s^L (1 + D_p/E_p),$$

which is the same as Equation 78.

Since

$$\beta_p^L = \beta_p^U\ (1 + D_p/E_p),$$

in the absence of taxes

$$1/\beta_p^U = \frac{(1 + D_p/E_p)}{\beta_p^L}$$

multiplying the second element on the right-hand side of Equation 78 by β_p^L/β_p^L provides that

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ \frac{(1 + D_p/E_p)}{\beta_p^L}\ \beta_s^L \tag{87}$$

Equation 87 is similar to that of Copeland and Watson (1979, p. 294) and Rubenstein (1973). Further, substituting the value

$$\frac{(1 + D_p/E_p)}{\beta_p^L} = \frac{1}{\beta_p^U}$$

in Equation 87, it follows that

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^L/\beta_p^U) \tag{88}$$

Equation 88 is identical to the equation that was presented by Pettway and Jordan (1983).

Equation 88 can also be written as

$$(K_p^L - K_f) = [(K_m - K_f)\ \beta_p^L]\ (\beta_s^L/\beta_p^U) \tag{89}$$

The left-hand side of Equation 89 represents the total risk premium required by the parent on its investment in the subsidiary. The first product term on the right-hand side of Equation 89 is the risk premium attributable to the parent's leverage, and the second factor term is the risk premium due to the subsidiary's leverage in its capital structure. Equation 89 can also be written as

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ [\beta_s^U\ (1 + D_s/E_s)]\ \beta_p^U \qquad (90)$$

If there is no debt in the subsidiary's capital structure, then Equation 90 reduces to

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L\ (\beta_s^U/\beta_p^U) \qquad (91)$$

or $$K_p^L - K_f = (K_m - K_f)\ \beta_p^L\ (\beta_s^U/\beta_p^U) \qquad (92)$$

Equation 92 shows that the risk premium required by the parent is proportional to the relative business risks of the subsidiary as well as the parent. Equation 92 has several implications for double leverage problems. We shall focus on these implications below.

Case 1. The business risks of the subsidiaries are equal to the business risk of the parent. This means,

$$\beta_{si}^U = \beta_p^U \text{ for all } i = 1, 2, 3, \ldots n. \qquad (93)$$

Then Equation 92 becomes

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L \qquad (94)$$

This implies, under the conditions of Equation 93, that the independent company approach and the double leverage approach provide the identical required rates of return on the parent's investment in its subsidiaries. As long as the business risks of the subsidiaries, whether they are regulated or unregulated, are equal to the business risks of the parent, the parent or the subsidiary of a parent can diversify into any number of unrelated ventures because such diversification cannot affect the parent's cost of capital. The above conclusions are also valid if

$$\beta^L_{si} = \beta^U_p, \text{ for } i = 1, 2, \ldots n. \quad (95)$$

Case 2.

$$\beta^U_{si} <> \beta^U_p, \text{ for } i, 1, 2, \ldots n. \quad (96)$$

This is a situation in which the business risks of the parent's subsidiaries are either greater than or less than the parent's business risk. If this occurs, the double leverage approach, according to Pettway and Jordan (1983), fails in satisfying the standards of fairness due to cross-subsidization. To illustrate the issue involved, two subsidiaries, say s1 and s2, are considered. The betas of the subsidiaries are such that:

$$\beta^U_{s1} \neq \beta^U_{s2} \neq \beta^U_p \quad (97)$$

Assume further,

K_f = .10, K_m = .15, β_p^L = .90, D_p/E_p = 45/55

β_{s1}^U = .40, β_{s2}^U = .59, β_p^U = .495.

It is possible to calculate, then, the rates of return contributed to the parent's investment in the two subsidiaries.

The required rate of return on the parent's investment in subsidiary s1 (using a double leverage approach) would be:

$$K_p^L = K_f + (K_m - K_f)\ (\beta_p^L)\ (\beta_{s1}^U/\beta_p^U)$$
$$= .10 + (.15 - .10)\ (.90)\ (.40/.495)$$
$$= .1364 \text{ or } 13.64\%$$

The required rate of return on the parent's investment in subsidiary s2 would be:

$$K_p^L = K_f + (K_m - K_f)\ (\beta_p^L)\ (\beta_{s2}^U/\beta_p^U)$$
$$= .10 + (.15 - .10)\ (.90)\ (.59/.495)$$
$$= .1536 \text{ or } 15.36\%$$

The weighted average of the return rates contributed by subsidiaries on the parent's equity would then be:

$$\text{Average return} = (13.64\% + 15.36\%)/2$$
$$= 14.50\%$$

The market cost of the parent's equity capital, using an independent company approach, would be:

$$K_p^L = K_f + (K_m - K_f)\ \beta_p^L$$
$$= .10 + (.15 - .10)\ (.90)$$
$$= 14.50\%$$

which is the same as the two subsidiaries' average return rate. But the problem is that subsidiary s2's customers are subsidizing subsidiary s1's customers. Thus, the phenomenon of cross-subsidization, according to Pettway and Jordan (1983), violates the regulatory standards of fairness. If the parent has only one subsidiary, Pettway and Jordan (1983) maintain that cross-subsidization will not take place.

The analysis assumes that the parent has invested its capital in the subsidiaries in the same proportion as its capital structure, that is, 45% debt and 55% equity. From the analysis it follows that the double leverage approach, according to Pettway and Jordan (1983), is valid only if:

1. The parent has only one subsidiary.
2. All the subsidiaries have the same "systematic risk" and are equal to the unlevered beta of the parent.

Generalized Approach to the Determination of the Required Rate of Return on the Parent's Investment in a Subsidiary Using the Consolidated Capital Structure Approach

The levered cost on equity capital of a subsidiary (s) can be determined by the following formula:

$$K_s^L = K_c^U + \frac{(K_p^U - K_f)}{(1 + D_c/E_c)} (\beta_c^L/\beta_p^U)\ (D_s/E_s) \qquad (98)$$

Where:

K_s^L = levered cost rate on equity capital of Subsidiary s

K_p^U = unlevered cost rate of the parent

K_f = risk-free rate of return

D_c/E_c = debt-to-equity ratio of the consolidated system

β_c^L = levered beta of the system

β_p^U = unlevered beta of the parent

K_c^U = unlevered cost rate on the system's equity capital

Proof:

By definition of the consolidated capital structure approach, it follows that:

$$K_c^U = \frac{K_s^L\ (E_s) + K_{ds}\ (D_s)}{(E_s + D_s)} \qquad (99)$$

A little simplification leads to

$$K_s^L = K_c^U + (K_c^U - K_f)\ (D_s/E_s),\ \text{if}\ K_f = K_{ds} \qquad (100)$$

But $\quad K_c^U = K_f + \beta_c^U\ (K_m - K_f)$

i.e., $\quad K_c^U - K_f = \beta_c^U\ (K_m - K_f) \qquad (101)$

Substituting the value of $K_c^U - K_f$ in Equation 100 by $\beta_c^U\ (K_m - K_f)$ will provide that:

$$K_s^L = K_c^U + \beta_c^U (K_m - K_f)(D_s/E_s) \qquad (102)$$

also

$$K_p^U - K_f = \beta_p^U (K_m - K_f)$$

$$K_m - K_f = \frac{K_p^U - K_f}{\beta_p^U} \qquad (103)$$

Substituting the value of $(K_m - K_f)$ from Equation 103 in Equation 102 gives

$$K_s^L = K_c^U + \beta_c^U \left[\frac{K_p^U - K_f}{\beta_p^U}\right] (D_s/E_s) \qquad (104)$$

But $\beta_c^L = \beta_c^U (1 + D_c/E_c)$

i.e., $\beta_c^L/(1 + D_c/E_c) = \beta_c^U \qquad (105)$

Substituting the value of β_c^U from Equation 105 in Equation 104 gives that:

$$K_s^L = K_c^U + \frac{[K_p^U - K_f]}{[\beta_p^U]} [\beta_c^L/(1 + D_c/E_c)] (D_s/E_s)$$

$$K_s^L = K_c^U + \frac{[K_p^U - K_f]}{[1 + D_c/E_c]} (\beta_c^L/\beta_p^U)(D_s/E_s) \qquad (106)$$

<u>Special Cases</u>

We have shown that the levered cost of equity capital of a subsidiary (s) is given by the general relationship:

$$K_s^L = K_c^U + \frac{(K_p^U - K_f)\ (\beta_c^L)\ (D_s/E_s)}{(1 + D_c/E_c)\ (\beta_p^U)}$$

Case 1. If $\beta_c^L = \beta_p^U$, then the equation above reduces to

$$K_s^L = K_c^U + \frac{(K_p^U - K_f)\ (D_s/E_s)}{(1 + D_c/E_c)}$$

Also, it is known that

$$\beta_c^L = \beta_c^U\ (1 + D_c/E_c) \qquad (107)$$

Substituting β_p^U for β_c^L in Equation 107 gives

$$\beta_p^U = \beta_c^U\ (1 + D_c/E_c)$$

$$\beta_p^U/\beta_c^U = 1 + D_c/E_c$$

or $$D_c/E_c = \beta_p^U/\beta_c^U - 1 \qquad (108)$$

Equation 108 shows that the debt-to-equity ratio of the consolidated system should equal the ratio of the parent's unlevered beta to the system's unlevered beta minus unity.

Case 2. If $\beta_c^L = \beta_p^U$, then it follows that the unlevered cost of the parent's equity capital will equal the system's levered cost of equity capital which does not include the parent's debt. This can be seen as follows. Since

$$K_p^U = K_f + \beta_p^U (K_m - K_f)$$

Substituting $\beta_c^L = \beta_p^U$ in the above equation gives

$$K_p^U = K_f + \beta_c^L (K_m - K_f)$$
$$= K_c^L$$

i.e., it is immaterial whether one uses the parent's consolidated capital structure approach or the parent's unconsolidated approach. In either case, the parent's revenue requirement will be satisfied. In other words, both methods will provide the same results.

APPENDIX C

ANALYSIS OF DATA AND BENCHMARK RATES OF RETURN

Determination of the Required Return Rates on the Equity Capital of 32 Independently Operating Telephone Companies, Based on Five-Year Average Debt/Equity Ratios, 1982-1986

1. ACT Telephone Company

$K_s^L = K^U + (K^U - K_f)\ (1 - t)\ (D_s/E_s)$

$= 10.81 + (10.81 - 8.58)\ (.66)\ (76/24)$

$= 10.81 + (1.4718)\ (3.1667)$

$= 10.81 + 4.66$

$= 15.47\%$

2. Allendale Telephone Company

$K_s^L = 10.81 + (1.4718)\ (26/74)$

$= 10.81 + .5171$

$= 11.33\%$

3. Au Gres Telephone Company

$K_s^L = 10.81 + (1.4718)\ (54/46)$

$= 10.81 + 1.7278$

$= 12.54\%$

4. Baraga Telephone Company

$K_s^L = 10.81 + (1.4718)\ (66/34)$

$= 10.81 + 2.857$

$= 13.67\%$

5. Barry Telephone Company

$$K_S^L = 10.81 + (1.4718)\ (66/34)$$
$$= 10.81 + 2.857$$
$$= 13.67\%$$

6. Blanchard Telephone Company

$$K_S^L = 10.81 + (1.4718)\ (69/31)$$
$$= 10.81 + 3.2759$$
$$= 14.09\%$$

7. Bloomingdale Telephone Company

$$K_S^L = 10.81 + (1.4718)\ (69/31)$$
$$= 10.81 + 3.2759$$
$$= 14.09\%$$

8. Carr Telephone Company

$$K_S^L = 10.81 + (1.4718)\ (87/13)$$
$$= 10.81 + 9.8497$$
$$= 20.66\%$$

9. Chippewa County Telephone Company

$$K_S^L = 10.81 + (1.4718)\ (90.4/9.6)$$
$$= 10.81 + 19.55$$
$$= 30.36\%$$

10. Climax Telephone Company

K_S^L = 10.81 + (1.4718) (60/40)

= 10.81 + 2.2077

= 13.02%

11. C, C, & S Telco., Inc.

K_S^L = 10.81 + (1.4718) (59/41)

= 10.81 + 2.1180

= 12.93%

12. Deerfield Farmer's Telephone Company

K_S^L = 10.81 + (1.4718) (43/57)

= 10.81 + 1.1103

= 11.92%

13. Drenthen Telephone Company

K_S^L = 10.81 + (1.4718) (8/92)

= 10.81 + .1280

= 10.94%

14. Farmers Mutual Telephone Company

K_S^L = 10.81%

15. Hadley Telephone Company

K_S^L = 10.81 + (1.4718) (57/43)

= 10.81 + 1.9510

= 12.76%

16. Hiawatha Telephone Company

K_S^L = 10.81 + (1.4718) (74/36)

= 10.81 + 3.0254

= 13.84%

17. Island Telephone Company

K_S^L = 10.81 + (1.4718) (15/85)

= 10.81 + .2597

= 11.07%

18. Kaleva Telephone Company

K_S^L = 10.81 + (1.4718) (29/71)

= 10.81 + .6012

= 11.41%

19. Kingsley Telephone Company

K_S^L = 10.81 + (1.4718) (80/20)

= 10.81 + 5.8872

= 16.70%

20. Lennon Telephone Company

K_S^L = 10.81 + (1.4718) (37/63)

= 10.81 + .8644

= 11.67%

21. Midway Telephone Company

$K_S^L = 10.81 + (1.4718)\ (75/25)$

$= 10.81 + 4.4154$

$= 15.23\%$

22. Ogden Telephone Company

$K_S^L = 10.81 + (1.4718)\ (8/92)$

$= 10.81 + .1280$

$= 10.94\%$

23. Ontonagon County Telephone Company

$K_S^L = 10.81 + (1.4718)\ (72/28)$

$= 10.81 + 3.7846)$

$= 14.60\%$

24. Peninsula Telephone Company

$K_S^L = 10.81 + (1.4718)\ (77/23)$

$= 10.81 + 4.9273$

$= 15.74\%$

25. Pigeon Telephone Company

$K_S^L = 10.81 + (1.4718)\ (86/14)$

$= 10.81 + 9.0411$

$= 19.85\%$

26. Sand Creek Telephone Company

K_s^L = 10.81 + (1.4718) (19/81)

= 10.81 + .3452

= 11.16%

27. Springport Telephone Company

K_s^L = 10.81 + (1.4718) (60/40)

= 10.81 + 2.2077

= 13.02%

28. Upper Peninsula Telephone Company

K_s^L = 10.81 + (1.4718) (75/25)

= 10.81 + 4.4154

= 15.23%

29. Waldron Telephone Company

K_s^L = 10.81 + (1.4718) (83/17)

= 10.81 = 7.1858

= 18.0%

30. Westphalia Telephone Company

K_s^L = 10.81 + (1.4718) (73/27)

= 10.81 + 3.9793

= 14.79%

31. Winn Telephone Company

$$K_s^L = 10.81 + (1.4718)\ (12/88)$$
$$= 10.81 + .2007$$
$$= 11.01\%$$

32. Wolverine Telephone Company

$$K_s^L = 10.81 + (1.4718)\ (79/21)$$
$$= 10.81 + 5.5368$$
$$= 16.35\%$$

Determination of the Required Return Rates on the Equity Capital of Eight Subsidiaries of Parent-Holding Companies

The subsidiaries of Telephone and Data Systems operating in Michigan include: Augusta Telephone Company, Chatham Telephone Company, Clayton Telephone Company, Hickory Telephone Company, and Shiawassee Telephone Company. The required rates of return are:

1. Augusta Telephone Company

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t)\ (D_s/E_s)$$

Where K_c^U is the unlevered beta of T&DS Consolidated Capital Structure.

$$K_s^L = 10.3861 + (10.3861 - 8.58)\ (.66)\ (36/64)$$
$$= 10.3861\% + .5331\%\ (.6705)$$
$$= 11.59\%$$

2. Chatham Telephone Company

K_S^L = 10.3861 + (1.192) (77/23)

= 14.38%

3. Clayton Telephone Company

K_S^L = 10.3861 + (1.192) (60/40)

= 12.17%

4. Hickory Telephone Company

K_S^L = 10.3861 + (1.192) (75/25)

= 13.96%

5. Shiawassee Telephone Company

K_S^L = 10.3861 + (1.192) (45/55)

= 11.36%

6. Alltel Telephone Company of Michigan

Alltel Corporation's Consolidated Capital Structure:

Debt	54.9%
Preferred	4.4
Equity	40.9
Total	100.0%

Unlevered beta of Alltel is calculated from:

$$\beta^L = \beta^U [1 + (1 - t) D/E + P/E]$$

$$.65 = \beta^U [1 + (.66) (54.9/40.7) + (4.4/40.7)]$$

$$= 2\ \beta^U$$

$$\beta^U = .325$$

The required return on the equity capital of Alltel of Michigan is:

$$K_S^L = 10.35 + (10.35 - 8.58)\ (.66)\ (55/45) = 11.78\%$$

7. Central Telephone Company of Michigan

Central Telephone Company of Michigan and Century Telephone Company are subsidiaries of Century Telephone Enterprises. To find the required return rates on the equity capital of Century Telephone and Central Telephone Companies of Michigan, we have to first estimate the unlevered beta of its parent's consolidated system and then determine the required return rates on the subsidiaries' equity.

Century Telephone Enterprises had the following capital structure in 1985.

Debt	63.8%
Preferred	4.0
Equity	32.2
Total	100.0%

Since the levered beta of the parent was .65, its unlevered beta is:

$$\beta_C^L = \beta_C^U\ [1 + (.66)\ (63.8/32.2) + (4.0/32.2)]$$

$$\beta_C^U = .3007$$

$K_c^U = 8.58 + .3007\ (14.02 - 8.58)$
$= 10.22$

The required return rate on the equity capital of Central Telephone Company of Michigan is:

$K_s^L = 10.22 + (10.22 - 8.58)\ (.66)\ (34/66)$
$= 10.78\%$

8. Century Telephone Company of Michigan

The required return rate on equity capital of Century Telephone Company of Michigan is:

$K_s^L = 10.22 + (10.22 - 8.58)\ (.66)\ (51/49)$
$= 11.35\%$

Expected and Benchmark Rates of Return for Small, Independent Telephone Companies

The expected return rate for 32 independently operating telephone companies using average capital structure--55% debt and 45% equity--is obtained from:

$K_a^L = 10.81 + (1.4718)\ (55/45)$
$= 12.61\%$

The expected return rate for eight telephone subsidiaries, using the average capital structure--54% debt and 46% equity--is obtained from:

Table 26

Rates of Return on Common Equity Capital of Michigan's Small Independent Telephone Companies (1982-1986)

Company Name	Earned on Book Equity[a] 1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	Average Return 1982-86 (%)	Authorized Return (%)	Debt (%)	Equity (%)
Ace Tel.	8.17	5.97	-3.94	30.75	40.64	16.3	13.50	76	24
Allendale Tel.	18.48	20.16	17.62	18.58	17.51	18.5	13.00	26	74
AuGres Tel.	0.00	0.00	-12.67	10.09	-0.04	-2.6	12.15	54	46
Baraga Tel.	14.07	15.78	13.10	10.06	22.34	15.1	11.48	59	41
Barry Tel.	26.65	26.55	20.24	18.23	22.91	22.9	13.50	66	34
Blanchard Tel.	29.43	32.74	24.46	20.22	15.76	24.5	10.60	69	31
Bloomingdale Tel.	19.45	18.03	15.12	11.97	17.88	16.5	12.75	55	45
Carr Tel.	0.00	77.37	26.76	22.81	13.11	28.0	13.75	87	13
Chippewa Tel.	62.64	42.47	30.98	28.24	.79	33.0	13.50	93	7
Climax Tel.	10.10	15.95	26.30	73.74	36.57	32.5	13.25	60	40
C, C & S Tel.	--	13.90	9.60	13.47	12.99	12.5	13.00	59	41
Deerfield Tel.	15.32	13.65	23.36	11.14	15.06	15.7	13.50	43	57

Table 26--Continued

Company Name	Earned on Book Equity[a] 1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	Average Return 1982-86 (%)	Author-ized Return (%)	Debt (%)	Equity (%)
Drenthen Tel.	15.63	11.86	19.40	10.18	14.30	14.3	13.00	8	92
Farmer's Mutual Tel.	9.93	8.11	17.62	11.57	11.51	11.8	13.00	0	100
Hadley Tel.	21.37	23.61	17.32	25.18	21.92	21.9	13.00	57	43
Hiawatha Tel.	43.40	26.66	4.45	6.81	28.01	21.9	12.00	74	36
Island Tel.	8.30	29.09	13.20	23.49	17.99	18.4	13.00	15	85
Kaleva Tel.	13.76	15.47	16.21	12.77	14.70	14.6	13.00	29	71
Kingsley Tel.	32.34	24.76	24.65	3.57	8.57	18.8	13.50	80	20
Lennon Tel.	14.01	10.86	17.81	22.91	12.40	15.6	13.25	37	63
Midway Tel.	34.47	26.57	24.37	20.94	20.72	25.4	13.00	75	25
Ogden Tel.	16.29	15.81	23.73	8.37	10.69	15.0	12.10	8	92
Ontonagon Tel.	14.20	11.89	12.38	8.92	10.61	11.6	13.50	72	28
Peninsula Tel.	8.04	16.37	17.09	31.29	10.81	16.7	13.00	77	23

Table 26--Continued

Company Name	Earned on Book Equity[a] 1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	Average Return 1982-86 (%)	Authorized Return (%)	Debt (%)	Equity (%)
Pigeon Tel.	12.96	22.25	13.46	20.26	19.89	17.8	13.25	86	14
Sandcreek Tel.	12.67	11.33	12.74	8.80	7.83	10.7	11.86	19	81
Springport Tel.	9.32	15.15	9.84	16.15	11.22	12.3	13.00	60	40
U.P. Tel.	27.10	25.02	27.19	16.32	22.84	26.7	14.00	75	25
Waldron Tel.	34.77	36.39	35.11	20.34	8.12	26.9	12.75	83	17
Westphalia Tel.	17.03	16.05	11.53	4.27	17.77	13.3	13.25	73	27
Winn Tel. Co.	16.44	17.96	18.78	24.50	3.05	16.1	13.00	12	88
Wolverine Tel.	18.20	10.25	13.76	13.31	6.66	12.4	13.50	79	21
Average						18.0%	12.94%	55%	45%

Note. Financial statements submitted by the companies to the Michigan Public Service Commission.

[a]Total company basis (intrastate and interstate combined).

Table 27

Rates of Return on Common Equity Capital of Michigan's Small and Large Telephone Companies That Are Subsidiaries of Holding Company Systems

Company Name	Earned on Book Equity 1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	Average Return 1982-86 (%)	Authorized Return (%)	Debt (%)	Equity (%)
A. Small Independent Telephone Subsidiaries									
Augusta Tel. (TSD)	8.53	10.14	4.45	5.65	11.02	8.0	13.50	36	64
Chatham Tel. (TSD)	12.75	14.57	13.96	2.62	15.47	11.9	13.25	77	23
Clayton Tel. (TSD)	22.40	14.34	15.68	14.72	15.46	13.7	12.00	60	40
Hickory Tel. (TSD)	0.00	20.91	26.95	10.20	4.77	12.6	13.50	75	25
Shiawassee (TSD)	12.44	11.04	4.75	8.58	19.18	11.2	13.50	45	55
Alltel of MI (Continental)	--	16.23	15.45	16.13	14.79	15.7	12.80	55	45
Century Tel. of MI (CE)	--	18.66	18.12	14.72	15.07	16.6	12.26	51	49
Central Tel. of MI (CE)	13.90	14.27	11.37	15.57	14.37	13.9	13.00	34	66
Average						13.0%	13.00%	54%	46%

Table 27--Continued

Company Name	Earned on Book Equity 1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	Average Return 1982-86 (%)	Authorized Return (%)	Debt (%)	Equity (%)
B. Large Telephone Subsidiaries[a]									
Michigan Bell (AMERITECH)	12.61	11.63	14.63	16.02	16.20	14.2	13.83	41	59
General Tel. of MI (GTM)	14.00	16.31	15.77	16.07	15.96	15.6	12.40	49	51
Mean						14.9%	13.12%	45%	55%

Note. Financial statements submitted by the companies to the Michigan Public Service Commission.

[a]Intrastate only.

K_a^L = 10.30 (10.30 - 8.58) (.66) (54/46)

= 11.63%

The benchmark rate of return for 22 independent telephone companies, using a benchmark capital structure--60% debt and 40% equity--is:

K_b^L = 10.81 + (1.4718) (60/40)

= 13%

The benchmark rate of return for eight telephone subsidiaries, using a benchmark capital structure, is:

K_b^L = 10.30 + (10.30 - 8.58) (.66) (60/40)

= 12%

Reconciliation Between the Parent's Unconsolidated Capital Structure Approach and the Parent's Consolidated Capital Structure Approach

In a rate case proceeding the question arises as to whether one should use a consolidated capital structure approach or a parent's unconsolidated capital structure approach for the determination of cost of capital of a subsidiary of parent holding company system. If there is clear presence of double leverage, which is the best way to go if the parent holding company and its subsidiary have debt in their capital structures?

An actual rate case example presented here will show that if the unlevered beta of the parent (β_P^U) is approximately the same as the levered beta of the system (β_C^L), it makes very little difference in the required rates of return on the cost of equity capital of the parent invested in the subsidiary if one uses either the parent's unconsolidated capital structure or the parent's consolidated capital structure. In such a situation, i.e., $\beta_p^U = \beta_c^L$, it can be shown that the unlevered weighted average cost of the parent and the weighted average cost of the consolidated system will be very close to each other.

The example that follows is derived from Rate Case No. U-6591, in which the author testified in 1981. The testimony was concerned with the determination of a required rate of return on equity capital of General Telephone Company of Michigan (GTM), a subsidiary of General Telephone and Electronics Corporation (GTE), the parent holding company, which itself is an operating company having debt in its capital structure.

The parent's (GTE) consolidated, unconsolidated, and GTM's capital structures are shown in Table 28.

Determination of Cost Rates on Equity Capital of Parent Consolidated, Unconsolidated, and Weighted Average Cost Rates of the Respective Capital Structures

Using the Sharp-Lintner version of the capital asset pricing model (CAPM), the parent's cost of equity capital can be obtained from:

$$K_p^L = K_f + \beta_p^L (K_m - K_f)$$

Where:

K_p^L = the levered cost of equity capital of the parent (unconsolidated)

β_p^L = the levered beta of the parent (unconsolidated)

t = corporate tax rate (46%)

K_M = risk-free rate of return

β_p^L = .75 (GTE's beta from Value Line Investment Survey, January 1981)

D_p = debt of the parent (long term and short term)

P = preferred stock

E_p = equity of the parent

Table 28

GTE and GTM Capital Structures

Type of Capital	Parent--GTE Unconsolidated (Pu) (%)	Parent--GTE Consolidated (Pc) (%)	Subsidiary--GTM (%)
Long-term debt	14.4%	48.92%	46.1%
Short-term debt	6.4	11.13	7.4
Preferred stock	6.0	8.14	7.7
Common equity	73.2	31.81	38.8
Total capital	100.0%	100.00%	100.0%

To Find the Unlevered Beta of the Parent

The relationship between levered beta and unlevered beta is given by

$$\beta_p^L = \beta_p^U [1 + (1 - t)\ (D_p/E_p) + P/E_p]$$

The parent's unconsolidated capital structure provides:

$D_p = 21\%$

$E_p = 73\%$

$P = 6\%$

$$\beta_p^U = \beta_p^L/[1 + (1 - t)\ (D_p/E_p) + P/E_p]$$

$$= .75/[1 + (1 - .46)\ (21/73) + 6/73]$$

$$= .6060$$

On January 15, the 30-year Treasury bond rate (K_f) was 12.09%. The historical market rate of return on the New York Stock Exchange stocks for the period 1959-1978 was 15.39%.

To Find the Levered Cost Rate on Equity Capital of Parent

The levered cost rate on equity capital K_p^L can be obtained from:

$$K_p^L = K_f + \beta_p^L\ (K_m - K_f)$$

Where:

K_f = 12.09%

β_p^L = .75%

K_m = 15.39%

K_p^L = 12.09 + .75 (15.39 - 12.09)

= 14.565% = K_c^L, since $\beta_p^L = \beta_c^L$ = .75

The unlevered cost rate on equity capital, K_p^U, is given by:

$$K_p^U = K_f + \beta_p^U (K_m - K_m)$$

= 12.09 + .6060 (15.39 - 12.09)

= 14.09%

Using the above cost rates and the cost rates on debt and preferred stock, it is possible to determine the weighted average cost rates for the parent unconsolidated and parent consolidated capital structures. These are provided in Table 29. One can see that the weighted average cost rates of the parent unconsolidated and parent consolidated are different. This is due to the differences in debt-to-equity ratios as well as the cost rates on debt and preferred stock. The consolidated capital structure debt-to-equity ratio was 68.2/31.8 (long-term debt plus short-term debt plus preferred stock), whereas the unconsolidated debt-to-equity ratio was 26.8/31.8. The question remains as to which weighted average cost rate should be used in the final determination of the required rate of return on parent's investment in the subsidiary.

Table 29

Weighted Average Cost Rates of Pu and Pc on October 31, 1980

Type	Pu			Pc		
	Percent	Cost Rate	Weighted Cost Rate	Percent	Cost Rate	Weighted Cost Rate
Long-term debt	14.4%	8.16%	1.18%	48.92%	8.87%	4.34%
Short-term debt	6.4	12.80	.82	11.13	11.57	1.29
Preferred stock	6.0	8.78	.53	8.14	7.65	.62
Common equity	73.2	14.57	10.67	31.81	14.57	4.63
Total	100.0%		13.20%	100.00%		10.88%

Note. Michigan Public Service Commission Docket No. U-6591, January 1982.

The proponents and the opponents of double leverage have taken different positions in this regard. The proponents of double leverage maintain that when investors purchase the common stock of GTE, they primarily look at the parent, since it is the parent that sells the common stock. They assert that the net earnings that are generated through the consolidated system belong to the parent; a portion of these earnings is paid in the form of dividends, and the balance of these earnings is kept as retained earnings with the subsidiaries. They maintain that since the net earnings that are generated through the consolidated system belong to the parent's stockholders, it is fair to consider the capital structure of the parent for the ultimate determination of a fair rate of return on the parent's investment in the subsidiary rather than the consolidated capital structure.

Opponents of double leverage, on the other hand, argue that investors only look at the consolidated capital structure rather than the capital structure of the parent while making their decisions pertinent to their purchases of stock of a company.

These conflicting positions can be reconciled only if the unlevered beta of the parent is approximately equal to the levered beta of the system at any given time. In such an event, it does not matter whether one adopts either the parent's unconsolidated or consolidated capital structure. But in any practical situation, the unlevered beta of the parent may not necessarily be the same as the levered beta of the system. If that happens, one has to adjust the capital structure of the system such that the unlevered beta of the parent is equal to the levered beta of the system. This point is illustrated in the case of GTE.

To Find the Unlevered Beta of the Consolidated Capital Structure

The unlevered beta of the consolidated capital structure (β_c^U) is given by:

$$\beta_c^U = \beta_c^L/[1 + (1 - t)\ (D_c/E_c) + P/E_c]$$

Where:

D_c = 60.05%, debt of the consolidated capital structure

P = 8.14%, preferred stock of the system

t = 46%, corporate tax rate

E_c = 31.81%, common equity of the system

Since $\beta_p^L = \beta_c^L = .75$, theoretically it follows that:

$$\beta_c^U = .75/[1 + (.54)\ (60.05/31.81) + 8.14/31.81]$$
$$= .3296,$$

which is lower than the unlevered beta of the parent ($\beta_p^U = .6060$).

The lower value ($\beta_c^U = .3296$) of the unlevered beta of the parent's consolidated capital structure was due to the use of a higher percentage of debt in the consolidated capital structure.

The problem is to determine the appropriate new debt-to-equity ratio of the consolidated system which would, in turn, provide a levered beta that is closer to the unlevered beta of the parent. This can only be achieved by trial and error.

Trial 1. Decrease the percentage of debt of the consolidated system from the initial level of 60.05% to 55%, and calculate the levered beta for the system, using its unlevered beta, .3296. The new levered beta of the system would be:

$$\beta_c^L = \beta_c^U \; [1 + (1 - t_c) \; (D_c/E_c) + P/E_c]$$
$$= .3296 \; [1 + (.54) \; (55.0/36.86) + 8.14/36.80]$$
$$= .6680,$$

which is greater than $\beta_p^U = .6060$.

Trial 2. Decrease the percentage of debt of the consolidated system from the initial level of 60.05% to 52% and then calculate β_c^L.

$$\beta_c^L = (.3296) \; [1 + (.54) \; (52.0/39.86) + 8.14/39.86]$$
$$= .6291,$$

which is still greater than $\beta_p^U = .6060$.

Trial 3. Decrease the percentage of debt of the consolidated system from 60.5% to 50% and then compute β_c^L.

$$\beta_c^L = (.3296)\ [1 + (.54)\ (50.0/41.86 + 8.14/41.86)]$$
$$= .6063,$$

which is almost equivalent to .6060, the unlevered beta (β_p^U) of the parent.

If the unlevered beta of the parent were to be equal to the levered beta of the consolidated capital structure, the correct capital structure of the consolidated system should be: 50% debt, 8.14% preferred stock, and 41.86% common equity.

Having shown that the unlevered beta of the parent (β_p^U) is almost identical to the levered beta of the system (β_c^L) for the capital structure proportions, namely, 50% debt, 8.14% preferred stock, and 41.86% common equity, the next step is to show that the weighted average cost rates of the parent's adjusted consolidated capital structure and the parent's unlevered capital structure are identical. The parent's unlevered cost rate on equity capital can be obtained from:

$$K_p^U = K_f + \beta_p^U\ (K_m - K_f)$$
$$= 12.09 + .6060\ (15.39 - 12.09)$$
$$= 12.09 + 1.9998$$
$$= 14.09$$
$$= K_c^L, \text{ since } \beta_p^U = \beta_c^L$$

The weighted average cost rates of the adjusted consolidated capital structure and unlevered capital structure of the parent are presented in Tables 30 and 31.

It is shown that the unlevered cost of equity capital of GTE was estimated at 14.09%. In Table 30, the weighted average cost of equity capital of the consolidated system using the unlevered cost of equity capital of the parent (system) was estimated at 11.20%. In Table 31, however, the levered and unlevered weighted average cost rates of the parent were estimated to be 13.19% and 11.20%. It can be seen that the unlevered weighted average cost of the parent and the weighted average cost of the adjusted consolidated capital structure, as shown in Tables 30 and 31, are identical to 11.20%. This is because leverage at the parent level has been removed from the capital structures.

The same conclusions would emerge even if the preferred stock was combined with common equity, as is traditionally done in the nonregulated sector. The results are shown in Tables 32 and 33.

The unlevered cost of common equity capital of the parent would be:

$$K_p^U = K_f + \beta_p^U (K_m - K_f)$$

$$= 12.09 + .6559\ (15.39 - 12.09)$$

$$= 14.25\%$$

$$= K_c^L,\ \text{since}\ \beta_p^U = \beta_c^L$$

Table 30

Weighted Average Cost Rate of Consolidated Capital Structure

Type	Actual on October 31, 1980			Modified Capital Structure		
	Percent	Cost Rate	Weighted Cost Rate	Percent	Cost Rate	Weighted Cost Rate
Long-term debt	48.9%	8.87%	4.33%	50.00%	9.35%	4.68%
Short-term debt	11.1	11.57	1.28	--	--	--
Preferred stock	8.1	7.65	.62	8.14	7.65	.62
Common equity	31.9	14.09	4.50	41.86	14.09	5.90
Total	100.0%		10.73%	100.00%		11.20%

Note. Michigan Public Service Commission Docket No. U-6591, January 1982.

Table 31

Parent's Levered and Unlevered Weighted Average Cost Rates

Type	Levered Weighted Cost			Unlevered Weighted Cost
	Percent	Cost Rate	Weighted Cost Rate	
Long-term debt	14.4%	8.16%	1.175%	0.0
Short-term debt	6.4	12.80	..819	0.0
Preferred stock	6.0	8.78	.527	.527
Common equity	73.2	14.57	10.670	11.670
Total	100.0%		13.191%	11.20%

Note. Michigan Public Service Commission Docket No. U-6591, January 1982.

Table 32

Weighted Average Cost Rate of Consolidated Capital Structure

Type	Actual on October 31, 1980			Modified Capital Structure		
	Percent	Cost Rate	Weighted Cost Rate	Percent	Cost Rate	Weighted Cost Rate
Long-term debt	48.9%	8.87%	4.33%	52.00%	9.35%	4.862%
Short-term debt	11.1	11.57	1.28	--	--	--
Preferred stock	8.1	7.65	.62	8.1	7.65	.619
Common equity	31.9	14.25	4.54	39.9	14.25	5.686
Total	100.0%		10.77%	100.00%		11.167%

Note. Michigan Public Service Commission Docket No. U-6591, January 1982.

Table 33

Parent's Levered and Unlevered Weighted Average Cost Rates

Type	Levered Weighted Cost			Unlevered Weighted Cost
	Percent	Cost Rate	Weighted Cost Rate	
Long-term debt	14.4%	8.16%	1.175%	0.0
Short-term debt	6.4	12.80	.819	0.0
Preferred stock	6.0	8.78	.527	.527
Common equity	73.2	14.57	10.665	11.636
Total	100.0%		13.191%	11.163%

<u>Note</u>. Michigan Public Service Commission Docket No. U-6591, January 1982.

It is now time to determine the required rate of return on the equity capital of the parent invested in the subsidiary (GTM) using the approach already described. Since the weighted average cost of capital of the parent's capital structure and the modified consolidated capital structure are identical to 11.16%, it can be used as a constraint to the subsidiary's overall cost of capital because according to the consolidated approach the overall rate of return of the subsidiary would be equal to the system's weighted average cost of capital.

As shown in Table 34, the cost rate on equity capital of GTM is 15.57%. The equity rate of return of GTM can also be obtained directly from the subsidiary pricing approach, i.e.,

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t_s)\ (D_{s1}/E_{s1})$$

$$= .1425 + (.1425 - .1209)\ (.54)\ (53.5/46.5)$$

$$= .1425 + (.0216)\ (.54)\ (1.15054)$$

$$= .1559 \text{ or } 15.59\%$$

Table 34

GTM Capital Structure and Cost Rates

Type	Percent	Cost Rate	Weighted Cost Rate
Long-term debt	46.1%	8.29%	3.82%
Short-term debt	7.4	10.00	.74
Preferred stock	7.7	7.23	.56
Common equity	38.8	15.57	6.04
Total	100.0%		11.16%

Chatham Telephone Company

Rate of Return Analysis

Chatham Telephone Company, a subsidiary of Telephone and Data Systems (T&DS), filed for a rate increase before the Michigan Public Service Commission (MPSC) on August 29, 1986. It requested a 17% return rate on its common equity capital based on 1985 test year capital structure. The analysis that follows provides a comparison between the "traditional" consolidated capital structure approach and the new approach adopted in this research for the determination of cost of equity capital and overall rate of return of Chatham Telephone Company.

Under the traditional approach, the return rate on equity capital of a subsidiary is determined by estimating the weighted average cost of capital (WACC) of the consolidated capital structure and then assigning the system's WACC as being the subsidiary's overall cost of capital. The subsidiary's return rate on equity capital will be obtained by subtracting the weighted embedded cost rate on the subsidiary's debt from WACC of the system and then dividing the remainder by the percentage of the subsidiary's equity. The traditional approach utilizes the embedded debt cost rates on debt capital of the system and its subsidiary. The new approach would use the marginal (current) cost rates on debt.

If the embedded average cost rate on debt capital of the system is greater than the embedded average cost rate on the debt of the subsidiary, the traditional approach would overstate the return on the equity capital of the subsidiary. In the opposite case, the return rate on equity capital of a subsidiary would be understated. Further, application of the embedded debt cost rates is inconsistent with the capital market theory and practice because the cost rate on equity capital of the system represents the current opportunity cost, whereas the embedded debt cost rates represent the historical opportunity costs. Thus, the overall rate of return determined for the system does not represent the overall opportunity cost of capital.

The example, as presented in Table 36, shows the extent to which the return rate on the equity capital of the subsidiary of a consolidated system is magnified by the adoption of the traditional approach. The analysis of the new approach is presented in Table 39 for the same telephone subsidiary. A comparison of the two approaches reveals that the traditional approach would have authorized the subsidiary a 25.18% return on its equity and a 9.35% overall rate of return as compared to a 14.45% return on the subsidiary's equity and a 6.99% return rate on total capital using the new approach. Recall that Chatham Telephone Company requested a 17% return rate on its equity capital. It is obvious that the requested rate of return is 2.55% higher than what the capital market conditions would dictate--14.45%. A settlement agreement was reached between the Commission's staff and the company, and the company agreed to have the same rate of return, 13.24%, which was authorized by MPSC in 1982.

Traditional Consolidated Capital Structure Approach to the Determination of Cost-of-Equity Capital of Chatham Telephone Company

Table 35

Telephone and Data System's Capital Structure on December 31, 1985, and Overall Rate of Return

Type of Capital	Amount ($ 000)	Percent	Cost Rate (%)	Weighted Cost Rate (%)
Short-term debt	$ 49,156	14.01%	8.74%	1.22%
Long-term debt	203,637	58.03	7.93	4.60
Preferred stock	11,014	3.14	8.66	.27
Common equity	87,105	24.82	14.07	3.49
Total capital	$350,912	100.00%		9.58%

Table 36

Cost of Equity Capital of Chatham Telephone Company

Type of Capital	Amount	Percent	Cost Rate (%)	Weighted Cost Rate (%)
Debt	$2,193,071	77.46%	5.04%	3.904%
Equity	638,150	22.54	25.18	5.676
Total capital	$2,031,221	100.00%		9.580%

Table 37

Overall Cost of Capital of Chatham Telephone Company for Ratemaking Purposes

Type of Capital	Amount	Percent	Cost Rate (%)	Weighted Cost Rate (%)
Long-term debt	$2,193,071	72.17%	5.04%	3.64%
Common equity	638,150	21.00	25.18	5.29
Deferred income tax credit	133,216	4.39	9.58	.42
Deferred federal income taxes	74,154	2.44	0.0	0.0
Total capital	$3,038,591	100.00%		9.35%

The cost of equity capital of the subsidiary is estimated to be 25.18%, which is out of line under the prevailing capital market conditions. This is due to the presence of a subsidized debt cost rate of 5.04%.

If the capital structure of a subsidiary contains a large portion of subsidized debt, the traditional consolidated capital structure approach cannot be used to arrive at an appropriate cost rate on equity capital of a subsidiary. Under such conditions, one has to adopt the new approach developed in this study.

New Approach to the Determination of Cost of Equity Capital of Chatham Telephone Company

The procedure to be adopted is as follows. First, determine the unlevered beta of the consolidated system; second, estimate the unlevered cost of equity capital of the consolidated system; third, use the formula given below for the estimation of cost of equity capital of the subsidiary.

$$K_s^L = K_c^U + (K_c^U - K_{ds})\ (1 - t_s)\ D_s/E_s$$

Where:

K_s^L = the levered cost of equity capital of the subsidiary

K_c^U = the unlevered cost of equity capital of the consolidated system

K_{ds} = the marginal cost rate on debt of the subsidiary, which is assumed as the risk-free rate

D_s/E_s = the debt-to-equity ratio

t_s = the marginal (effective) tax rate of the subsidiary

Note: The marginal tax rate of the system and subsidiary is assumed to be 34%.

Step 1: Determine the Unlevered Beta of the System.

$$\beta_c^L = \beta_c^U\ [1 + (1 - t)\ (D_c/E_c) + P_c/E_c]$$

$$= \beta_c^U\ [1 + (.66)\ (72.04/24.82) + 3.14/24.82]$$

$$= \beta_c^U\ (3.0418)$$

Since $\beta_c^L = 1.01$, we get

$$\beta_c^U = 1.01/3.0418$$
$$= .3320$$

Step 2: Determine the Unlevered Cost of Equity Capital of the Consolidated System.

$$K_c^U = K_f + \beta_c^U (K_m - K_f)$$

Where:

K_c^U = the unlevered cost of equity capital of the system

$$K_c^U = 8.58 + .3320 (14.02 - 8.58)$$
$$= 8.58\% + 1.8061\%$$
$$= 10.3861\%$$

Step 3: Determine the Levered Cost of Equity Capital of the Subsidiary--Chatham Telephone Company.

$$K_s^L = K_c^U + (K_c^U - K_{ds}) (1 - t_s) (D_s/E_s)$$
$$= 10.3861 + (10.3861 - 8.58) (.66) (77.46/22.54)$$
$$= 10.3861 + 4.0965$$
$$= 14.4826\%$$

It should be noted that 14.4826% is quite reasonable as compared to 25.18%, which was obtained using the traditional approach. Moreover, the risk to the subsidiary is higher due to a higher proportion of debt in its capital structure as compared to the proportion of debt in the system's capital structure.

Table 38

Chatham Telephone Company's Rate of Return for Ratemaking Purposes, Based on Average Capital Structure for 1985

Type of Capital	Amount	Percent	Cost Rate (%)	Weighted Cost Rate (%)
Long-term debt	$2,193,071	77.46%	5.04%	3.90%
Common equity	638,150	22.54	14.48	3.26
Total capital	$2,831,221	100.00%		7.16%

Note. Michigan Public Service Commission Docket No. U-8553, August 29, 1986.

Table 39

Chatham Telephone Company's Rate of Return for Ratemaking Purposes, Based on Average Capital Structure for 1985

Type of Capital	Amount	Percent	Cost Rate (%)	Weighted Cost Rate (%)
Long-term debt	$2,193,071	72.17%	5.04%	3.64%
Common equity	638,150	21.00	14.48	3.04
Deferred investment tax credit	133,216	4.39	7.15	.31
Deferred income taxes	74,154	2.44	0.00	0.0
Total capital	$3,038,591	100.00%		6.99%

Note. Michigan Public Service Commission Docket No. U-8553, August 29, 1986.

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