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An assessment of the impact of changes in the student-faculty ratio used in the budget formula for Virginia's colleges and universities on instructional costs per student, institutional complexity, and financial stability

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Dedication

It it to my father and mother that I dedicate this dissertation. You gave me the strength and support to reach my goal.

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CHAPTER I

INTRODUCTION

> One of the primary purposes of any analysis of expenditures for educational and general purposes is to determine if an institution is putting every dollar it possibly can into the function of instruction. (Russell & Doi, 1956a, p.35)

This statement emphasizes the need for focusing financial investigations on the allocation of resources to instruction and for maximizing expenditures on instruction. These issues require increased attention as a result of concern over the priorities of an institution of higher education during its resource allocation process. In the decade of the 1980s, there is renewed interest in this topic and it is of greater importance as colleges and universities are experiencing a major turnaround from rapidly increasing enrollments and growth in financial support that characterized the decade of the 1960s. The trend is shifting to the steady state in higher education. This condition was predicted more than a decade ago when The National Commission on the Financing of Postsecondary Education (NCOFPE) (1973) expressed:

> The burgeoning enrollments of the 1960s shifted the focus of concern from the financial condition of the enterprise to its ability to meet the challenge of accelerating growth. In the past several years, however, as enrollment growth has slowed--and now, for many institutions, apparently stopped altogether--there are again serious fears that some institutions, public and private, will not survive the continuing struggle to obtain the income necessary to meet rapidly rising costs. (p. 188)

Public institutions are caught in a special cross fire. They are becoming more financially dependent upon their state governments (Gross, 1973/1974) while continued inflationary costs intensifies the public's concern for controlling and limiting the growth of public appropriations (University of California [UCB], 1979). With decelerating rates of enrollment and revenue decline, financial stability and institutional autonomy are threatened by new demands for accountability. However, this turnaround is uneven among states (Kramer, 1980). Much of this new emphasis is in formerly internal matters of institutional workload which affect unit costs. With increased accountability, there is an appeal (Scheps, 1976) for a balance between institutional autonomy and external accountability. Recently, the State Council of Higher Education for Virginia (SCHEV) (1981c) expressed the view that financial accountability has developed to the point of diminishing returns with excessive controls which may exceed their usefulness.

Other political demands that result in additional state services are seriously challenging the direction and flow of public financial support (Henry, 1974). Furthermore, expenditures in balanced-budget states increase or decrease according to the revenue that flows into the state treasury (Adams, 1977). According to him, this expenditure pattern has negative consequences for higher education during a recession when it is competing with other essential services that are priority items. Ingle (1982) anticipates that higher education's future battle will be between itself and other interests. Effective planning is more difficult under declining conditions. There is little an institution can do immediately to eliminate the need for retrenchment if it is still growth oriented (Rubin, 1979).

An outgrowth of these developments is a new concern for fairness in the allocation and efficiency in the use of financial resources allocated to higher education institutions through the formal budgetary process. In addition, states have become increasingly annoyed about institutions that exceed their projected enrollments (Fickett, 1977). According to Glenny and Dalglish (1973), the budgetary process is increasingly relied upon to exert influence and prescribe workload measures. However, Spence and Weathersby (1981) believe that a choice will increasingly have to be between increasing productivity as an efficiency response to revenue distress or decreasing the quality of academic programs.

This study will address itself to one dimension in the allocation of resources to instruction: the relationship of selected factors to a change in the budgetary formula for instruction. The factors to be considered are instructional costs per student unit, institutional complexity, and financial stability as developed from three principles that form the conceptual framework.

Statement of the Problem

The purpose of this study is to determine the impact over time of a change in the student-faculty ratio used in a state budget formula. More specifically, this will be accomplished by determining (1) the change in the level of instructional costs per student unit as well as which factors explain its variance, (2) the change in the level of institutional complexity, and (3) the change in the level of financial stability within all public colleges and universities in Virginia as well as within the community college sector and the senior-level institutions sector.

Background

One response of state governments to budgetary shortfalls caused by reduced revenues and higher inflation has been to raise the student-faculty ratio in budget formulas for higher education institutions. This is occurring in Virginia as well as in other states such as Texas (Meisinger, 1976), Florida (Caruthers, 1977) and New York (Martorana, 1978). According to Boutwell (1973), states have had more difficulty during enrollment growth providing adequate resources. Therefore, formula provisions have been increased to reduce requests.

State legislatures, state boards of higher education, and state budget officers are initiating this process in an effort to economize and increase the productivity of higher education institutions (Balderston, 1974). Moss and Gaither (1976) attribute formulas' adoption to periods of swelling enrollments. Formulas were revised to reflect available resources rather than institutional needs. McLaughlin, Montgomery, Smith, Mahan, and Broomall (1980) claim that faculty to student ratios have recently been determined as a result of available dollars. Similarly, Caruthers (1977) describes existing budget formulas as a result of numerous budgetary cutbacks. A consequence of this behavior may be that attempts to achieve equity may be sacrificed. Relatedly, Adams, Hankins, Kingston, and Schroeder (1978) refer to the budgetary process as a "defense mechanism" of the legislature in response to unclear institutional requests. As higher education enters a period of potential enrollment and revenue distress, this trend promotes the issue of adequacy in state funding.

While these events are occurring, faculty and administrators also are raising issues, in various forms, over the possible impact of these actions upon the quality of an institution and its outputs. Bailey

(1974) stresses that administrators need to consider their human as well as other resources. However, public institutions tend to avoid reducing personnel as a response to revenue distress (H. R. Bowen, 1972b; Gomberg & Atelsek, 1981). In turn, this reduces an institution's flexibility to respond to any further decline which may weaken its chances to fulfill its mission (SCHEV, 1979d). Therefore, Moss and Gaither (1976) express concern that formulas may be detrimental to quality under steady-state conditions.

Funding formulas will be under considerable strain during the 1980s. In defense, educators frequently assert that a reduction in funding will destroy the quality of institutions (Jenny, 1979b). Furthermore, excessive demands for accountability may turn into control and encroach upon institutional autonomy (Southern Regional Education Board [SREB], 1978). However, without an ideal student-faculty ratio, Radner and Miller (1974) accuse higher education of trying to have a double-edged sword when increases in the student-faculty ratio are presented to a legislature to demonstrate efficiency as well as a reduction of quality.

The effect from budgetary cutbacks upon institutional operations is a crucial issue. Some institutional and state legislature bodies have attempted to increase faculty productivity through increased workload requirements without concern for long-range implications (V. B. Smith, 1972). This issue is a central concern in this research. It will be more difficult to adequately support institutional goals under these conditions. Furthermore, inappropriate responses to revenue decline may exacerbate an institution's financial difficulties.

All educators are not so defensive to requirements for improved efficiency. Bogue (1982) suggests that quality may not decrease during a period of revenue distress. This could occur if there is a refinement and clarity in institutional mission. H. R. Bowen (1972a) believes that any relation between expenditure and effectiveness is not causal. Similarly, Schroeder (1978) attributes the increased amount of requested information as a reaction to higher education's biased and increasing demand for more resources. Even Stumph (1970/1971) admits that low student-faculty ratios become impractical as size increases.

The previous discussion does not firmly establish whether higher education is overly defensive and resistant to any movement toward accountability since much of higher education's defense is rooted in the budgetary process. Despite previous defenses, higher education will be mandated to accept the requirements for increased accountability and must be prepared to document where and how it is affected under conditions of revenue and/or enrollment distress during an era of the "steady state."

Significance of the Study

Increasing the student-faculty ratio is a short-term reaction (Pickens, 1981) often considered by the states during a period of tight monetary resources. It is one response used to increase efficiency and to economize in higher education. Breneman and Nelson (1981) posit that higher education will be vulnerable to cutbacks, especially if enrollments decline. Even though it is argued that this will be a period to improve quality, by maintaining the current level of funding, the legislatures have other ideas. In addition, public institutions may be required to accept larger enrollments without additional inputs (Change Panel on Academic Economics [CPAE], 1976). J. R. Nelson (1977) suggests that this action will increase productivity and lower unit costs. Furthermore, according to the Kentucky Council on Higher Education (KCHE) (1977), formula adjustments are easily implemented to economize.

This approach emphasizes efficiency rather than achieving the most effective use of available resources. Therefore, Cartter and Solmon (1976) project that student-faculty ratios will continue to increase due to general belief that educational productivity is less than optimal. One method to convince legislatures that productivity is improving is to require faculty to teach more students. This pressure conflicts with any internal need to respond to declining enrollments. Recently, there is increased criticism of across-the-board cutback responses (Campbell, 1982), which limits flexibility to adapt (Thompson, 1981), instead of program evaluations. This concern should intensify with the severity of state cutbacks.

Funding institutions at less than 100% of the budget formula request, such as 75% in Oklahoma (Stumph, 1970/1971), is another method employed which provides the allusion of more generous budget formulas than in reality. This procedure is still a means of economizing by a state (Asby, 1981). According to Moss and Gaither (1976), this is an alternative to formula adjustments but both lead to a loss of institutional flexibility and an erosion in the quality of programs. Most administrators agree that flexibility is reduced with revenue distress. However, an institution's immediate response may not reduce quality but there may be hidden effects. Salary distress may also result (KCHE, 1981b) which has the implication of lowering the ability to attract quality faculty.

These budgetary formula adjustments by the state are labelled by Glenny (1982) as exemplary of short-range decision making. When there is institutional growth outside an acceptable region, expensive provisions of the formula may be altered (Meisinger, 1976). With extreme revenue shortfalls, an existing formula may be completely abandoned. An across-the-board cutback, with less than 100% funding, will be most harmful to more efficient institutions (Gambino, 1979).

Obviously, there is a point beyond which further budget reductions will have extreme adverse consequences upon an institution. According to Boutwell (1973), this will occur when courses and programs have to be eliminated which may affect program quality. Response to revenue distress may have intended as well as unintended consequences. The sooner the unintended consequences can be identified, the more rapidly better policy can be developed.

In order to respond to revenue distress, institutions need to identify significant predictors of per unit costs. A recent cost study by Brinkman (1981) reports that institutional complexity is a primary variable in explaining the variation in instructional costs per student unit between institutions. In certain cases, this could eclipse the effects of size (McLaughlin, et al., 1980). As institutional size increases, so does the number of programs with the aid of increased faculty and their demands for proliferated offerings (Larrimore, 1974). If the state's objective in changing the student-faculty ratio is to economize on state revenues, its impact on institutional complexity should be considered and analyzed. Increasing the student-faculty ratio may overlook the fact that institutional complexity could be a more important predictor in explaining the behavior of instructional costs. If the pattern of institutional complexity is not altered in response, an action to increase the student-faculty ratio may lead to greater financial instability with a decline in revenues relative to the level of expenses. If the pattern of institutional complexity is modified, the strategy would achieve internal economies but institutional quality might suffer especially if students shift to higher cost programs. D. K. Smith (1981) expresses that the long-range effect from fiscal crisis on program quality must be considered by those proposing budgetary reductions. Furthermore, if complexity is reduced, student choice may be limited. Relatedly, Zammuto (1982b, 1982c) suggests that under certain conditions, complexity is related to an institution's ability to withstand enrollment distress even though resources may be thinly spread (CPAE, 1976).

Most existing cost studies focus on one of two perspectives. They are either a cross-sectional description of conditions within a given year (Wing & Williams, 1977) or a longitudinal study under uniform conditions (Cable, 1980). Overall, there is considerable support for cost studies (Fincher, 1978; Verry & Layard, 1975; Witmer, 1972). However, there are some concerns over their use. Hull (1961) identifies the following: (1) they are quantitative not qualitative, (2) they may lead to abuse from excessive concern to cut costs when achieved economies are unsound, and (3) cost may be implied as the most important aspect of the educational process. There is also the problem of joint supply (Carlson, 1972; James, 1978; Kress, 1978). Furthermore, hard quantitative data may drive out soft qualitative judgments on institutions (Berdahl, 1971). Despite these problems and limitations in cost studies, Hull (1961) believes their advantages outweigh their drawbacks even though further refinement is necessary.

Given these conditions, an assessment is needed following an upward adjustment in the student-faculty ratio, as a state reaction during a period of declining resources, to determine its effect upon higher education institutions. An extreme case of revenue distress will adversely affect institutional adaptability, flexibility, and the ability to reverse a financial decline (Rubin, 1980). It also may impede institutions' fulfillment of valued objectives.

The assessment should include data and analysis over several years on a longitudinal and cross-sectional basis to allow sufficient time for any change to be detected. Babcock (1981/1982) suggests that changes occur over at least a five year period and earlier responses are different from those of this time period which become more selective and program oriented (Glenny, 1982).

This study will address these and other concerns by assessing the impact of a change in the budget formula using longitudinal as well as cross-sectional data. Studying the impact of a formula policy change should be beneficial when planning or implementing any further technical adjustment or policy change in funding. Relatedly, this change may not affect all sectors evenly (Minter, 1979a). For example, community colleges are heavily dependent on state revenues and may suffer more adversely from revenue distress. Furthermore, a policy may need revising because of changing environmental conditions (Berdahl, 1971). Otherwise, the end result of a policy change may not be in the best interest of a state, individual institutions, or students (Mullen, 1981/1982).

Collier (1979) links the impact of budgetary cutbacks to state goals:

> An institution's survival is only significant to the extent that the institution is contributing something to the accomplishment of some other goals. . . . It is suggested that the significance of financial distress relates to the significance of the institution experiencing that distress and what the institution does that is valued by the policy-maker. (p. 18)

He expresses that a policy-maker is only concerned with an institution's distress if: (1) the institution experiencing that distress is contributing in some way to the achievement of a goal valued by the policy maker and (2) the particular form of distress being experienced by the institution detracts from the ability to contribute to the achievement of the goal. In other words, distress may reduce an institution's effectiveness in achieving valued goals or impair the quality of an institution (Bonham, 1976; Mingle, 1981b) from institutional responses which, from a state perspective, should be considered when developing policy.

Collier (1979) suggests that further study is needed to understand: (1) the linkages that exist between various forms of distress and the institutional responses to distress and (2) the linkages that exist between institutional response to distress and the ability of institutions to contribute to particular state and federal-level goals.

In other words, a change in the student-faculty ratio can lead to revenue distress. An institution's response, which can affect financial stability, may be to: (1) decrease the number of faculty and/or institutional complexity, (2) trigger salary distress, or (3) increase the staffing ratio. Its response also may reduce per unit costs and increase efficiency but lead to lower quality. Thus, there can be a complex reaction. This also illustrates the elusive nature of financial stability (Elliott, 1979) as it is linked to revenue distress.

Some of the recognized state-level goals for Virginia (Virginia, Department of Planning and Budget [VDPB], 1982) that are valued include: (1) to provide and maintain a higher education system of quality, excellence, and accessibility for citizens of the Commonwealth, (2) to recognize the importance of attracting and retaining excellent college faculty through competitive compensation, and (3) to view projected decline in higher education enrollment as an opportunity to enhance quality. Other goals previously enumerated (SCHEV, 1977b) include: (1) to protect and enhance institutional diversity, (2) to encourage a continuing emphasis on instructional quality, and (3) to assure the most effective and efficient use of all resources provided to higher education. However, the goals of quality, efficiency, and access are often conflicting (Mingle, 1981a).

As previously documented, it will be difficult to achieve all of these goals during the decade of the 1980s. Continued budgetary shortfalls and cutbacks could seriously hinder a state's progress while certain institutional responses to decline may drive any progress backwards. Unless institutions and policy makers are mindful of the effect from these responses, it may be too late to effectively reverse them. Also, the degree of change in financial stability that will be tolerated must be determined (Collier & Patrick, 1978). Jenny (1979c) adds that:

> State policy . . . may strengthen or weaken the educational mission of particular institutions. Public policy is not pre-ordained to have favorable effects--even if so intended--on all concerned. . . . Well intended legislation can have unforeseen consequences, and some of these may be patently undesirable. (p. 19-20)

Quantitative, as well as qualitative, measures or indicators have only recently been well developed (Patrick & Collier, 1978) or adequately available (Ryland, 1981a) and have not been used by many institutions to substantiate any true change in financial stability. Coldren, Mertins, Knepper, and Brandt (1979) suggest that higher education agencies will be the first extensive users of these indicators. They may use indicators to assess the effect of legislation on financial stability by sector (Dickmeyer, 1979). Recently, this topic has received increased attention, as the work of Dickmeyer (1980a) illustrates, and there should be substantial improvement in indicator research with continued development and use of them.

Financial and nonfinancial measures must be considered when assessing financial stability. An assessment of financial stability should include nonfinancial measures, such as enrollment, to determine the effect of decline upon the educational activities of an institution. Qualitative and intangible factors communicate a more complete story about financial distress (NCOFPE, 1973). By cutting back their functions and programs, institutions are able to respond to revenue distress and maintain their financial status, but in so doing, they may significantly forestall the achievement of valued objectives.

Primarily quantitative financial and nonfinancial indicators will be employed in this study since they are more objective than qualitative measures (Skousen, Smith, and Woodfield, 1975; Coldren et al., 1979) given the difficulty of measuring educational output. Defining output, especially on a qualitative basis (Wilkinson, 1977) with one proper index (J. P. Miller, 1970) is difficult as reflected by the variety of measures that have been proposed which include input proxies for output (D. G. Brown, 1970).

Theoretical Rationale

The conceptual framework for this study is derived from three principles from finance and economics. The first is the "revenue theory of cost." It posits that educational costs per student are related to the amount of institutional revenues generated (H. R. Bowen, 1980). This concept assumes institutions spend all the revenues they raise. With an enrollment-driven formula, costs per student unit should decrease if there are less available revenues but there is also the problem of the "lumpy" addition of resources (Academy for Educational Development [AED], 1979). A change in the student-faculty ratio triggers revenue distress which exerts pressure for per unit costs to decrease. But the question is do per unit costs fall quickly and evenly with revenue distress per Bowen's theory?

In recent years, institutions' educational costs have been soaring as a consequence of inflation, rapid enrollment growth, and added educational missions. The growth in educational costs has outpaced that of state revenues while rampant inflation has exacerbated the trend. In addition, there has been a problem of lagging productivity within the labor-intensive industry of higher education (J. O'Neill, 1971) which has also attributed to rising costs. The combination of these factors plus increased competition for limited state resources from other constituencies has forced the states to finds the means to economize. Since instructional costs has been a large proportion of institutional budgeted expenditures, this functional item has received considerable attention. One approach to economize on limited state resources taken within the Commonwealth of Virginia has been to increase the student-faculty ratio used in a budget formula to determine institutional budget requests. This action was initially taken during the 1978-1980 biennium. Since an increase in the student-faculty ratio would reduce the amount of revenues allocated to an institution when enrollment is held constant, instructional costs per student unit are expected to decrease per Bowen's (1980) theory.

The second principle used in the conceptual framework is the "threshold level" of enrollment (Maynard, 1971). After attempting to describe the relationship between educational costs per student and institutional size, he finds that larger institutions have better chances to achieve economies of scale. Extremely small colleges or universities lack sufficient enrollment to reach a threshold level due to the minimum number of programs and faculty necessary to operate an effective institution. Once a threshold level of enrollment is obtained, the long-run average cost curve quickly flattens over a wide range of enrollment. Developing this line of thought further, Brinkman

(1982) claims an institution's marginal costs are less than its average costs at lower levels of enrollment but nearly the same with scale (Mullen, 1981/1982) beyond the threshold level. One factor that determines an institution's threshold level is the staffing ratio. If there is an increase in the staffing ratio in response to revenue distress, then it is expected that an institution's threshold level will expand over a wider range of enrollment when complexity is held constant per Maynard's (1971) theory. Therefore, economies of scale may cover a greater range of enrollment. As a result, there may be a change in the relationship among the factors that explain the variance in instructional costs per student unit.

In recent research on formula funding, Brinkman (1981) identifies institutional complexity as one factor which explains the variance in instructional costs per student unit between institutions. This variable was found to be more important than institutional size or the staffing ratio. In related research, McLaughlin et al. (1980) found a positive relationship between the number of faculty and institutional complexity. Also, complexity rather than size was more important in their explanation of per unit costs. In addition, they found the staffing ratio to be the most significant variable explaining the variance in instructional costs per student unit. If there is an increase in the student-faculty ratio, the level of staffing may be modified as one response to revenue distress. According to their finding, this could change the level of institutional complexity if the number of faculty are related to this variable. Therefore, a decrease in instructional costs per student unit from an upward revision in the student-faculty ratio could affect institutional complexity by modifying the continued growth in this feature of educational organizations as identified by Blau (1974). However, due to its strong relationship with per unit costs, complexity may still be more important, especially if it is not altered, in explaining the behavior of instructional costs.

The third principle used in the conceptual framework is one of Bowen's (1980) "laws of higher education costs" which states that each institution spends all available revenues. He argues that the financial stability of all institutions is about the same and not related to per unit costs since they spend to the limit of their resources. However, different institutions face different environments and potential (Brinkman, 1982) for various types of decline (Mullen, 1981/1982) even though the public sector's overall stability is fragile (Stampen, 1980). Furthermore, the availability of resources influences the extent institutions can preserve financial stability through appropriate responses to decline (Dickmeyer & Hughes, 1979a).

In recent research on financial stability, Gilmartin (1981) found that the likelihood of distress was greater in smaller institutions. In addition to the level of costs, other factors can influence the financial stability of an institution. There also are nonfinancial variables, such as the level and trend of faculty salaries (D. K. Smith, 1979) that are influential. Furthermore, one institution may be more efficient, measured by educational costs per student, but not as effective in performing its mission (R. I. Miller, 1979). To illustrate, it may have suffered a reduction in quality of its basic educational program (Halstead, 1974), such as the attractiveness of the institution or the level of faculty salaries, even though quantifiable financial indicators register improvement in the short-run which may not show up until the long-run (Schmidtlein, 1979).

An increase in the student-faculty ratio may affect validated indicators that assess an institution's financial stability in different ways. Increasing the budget formula leads to revenue distress. In response, an institution may become more efficient by requiring more productivity from its faculty. This could counteract the effects of revenue distress. If there is an increase in the student-faculty ratio, then it is expected that there would be no change in the level of financial stability for an institution per H. R. Bowen's (1980) theory. However, more recent research by Gilmartin (1981) suggests that this change in policy may not affect all sectors nor all institutions in the same sector evenly. Therefore, there is the possibility of an interaction effect between educational sectors and the level of financial stability especially if some are better able to respond to revenue distress created by the state's efforts to economize.

In summarizing and linking the three principles used in the conceptual framework, an upward revision in the budget formula leads to revenue distress. This exerts pressure for institutions to reduce instructional costs per student unit in accordance with H. R. Bowen's (1980) theory. In response, an institution may eliminate programs and/or reduce its staffing level which affects the threshold level and the range where economies of scale are achieved. Other responses may be taken, such as salary distress, that does not affect complexity nor an institution's threshold level. Therefore, the relationship among the predictor variables to the criterion variable of instructional costs per student unit may change. Institutional responses to revenue distress may counteract its effect and not influence financial stability. H. R. Bowen's theory suggests that institutional financial stability will not differ nor be related to instructional costs per student unit before or after the budgetary change. However, certain responses may be more effective in reversing a declining trend and preventing a deterioration in financial stability (Alfred, 1978a). In addition, the same responses may not be available to all institutions. Finally, institutional responses may or may not counteract revenue distress and preserve financial stability which are linked to the ability of institutions to fulfill valued objectives. In short, the three principles that constitute the conceptual framework relate to revenue distress, the responses to it, and the impact of the responses on financial stability and goal achievement as a policy analysis.

General Hypotheses

It is hypothesized that a change in the student-faculty ratio affects instructional costs per student unit. This study will determine which predictors of per unit costs are influenced by such a change in budgetary policy. If institutional complexity is altered after the budgetary change, its relationship to instructional costs per student unit may change. However, this variable may still have a greater influence on instructional costs per student unit than the change in the budgetary formula. If so, the behavior of complexity should be considered when developing any type of technical adjustment or policy change in funding.

The second hypothesis advanced is that the financial stability of Virginia's colleges and universities has not changed, despite revenue distress, after the change in budgetary policy. This study will track any change in financial stability using quantitative financial measures as well as the inclusion of nonfinancial indicators.

The third hypotheses forwarded is that the impact of a change in the student-faculty ratio will differ among community colleges and the senior-level institutions sector in Virginia. To test this hypothesis, Virginia's public colleges and universities will be categorized into two sectors, which are community colleges and senior-level institutions, and analysis will be conducted of the individual sectors and for the combined sectors.

To test these hypotheses, pooled cross-sectional time-series multiple regression analysis will be employed. Dummy variables will be included to remove the variance due to repeated measures. In addition, stepwise multiple regression analysis will be used to identify the most significant predictor variables of instructional costs per student unit. Finally, current institutional financial stability as well as its change in direction will be assessed from a composite score developed from a series of financial and nonfinancial indicators.

Limitations

The use and application of budget formulas vary among the states (Budig, 1982b; Stumph, 1970/1971). Therefore, to minimize threats to internal validity introduced by interstate comparisons (Gross, 1973/1974), this study is limited to one state's 39 public institutions as such state specific accounting and budgetary practices and variability in funding levels limit the usefulness of interstate comparisons (Mullen, 1981/1982; Study Committee on Public Higher Education Finance [SCOPHEF], 1982). According to J. L. Miller (1964), states differ in their recognition of institutional types, program types, and instructional levels. Because of these concerns, Rubin (1979) only used one state in her study. Moreover, HEGIS finance data are well suited for single state studies and even better when used for sector comparisons (Andrew, Fortune, & McCluskey, 1980).

This study will only consider the public colleges and universities located within the Commonwealth of Virginia. Budget formulas do not apply to the private sector since state appropriations are not a major source of their revenues. Furthermore, the differences between these two sectors become evident when comparing their financial stability (Minter & H. R. Bowen, 1980b). According to Dickmeyer (1980a):

> The difference between public and independent institutions gives a good example of the difficulty of using resource measures as signs of distress. Declining resources at independent institutions are important because they may signal an increasing probability of institutional failure. At public institutions, failure is an unlikely legislative option and probably cannot be predicted by resource declines. (p. 14)

In this study, the concept of educational costs is operationally defined in instructional costs. While this is the largest single expenditure category for educational institutions (AED, 1979), it also provides a more objective measurement of outcome criterion than many other categories such as research (Lyons, 1978) or public service (Stumph, 1970/1971). Nonetheless, the study relies upon one category of educational expenses which may exclude other important functions of an institution. Other studies have also concentrated on instruction (Adams, Hankins, Kingston, & Schroeder, 1978; Babcock, 1981/1982; Williams, 1959). Thus, there is precedent for this limited focus. This study relies upon average unit costs which are used extensively in higher education cost studies (Gambino, 1979) due to the difficulty in measuring educational output (Balderston, 1972b) and are also used to justify budget requests (Powel & Lamson, 1972).

There is inconsistent treatment of fringe benefits in Virginia across the six-year period used in this study. From academic year 1976-1978, they were centrally appropriated and were not separately reported by functional area. After 1978, they were appropriated to institutions and reflected in their functional expenditure categories. To provide comparable data for instructional costs during this six-year period, fringe benefits were removed from academic years' 1979-1981 expenditures by functional area. Similarly, state revenue appropriations were adjusted for the total of these corrections to educational expenditures.

Another limitation in this study is the reliance on HEGIS data. There are certain reporting problems inherent in this data base. However, given the extensive amount of data collected, reporting inaccuracies are not totally unexpected. Moreover, institutional reporting has become more accurate in recent years.

A final limitation in the study relates to the number of years of available data for a longitudinal study. There are several reasons for this limitation. Initially, SCHEV adopted Appendix M, which contains the guidelines and formulas to be applied for the preparation of institutional appropriation requests, for the first time during the 1974-1976 biennium (Kellogg, 1974). Therefore, the number of years experience with budget formulas in Virginia is limited by their recent adoption. Furthermore, the budget formula was not revised upward for the instructional function until the 1978-1980 biennium (SCHEV, 1977a). Consequently, the time period addressed by the study is defined by the experience and change in policy with budgetary formulas. This study will cover a six-year period which permits time before and after the change in the budget formula to assess institutional trends. This time period is felt to be sufficient by Russell and Doi (1956b) and Meeth (1974).

Only recently, have Virginia's colleges and universities been audited. Furthermore, comparability is impractical for prior years (SCHEV, 1964) due to a change in the reporting requirements (American Institute of Certified Public Accountants [AICPA], 1973). The reporting format of the HEGIS Financial Statistics Survey was revised in 1974-1975 (Brandt, 1980) to comply with new reporting guidelines (Minter & Conger, 1979a). Since then, there have been only minor revisions (Ryland, 1981b). Therefore, the data available for comparative purposes are limited to the period 1975 to 1981. Nonetheless, the time frame is adequate to determine the impact of a change in state policy.

The Organization of the Study

In Chapter II, the literature related to the conceptual framework used in the study is reviewed. There are sections on cost studies, the use of microeconomics in higher education, and studies of institutional financial stability. In Chapter III, the design of the study is presented. There are sections on sampling, data gathering procedures, measurement considerations that are necessary in the process of conducting the study, an outline of the design of the study, the specific hypotheses for the study, and a description of the statistical analysis to be used. In Chapter IV, the findings of the study are presented by each sector as well as for all colleges and universities in Virginia. Finally, Chapter V includes a summary, conclusions, discussion of the findings, and implications for future research.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter is organized by topics that correspond to the three principles that form the conceptual framework used in this study. The chapter consists of four sections. The first section reviews cost studies in higher education as they relate to instructional costs and allocation decisions. The second section reviews the use of microeconomics in higher education. In the third section, the development of a conceptual framework and validated indicators to measure institutional financial stability are discussed. Finally, a summary of the research is presented in the fourth section reflecting findings captured from the literature review.

Cost Studies in Higher Education

This section reviews pertinent issues emerging out of recent cost studies. Included are the growth of educational costs, productivity, efficiency, effectiveness, the use of budget formulas as an allocation device, their development in Virginia, and the revenue theory of cost. Although the first cost studies date back to the late 1800s (Witmer, 1972), the study limits the review from the 1950s to the present. Only in the latter part of this period is reallocation of existing resources of utmost interest (Adams, Hankins, & Schroeder, 1978).

The growth of educational costs. Educational costs have soared in recent years. Part of this was attributed to dramatic growth in enrollments over the past several decades, but educational costs have risen faster than enrollment. Educational costs increased 69 times between 1929 and 1976 while enrollments increased tenfold (H. R. Bowen, 1980).

A second factor contributing to increased educational costs was inflation. Between 1929 and 1976, the Consumer Price Index rose from 50.3 to 165.9 with 1967=100 (H. R. Bowen, 1980). Nonetheless, educational costs rose faster than inflation.

Controlling for inflation and enrollment changes, educational costs increased on the average by 1.4% a year over this same time period (H. R. Bowen, 1980). However, this increase was not uniform across the years. The only period where higher education expenditures were growing in constant dollars was between 1950 and 1970. But, they were continuing to grow in current dollars (H. R. Bowen, 1972).

Since 1970, constant costs per student have declined nationally (McCoy, 1979) but continued to grow in Virginia up to 1979 (SCHEV, 1981c) even though constant revenues had begun to decline as enrollments continued to increase. Marks (1980) attributed some of this decrease in community colleges to economies of scale and the rest from insufficient funding to match enrollment growth during an inflationary period. S. C. Nelson (1980) also suggested that faculty salary distress in response to revenue distress was a further reason for the decline in real terms. Therefore, to maintain stability during a steady state, more resources and internal economies were needed (Levine, 1980c) to cope with a cost squeeze. Marks (1980) also found that during the 1970s the percent of expenditures devoted to instruction decreased in community colleges in response to these conditions. However, his data contained inconsistencies during a five-year period.

Several other factors caused expenditures per student to increase over time in current and constant dollars before the recent period of revenue distress. One of these factors was the need for increased complexity within an institution. The explosion of knowledge and its fragmentation resulted in the birth of many new disciplines, programs (Jellema, 1973a), and course offerings (Cheit, 1971). These events affected instructional costs by exerting upward pressure on the instruction function that comprised a major portion of an institution's total educational and general expenditures.

Many new programs required large start-up costs as well as high instructional costs per student (Scheps & Davidson, 1978). In addition, rapid course proliferation proved to be expensive since less costly courses typically lost enrollment to more costly courses (F. M. Bowen & Glenny, 1980). When there were insufficient revenues to support high cost programs, reallocation was necessary (AED, 1979) since programs were seldom deleted on grounds of excessive cost (SREB, 1959) even though Hoenack and Norman (1974) expected more of this to occur with increased competition to strengthen specialty areas.

On the other hand, an institution had to offer a certain variety of courses in order to remain dynamic, to be effective (Russell & Doi, 1956e), and to achieve its institutional mission (Tucker, 1978). Therefore, a paradox developed when additional courses and programs were added without the deletion of old programs and undersubscribed courses (Boren, 1977). This pattern resulted in increased instructional costs per student but was considered necessary to effectively achieve institutional missions. Excess instructional costs was not a major factor in earlier allocation decisions.

As more students pursued graduate instruction and as graduate schools grew in size and complexity, instructional costs continued to rise. However, part of this has been attributed to hidden research subsidies (Abowd, 1981). For lower-division undergraduate students, Corrallo and O'Conor (1973) suggested that instructional costs were similar across different sectors. Graduate schools and courses were much more expensive to operate (Hopkins & Massy, 1981) with their heavier emphasis on research (James, 1978), reduced teaching loads, and small classes. James (1978) proposed, when research costs were properly considered, that undergraduate costs were lower and decreasing over time, but her view was discounted by H. R. Bowen (1980). If there were less research funds, more graduate costs would have to be allocated to instruction (Balderston, 1974) which was a point not considered by James (1978). Furthermore, the complexity issue was not addressed nor was there consideration that because of joint costs any increase in undergraduate teaching may have increased total costs more than she anticipated.

The productivity problem. W. G. Bowen (1968) conducted a useful study of productivity (See Appendix A) in relation to rising costs in the private sector. He attributed the rising cost of instruction per student to two factors. First, the extent of course proliferation and new program development in recent decades had grown dramatically which added to institutional complexity and subsequently to rising costs. Second, this trend made it difficult to achieve increased productivity (J. O'Neill, 1971; Weathersby, 1980). W. G. Bowen (1968) contrasted the economic plight of the private sector to industry. He attributed the push for rising educational costs from the competitiveness for increased salaries in the private sector commensurate with those in industry. This was considered necessary in order to effectively compete and attract quality faculty as well as administrators (Balderston, 1972b). Without regard to changes in productivity, competitive pressure for increased salaries forced upward trends in expenditures per student (Green, 1971).

The reasons productivity lagged in educational institutions were multifaceted (Niskanen, 1975) and were difficult to explain without a clear understanding of the production function (Topping, 1974). Also, faculty preferred to use the old tried and true methods and were reluctant to use newer instructional technology (Binning, 1971; Halstead, 1975) that was more efficient (Besse, 1973) but less acceptable. Some of the new media-oriented courses, if used enough could have converted some of the labor intensiveness of higher education to more of a capital-intensive nature without jeopardizing quality (Caruthers & Orwig, 1979) while maintaining viability (Froomkin, 1978). However, unwillingness by faculty to use these methods (Witmer, 1972) meant that they were not proven economical. Therefore, most increases in productivity have been obtained through increases in class size (Corrallo, 1970).

As inflation drives costs up faster (Jenny 1979c) than state appropriations increase, higher education will need to achieve the most out of its available resources (Cyert, 1977; Hodgkinson, 1981) through increased productivity (Moon, 1972) which institutions should be allowed to keep (Bogue, 1982). If revenue distress emerges, productivity may be increased in response (Frances, 1982b) and has also occurred under collective bargaining (W. W. Brown & Stone, 1979) even though this may have been partly attributed to the use of more part-time faculty.

Efficiency. A number of different measures have been proposed (National Association of College and University Business Officers [NACUBO], 1975) that could be used to express the efficiency of an educational institution. One typical measure was the amount of educational expenditures per student (Scales, 1969). Efficiency (See Appendix A) represented an internal concern (Cameron, 1982) of "doing things right" (R. I. Miller, 1979). However, low costs per student, while efficient, could have meant poor quality (Enthoven, 1970; Scheps, 1972) and poor effectiveness (D. G. Brown, 1977) especially when institutional missions were not considered (Fraser & Wright, 1978) while the opposite did not always imply inefficiency (Halstead, 1974). In addition, efficiency could be increased (Bell, 1972) without impairing quality. Despite resistance to improved efficiency (D. G. Brown, 1977; Verry & Davies, 1976), it has been a typical response to revenue distress and was a method to improve quality (H. R. Bowen & Douglass, 1972; Russell & Doi, 1956e).

Effectiveness. In addition to efficiency concerns, an institution also needed to be effective. Effectiveness has been concerned with "doing the right things" (Drucker, 1967) or influencing the environment (Cameron, 1983). It was the degree an institution succeeded in achieving its goals (Halstead, 1974) and objectives (Scheps & Davidson, 1978). Excess concern for efficiency often impaired the effectiveness of an institution (Gambino, 1979) as well as its quality (Wachman, 1977). There were trade-offs between effectiveness and efficiency but possibly both were improved at the same time (Meeth, 1974).

The use of budget formulas in the appropriations process. Budget formulas were first used in 1951 in four states (Gross, 1973/1974). These states were (1) California (Porter & Brown, 1982), (2) Indiana, (3) Oklahoma, and (4) Texas. Miller (1964) identified 1957 as a second period in their development. Antecedents to the development of budget formulas included: (1) greater centralization of control over state funds (Kellogg, 1974), (2) political complexities (Meisinger, 1976), (3) increased demands for accountability (Hale & Rawson, 1976), (4) desired rationality in budgeting (Michigan Department of Education, 1976), (5) desired objectivity in budgeting (Spence, 1978), (6) desired equity in budgeting (Gross, 1979), (7) projected increases in enrollment ahead of revenues (SCOPHEF, 1982), (8) refined cost analysis between programs (Bogue, 1977), and (9) development of classified financial accounts for institutions (J. L. Miller, 1964) which made comparisons possible.

In addition, several other factors aided the process. There was a spread of statewide coordinating and governing boards (J. L. Miller, 1964). Also, the projected needs for higher education during the 1950s called for a dramatic increase in required resources. Planning for growth was a necessity (Kramer, 1980). According to Gross (1973/1974), formulas were promoted, with their objectivity and equity, as a replacement for pork-barrel allocation methods. He perceived budget formulas as a compromise between demand for accountability and protection of autonomy. However, Kramer (1980) expressed the concern that they could turn into a control device for the allocation of resources.

More states began to rely on budget formulas to determine institutional requests for resources (Hale & Rawson, 1976), and in some cases, for final appropriation to a state system of colleges and universities (Gross, 1973/1974). These formulas were used most often by state coordinating boards (Adams, Hankins, Kingston, & Schroeder, 1978) with advisory or regulatory power for budgetary review. Most formulas were used for budget appropriation requests (Gross, 1979) which may not have been fully funded (Linhart & Yeager, 1978) with institutional flexibility to determine internal institutional allocations of appropriated funds (Van Wijk & Levine, 1969). But, there was growing concern (Schroeder, 1978) that they would be used for accountability for resource allocations (Breneman & S. C. Nelson, 1981) and would threaten institutional autonomy (Gillis, 1982) especially with restrictions in transfers between functions (McKinney, 1982).

In 1973, Gross made a comparative study of the use of budget formulas in the 50 states. At that time, he found that 25 states directly employed budget formulas since their birth two decades before. There were inconsistencies between states as to how formulas were applied (Skousen et al., 1975) or which specific methods were used (KCHE, 1977) for a given functional area such as instruction or which functional areas were covered. Nonetheless, the instructional cost formula was the single most important one (J. L. Miller, 1964). An estimate of full-time equivalent (FTE) enrollment was usually the starting point in the budget process (Van Wijk & Levine, 1969) even though its definition varied among states (Wattenbarger & Starnes, 1976). Using projected enrollments sometimes became an incentive for institutions to overestimate enrollment projections (SCOPHEF, 1982). In turn as resources became scarcer, some states have recently "capped" enrollments or penalized institutions for overestimates (F. M. Bowen & Glenny, 1981b).

In 1975, a survey (New York, Division of the Budget [NYDB]) was conducted which was prompted due to the varying application of student-faculty ratios in formulas between states in determining budgetary allocations to colleges and universities. As expected, there was a wide variety of application between the states and between different programs and academic levels within a state. In lower-division academic levels for the year surveyed, the student-faculty ratio used for budgetary formulas varied from a low of 12:1 in Washington to a high of 34:1 in the University of California System. In contrast, the doctoral-level range was 4:1 for the University of California System to 24:1 in South Dakota.

This document (NYDB, 1975) was concerned with the trend in student-faculty ratios over the course of time. The observation was narrowed to the State University of New York which was not truly representative of the entire population of colleges and universities (Minter & H. R. Bowen, 1976). Through the first half of the 1970s, the student-faculty ratio employed in this state system rose from 13.2:1 to 15.8:1. Naturally, this ratio varied between undergraduate and graduate levels and was not uniform among programs. However, during this period of resource scarcity, decreases were an exception rather than the rule (Bolin & McMurrain, 1969) in order to restrain requests to available resources. Internally, these increases were achieved by increased class sizes rather than increased faculty workloads (Balderston, 1972b).

The trend of the growing use of budget formulas stemmed from the fact that they were (1) objective (Arceneaux, 1981), (2) equitable between institutions (Millett, 1974), (3) gave institutions a minimal amount of funding (Gross, 1973/1974), (4) included quantifiable measures of performance, and (5) made comparisons between institutions easier. In documenting the rise and growth of formulas, J. L. Miller (1964) pointed out that the growing level of appropriation requests was a great concern to state officials. Achieving equity was difficult in those states with limited resources (Moss & Gaither, 1976) which was aided by employing budget formulas (KCHE, 1977). However, equity did not mean equal expenditures per FTE with no reflection of program differences. Instead, equity meant the same amount of expenditures for comparable programs by level (AED, 1979) or common funding for common activities (KCHE, 1977).

There was also the possibility that more funds would be appropriated for higher education under objective requests (Stumph, 1970/1971) even though these requests usually incorporated ratios in existence at the time of their adoption (Caruthers, 1977; Gross, 1973/1974). However, Gross (1973/1974) did not evaluate the effect of budget formulas on funding levels. But, he suggested that they would not necessarily lead to economies in spending.

Critics have argued that formulas (1) did not measure quality (Allen & Topping, 1979), (2) did not reflect differences in costs between programs (Warren, Anderson, & Hardin, 1976) or institutions (Caruthers, 1977), (3) became rigid (Cope, 1969) even though some areas in some states did reflect scale economies such as Florida (Gross, 1973/1974), (4) were enrollment driven during a steady state (Henderson, 1978), and (5) were linear (Monical, 1981). McLaughlin et al. (1980) expressed concern that quality, performance, and complexity were ignored when only size was recognized in a formula as a means to achieve equity. The KCHE (1981a) also wanted formulas to recognize institutional efforts to achieve excellence. There was also concern that formulas could impair the quality of an educational system as an unintended consequence from enrollment decline. Criticism of formulas was partially in response to their lack of recognizing program differences when certain ones were declared to be of higher priority (Minahan, 1974). In addition, formulas tended to become static when they did not recognize the need for changing circumstances (Gross, 1973/1974). Because they were enrollment-driven, formulas often did not recognize the effects of inflation or other costly factors.

There has been growing concern about the possible effect budget formulas would have during periods of enrollment distress (Gross, 1973/1974) and/or revenue distress (Minter & H. R. Bowen, 1980b). However, Caruthers and Orwig (1979) did not expect their abandonment from this concern even though they may become more complex with declining enrollments (Allen & Topping, 1979). Caruthers (1977) could find no suitable alternative to them even though modifications have been proposed to "fine tune" them (Bogue, 1977; SCOPHEF, 1982). Since they were enrollment-driven and linear to size (Boutwell, 1973), budget formulas potentially could work to a state's advantage (Kramer, 1980) during this decade even if a state emphasized qualitative standards (Keegan & Cohen, 1978).

Babcock (1981/1982) suggested formulas worked better during expansion versus contraction periods. During the latter, costs climbed up the marginal and long-run average cost curve (Johnson, 1981) as fixed overhead was spread among a smaller student body (Schmidtlein, 1979) which has been recognized in some formulas for the administrative area (Cox, 1980). These events were compounded when inflationary expenditures exceeded revenues. In response to revenue distress, some institutions have derived an increased percentage of revenues from tuition. But, there were potential limits to this strategy. Furthermore, the KCHE (1981b) stressed that marginal costs did not decrease as much, while institutions tried to adjust their expenditures (Enarson, 1979), as the average cost funding in budget formulas lost when enrollments declined. Some costs were not variable or "sticky" (Dickmeyer, 1980b) to enrollment decreases (Pickens, 1981; SREB, 1978) in the short-run without a change in mission (SCHEV, 1979d). Therefore, any loss of revenues from enrollment distress could have jeopardized financial stability if costs were not controlled (Balderston, 1972a; AED, 1979) and no buffering was provided by a state. This would have been an unintended consequence from the use of formulas. However, the AED (1979) was only addressing one dimension of the problem with an enrollment decline triggering revenue distress. In addition, an institution could have suffered revenue distress, with a change in the student-faculty ratio used in the formula from a state's need to economize, without any enrollment decline. This aspect will be a central concern in this study.

H. R. Bowen's (1980) revenue theory of cost suggested that when revenues declined, so would costs. However, if a state buffered institutions from the loss in average costs in an enrollment-driven formula from declining enrollments, this would interact with any inability of an institution to rapidly respond to declining enrollments. Also, enrollment ceilings were another recent device which reflected state intervention from limited resources (F. M. Bowen & Glenny, 1981b). Despite these concerns, they indicated that it would be difficult to completely separate funding from enrollment.

Skousen et al. (1975) identified another shortcoming of budget formulas when they included other sources of income in addition to state appropriations. But, formulas did not apply to all functions and all revenues of an institution (Caruthers, 1977). Berdahl (1971) argued that including outside income in the budget formula reduced an institution's incentive to seek such support and to achieve quality. While attempting to achieve equity, this policy was especially troublesome for "flagship" institutions (Gross, 1973/1974) and had a levelling effect on quality. To prevent this, only tuition revenue should have been subtracted from the state allotment if quality was to be enhanced (Linhart & Yeager, 1978). Finally, S. C. Nelson (1980) added that formulas should not penalize institutions that maintained a steady enrollment level.

The development of formula funding in Virginia. There was a change in the philosophy of budgeting for higher education in Virginia from incremental budgeting (Campbell, 1980) to formula budgeting (Kellogg, 1974). However, this change was gradual and occurred over many years. The background development of Virginia's budgetary process and methods included a philosophy of efficiency and economy. Fragmented from the Governor's Office, the Division of the Budget was formed in the 1920s and was later declared by SCHEV to be responsible for determining the format of budgetary requests (Kellogg, 1974). SCHEV was organized in the 1950s to serve as the state coordinating agency for higher education and was later designated the agency to make enrollment projections for higher education. Prior to the 1968-1970 biennium, a few student-faculty ratios were included in the budget instructions as an exception to the incremental approach. During the 1968-1970 biennium, these guidelines for teaching positions were used to review budget requests and were based on four levels of instruction. This was an attempt to bring rationality to the budgeting process in Virginia when there were insufficient resources.

For the 1970-1972 biennium, Appendix M was prepared by the Division of the Budget as the first formal formula for higher education in Virginia (Kellogg, 1974). However, there was a dispute between the Division of the Budget and SCHEV since the latter had not participated in the process of developing the guidelines and also wanted institutional involvement in the process so that their presidents could review the guidelines. Also, SCHEV favored the use of ratios based on academic fields as well as by level of instruction which was a better means to recognize diversity as well as to achieve equity. However, the philosophy of the Division of the Budget prevailed and no fields were included nor were all formulas completed. Some of the unsettled problems at that time included developing ratios for (1) extension, (2) medicine, (3) dentistry, (4) law, and (5) allied health professions.

As of 1973, the formula for the community colleges was based on the expected number of students and the expected number of required staff (Wattenbarger & Starnes, 1973). The SREB (1978) attributed the popular use of formulas in southern states to the fact that these states, including Virginia, contained several major universities in their public system that were similar rather than one multiversity. Therefore, the need for rationality and equity in the budgetary process was crucial.

When Virginia decided to employ budget formulas, they considered what other states such as Texas and California were using (Gross, 1973/1974). Budget formulas appeared in Appendix M and were first used by SCHEV during the 1974-76 biennium (Kellogg, 1974). It was at this time that SCHEV assumed responsibility for developing the guidelines (SCHEV, 1979d). In Virginia, full-time equivalent student enrollments were used, versus student-credit hours as a measure of output (Tyndall & Barnes, 1962) in some states such as Florida (Fickett, 1977), which has caused difficulty in achieving adequate faculty support in lab classes (Strom, 1977), to drive the budget formula for instruction.

Spence (1978) studied the diversity of budget formulas used within individual programs. For comparative purposes, he found that Virginia used student-faculty ratios for 13 specific disciplines on four academic student levels while South Carolina used as many for 22 specific disciplines which reflected differences in the degree of recognizing institutional diversity. Evidence from Spence's study emphasized the importance of concentrating on one state system that used student-faculty ratios for budgetary funding purposes. From this, an analysis and assessment could be conducted of changes, before versus after a formula revision, in the relationship of cost factors (Fickett, 1977) that explained the behavior of instructional costs. Otherwise, the lack of consistency between states eroded the ability to draw conclusions.

Consequently, Spence (1978) updated the work of Gross (1973/1974) by charting the progress of budget formulas. Gross rated Virginia's formula as: (1) inflexible, (2) not broad-based, and (3) did not recognize varying instructional costs. But, he considered that it was (1) objective, (2) equitable, and (3) not used for detailed control. In the interim between these two studies, Virginia's budget formulas became more complex and detailed by including different disciplines as well as academic levels but still did not cover all functional areas. By 1978, Virginia recognized 13 specific disciplines and one non-specific discipline for four student levels (See Appendix B). Thus, there were now two factors in budget formulas that differed between the states. By referring to a particular state system, such as Virginia, comparisons within a state and conclusions could be drawn on the findings in relation to the hypotheses.

Other states have recently taken steps to improve their budget formulas. These steps included: (1) the recognition of fixed and variable costs during enrollment decline (SREB, 1978) or to limit increased appropriations with enrollment growth (Millington, 1981), (2) the recognition of inflation (KCHE, 1981c), and (3) the provision of quality improvement funds (SCOPHEF, 1982). However, even these were sometimes less than optimal (Bogue, 1977). Also, some functional areas have been funded without being directly linked to enrollment (Schultze, 1981) or partially buffered to enrollment changes (Spence & Weathersby, 1981).

After the change in budgetary policy, the Commonwealth of Virginia buffered small inflexible institutions from the full effect of revenue distress or potential enrollment distress by providing a funding floor for a minimum number of faculty, based upon previous levels despite size, even though the revised formula would have provided for less funded faculty positions (SCHEV, 1980a). This gave these institutions more time to adjust their programs and resources as well as to preserve the quality of their current activities (Schultze, 1981). During the 1980-1982 biennium, 15 of Virginia's public institutions were eligible under this provision which meant that resources were redistributed to these institutions (SCHEV, 1981b).

The revenue theory of cost. H. R. Bowen (1980) argued that the revenue theory of cost explained why educational costs per student varied so widely between institutions. His theory stated:

> That an institution's educational cost per student unit is determined by the revenues available for educational purposes. Given the enrollment, cost per student unit is directly proportional to these revenues. (p. 17)

From this, he derived his laws of higher education costs assuming the size and mission of an institution were already given. These laws included: (1) the dominant goals of institutions were educational excellence, prestige, and influence, (2) in quest of these, there was no limit to the amount of resources an institutions could spend for seemingly fruitful educational ends, (3) each institution raised all the resources it could, (4) each institution spent all it raised, and (5) the cumulative effect of the preceding four laws was toward ever-increasing expenditure. Some institutions with strong political power (McGuire, 1981) were able to raise more money than others which controlled their level of expenditures (Cavanaugh, 1969; H. R. Bowen, 1972b; Kershaw, 1972). Therefore, they had higher operating costs (Brinkman, 1982) which may (Sussman, 1978; Williams, 1959) or may not have been correlated with quality (Corrallo & O'Conor, 1973) or efficiency (Adams, Hankins, & Schroeder, 1978). However, there was no ideal level of expenditures (Cavanaugh, 1969) since institutions may have spent more and increased or not changed effectiveness with the latter being the greater expectation (R. I. Miller, 1979).

After factoring out inflation, states that have raised their student-faculty ratio in recent years should allocate less revenues to institutions. That is, unless the states have intervened to protect certain institutions from declining resources. In turn, instructional expenditures per student unit should have been lowered per H. R. Bowen's (1980) theory. This assumed that the trend in institutional complexity remained unchanged and that institutions could rapidly adjust their expenditures to the level of revenues. However, the Southern Association of Colleges and Schools (SACS) (1978) found that larger and more affluent institutions spent a larger proportion of expenditures for the instructional function versus achieving economies. But, this was before any condition of revenue distress. Afterwards, this pattern may have been reversed depending upon institutions' responses to decline.

The Use of Microeconomics in Higher Education

This section reviews topics from microeconomics as they relate to higher education. Included are the economies of scale argument as it relates to an institution's threshold level of enrollment and institutional complexity.

The economies of scale argument. Maynard (1971) wanted to develop a microeconomic model, using the principle of economies of scale with institutional size, that would explain the cost behavior in higher educational institutions. In essence, he wanted to study the relationship that existed between educational costs with variations in institutional size. He hypothesized that increasing the size of an institution and its outputs would achieve economies in operations that would flatten out the long-run average cost curve. On the other hand, a continuation of this growth could reach a point where there were diseconomies of scale (Corrallo, 1970; SACS, 1978). He attempted to determine how increased size and productivity affected economies of scale for the various types of educational costs.

Maynard (1971) found that economies of scale in educational costs existed. Since instructional costs were the largest percentage of total educational and general expenditures, he primarily wanted to find where economies of scale were lacking for this item. Staffing ratios were found to be the most important variable in determining overall and average instructional costs. He argued that an institution could expect to achieve greater economies of scale, while lowering its average costs, by operating at a size necessary to reach a threshold level of students in proportion to faculty. A core of faculty were necessary (Glenny & F. M. Bowen, 1980) regardless of enrollment to provide choice (Carnegie Commission on Higher Education [CCHE], 1972) but the staffing ratio increased with size (Meeth, 1974). According to this argument, instructional costs would be variable beyond this point with a constant staffing ratio. Maynard (1971) hypothesized that the economic plight of many private institutions was due to the impossibility of achieving productivity increases to support a threshold level of staffing which had to be subsidized from endowment income (Schipper, 1981). Therefore, this meant higher average costs per student but may have been necessary due to geographic location. However, Dickmeyer (1980b) pointed out that some small institutions were unwilling (H. R. Bowen, 1980) or unable to grow (V. B. Smith, 1972) because of inadequate revenues. Also, increased size alone did not always cure financial problems (Meeth, 1974) if revenues did not increase proportionately.

If student-faculty ratios were increased, an institution's threshold level of enrollment could increase, but this would depend upon the response taken to revenue distress. If the threshold level did increase, this would mean tighter control over faculty positions. Maynard (1971) argued that average instructional costs levelled out once the threshold level was reached especially when there were average cost budget formulas (Corrallo, 1970). Halstead (1974) suggested that this occurred over a wide range of enrollment but cautioned against making comparisons of dissimilar institutions among states. Since increased institutional size has lead to further complexity, the threshold level also could have risen from this occurrence. If so, rapid course proliferation (Russell & Doi, 1956d) and added services (Drucker, 1967) may have generated diseconomies of scale if there were no limits to the growth of institutional complexity. However, a certain size was required for an institution to be effective, diverse, and to have flexible use of its faculty. As institutions grew, they spent more on the instructional function (Corrallo, 1970; Jellema, 1973a), through reallocation of resources from respent economies (H. R. Bowen, 1980), for additional programs and other items. This pattern did not suggest strong scale economies. This phenomenon could explain why larger size institutions have had as many financial problems as their smaller counterparts since the percentage of expenditures spent for instruction increased to mask achieved economies.

Maynard (1971) used this threshold level principle while attempting to identify the point where maximum economies were achieved. He found this point to be an enrollment of slightly over 5,000 full-time equivalent students. Mullen (1981/1982) argued that this point was 2,500 FTE students for community colleges even though the CCHE (1972) had suggested 1,000 students. Since an institution had to offer a minimum number of programs regardless of its size, Maynard (1971) argued that its faculty costs were largely fixed until it reached a threshold level of enrollment. However, the effect of a change in the budget formula on the long-run average cost curve was not considered. In addition, he did not consider the complexity issue since his sample included institutions that were very similar except for size. If institutional complexity was affected from responses to revenue distress triggered by a change in the student-faculty ratio, the long-run average cost curve could have changed in shape.

Institutional complexity. In a recent study by McLaughlin et al. (1980), they found that institutional complexity increased along with size which negated any tendency toward achieving economies of scale. Their definition of complexity was different from the earlier one of Hawley, Boland, and Boland (1965) which was based on the number or diversity of programs (Chaffee, 1983). With the use of path analysis, McLaughlin et al. (1980) found that economies of scale were significant, though weak, in explaining the differences in instructional costs per student between institutions of various sizes. In contrast, they found a strong relationship between institutional complexity and the differences in instructional costs per student between institutions. They suggested that economies of scale were eclipsed by the greater effect of complexity when any savings were spent elsewhere for more expensive programs which also meant a lower staffing ratio. Their finding helped explain why the long-run average costs curve fell sharply and then levelled out over a wide range of enrollment.

Boutwell (1973) argued that budget formulas should have included provisions for economies of scale while Broomall, Mahan, McLaughlin, and Patton (1978) disagreed. These differences related to enrollment decreases versus increases. Boutwell (1973) indicated that educators trapped themselves into the linear cost syndrome with declining enrollments due to their persistence of keeping linear budget formulas when there were increasing enrollments even though complexity was an important factor. It would seem to be more complexity in research universities (Verry & Layard, 1975) which has led to increased per unit costs (Dickmeyer & Farmer, 1979) than a community college who had a better chance to achieve scale economies (H. R. Bowen, 1980; Corrallo, 1970) even though community colleges had a lower threshold level of faculty (Carlson, 1972). Uneven resource acquisition (Mullen, 1981/1982) during growth periods and increased complexity also helped to explain the linear nature of average costs with scale along with increased expenditures on the instructional function.

In 1981, Brinkman updated and extended the research on this topic. Using multiple regression analysis, he found that the staffing ratio was the most influential input variable in determining per unit costs for instruction. Thus, if it was changed, there should be an affect on instructional costs per student as a response to revenue distress. With the same analysis, he found that institutional complexity, defined as the number of degree programs to total enrollment, was the most influential output variable in determining per unit costs for instruction. Therefore, it there was a change in the staffing ratio, the behavior of institutional complexity also needed to be considered. If the pattern of institutional complexity was altered, there was a greater chance of achieving cost efficiencies (H. R. Bowen, 1972a). One other influential variable in Brinkman's (1981) study was the ratio of graduate to undergraduate students. There were diseconomies when this ratio increased.

Neither McLaughlin et al. (1980) nor Brinkman's (1981) study considered a change in the budget formula. They assumed that the student-faculty ratio was constant and used only one year's data. Furthermore, cost curves were sensitive to revenues (Brinkman, 1982) and could have behaved differently under conditions of decline.

Given the influence of institutional complexity, H. R. Bowen's (1980) revenue theory of cost, and changes in the budget formula for instruction, the impact of its revision will be assessed in Virginia. Current conditions as well as those existing in the period before and immediately following the upward change in the budget formula will be examined. If the revenue theory of cost prevailed and the pattern of institutional complexity was altered, new economies may have been achieved. However, continued trends in the pattern of institution complexity, without alteration, could offset efforts to achieve greater efficiency and could lead to further revenue distress and weakened financial stability of institutions.

Measurement of Institutional Financial Stability

This section reviews recent efforts to develop a conceptual framework to validate indicators of financial stability. Included are the development of a conceptual framework for financial stability, validation efforts on hypothesized indicators, H. R. Bowen's (1980) law of higher education costs, and responding to declining conditions.

The development of a conceptual framework. The attempt to develop measures to assess the financial stability of higher educational institutions has been intensive in recent years but was still largely in the formative stage (Glenny & F. M. Bowen, 1980). Summarizing some of the literature in this area to date, the NCOFPE (1973) pointed out that there was no agreement on a definition of financial distress in order to determine its extent and any attempt was likely to be inadequate (Wilkinson, 1973). This was still a concern subsequent to this time (Jenny, 1979c) with its elusive nature (Elliott, 1979). Since then, the demand for significant indicators has increased (Adams, Kingston, & Schroeder, 1978) even though subjective evaluations were involved (Dickmeyer & Hughes, 1979a). There were improvements in accounting data which hindered earlier progress (Van Alstyne, 1976b; Jenny, 1979a). More recent works were more technical (Kramer, 1982) in clarifying concepts in order to make more valid judgments of financial stability. However, it was Kramer's opinion that indicators could not suggest solutions but could only register improvements through responses. Nonetheless, if adverse conditions continued, they could lead to institutional distress which would be reflected in an institution's current condition (Dickmeyer, 1983).

Analysts such as Dickmeyer and Hughes (1980) used a core of "special alert" statistics to highlight damaging or encouraging financial trends for self-assessment of overall institutional financial condition (Frances, 1982a). However, any indication of weakness had to be cautiously handled internally as well as externally (Lapovsky, 1979) to avoid further difficulty (Truitt, 1975) or a self-fulfilling prophecy (Brubaker, 1979; Wing,1979a) unless additional support was provided. Collier (1976) added that the method of analysis used in earlier studies was largely subjective and dealt more often with the higher education industry rather than individual institutions (Frances, 1979; NCOFPE, 1973; Williamson, 1978). Results, rather than the method of assessment, were emphasized (Collier & Patrick, 1978). Without specifying which institutions were healthy, any normative values reflected those of unhealthy institutions which diluted the worthiness of results (Spence, 1975) as well as any changes (NCOFPE, 1973).

Earlier attempts to use business indicators in higher education were also criticized (Robinson, 1975). Lupton et al. (1976) pointed out that higher education's focus was on services versus profit, it used any subsidies to lower its price, and the importance of intangibles made the use of business ratios difficult, if not impractical. One of the more controversial works in this effort to develop a conceptual framework was that of Lupton et al. (1976). There has been a sharp difference in viewpoint on the usefulness of their work even though it was more objective than Cheit's (1971) definition which was made more operational by Collier's (1979) effort. The AED (1979) suggested that Lupton et al. (1976) indicators were useful to review institutional financial health as an early warning system to detect trouble (Millett, 1976). In contrast, Van Alstyne (1976b) argued that Lupton et al. (1976) indicators could not be used, because of incompleteness, to measure the financial health of institutions nor for self-assessment without any agreed upon definition of financial health nor any linkage between the diagnosis of financial health and the indicators employed (Stenner, 1977). In spite of this difference, Lupton et al. work served to stimulate interest in this topic (Minter, 1979a) and led to later conceptual improvements such as separate analysis by sector where less interaction effects were likely in interpreting the results (Frances & Stenner, 1979). It was also a first attempt to validate indicators (Budig, 1982a) in contrast to the earlier studies of Cheit (1971), Jellema (1973b), and NCOFPE (1973).

Bonham (1977) cautioned that there were some political aspects to the financial analysis of institutions. These included: (1) it was not easy to decide which institutions would fold, (2) trend data could be a political plus if they showed the erosion of academic vitality or a minus if they showed increasing costs, (3) if an institution's financial health assessment was above average it may have been neglected, (4) quantitative fiscal data versus qualitative performance data could be used, and (5) national data analysis could homogenize higher education even further toward mediocrity. Van Alstyne (1977) questioned whether one should use existing data or wait for sharper concepts. As a response, she concluded that:

> We cannot wait. While striving to develop more comprehensive conceptual frameworks for defining and interpreting indicators in postsecondary education, and while recognizing both the analytical and political risks of misusing, or simply using possibly misleading data, we should go ahead trying to construct indicators from existing data with the conviction that the active use of data is essential to improve the collection, processing, and interpretation of such data. . . . Focusing on the institution, will yield more sensitive, reliable, and creditable indicators. (p. 62)

In contrast, Jenny (1978) argued that better consensus was needed before developing indicators.

Brubaker (1979) found that indicators had been useful enough to use for decision making even though further development was necessary to match those in other industries. Different purposes and uses for financial indicators resulted in different sets of indicators. However, confidence in the use of indicators for specific purposes has improved even though uniform criteria of financial health were absent. He suggested that higher education was trying to quickly do what it took industry decades to do. Stich (1979) made a number of recommendations for new work to be inaugurated for financial indicator development. These included: (1) an attempt needed to be made to gain a better understanding of demographic, economic, political, and other factors that affected an institution's ability to achieve financial targets it set for itself, (2) sector financial analysis needed to be examined for implications it held for public policy issues concerning support for higher education, and (3) the impact on educational quality and educational opportunity for students which resulted from changing financial conditions of colleges and universities needed to be assessed. This last area was addressed in the 1980 American Council on Education (ACE) Working Conference (Frances, 1980b).

Much of the initial effort of developing financial indicators centered upon private institutions (Collier, 1976) as represented by the reports of Minter and H. R. Bowen (1976, 1978, 1980a). According to Minter and H. R. Bowen (1976):

> When the fortunes of higher education changed in the late 1960s and when many institutions were experiencing deficits while adjusting to new and less expansive conditions, dire predictions were made about the future of the private sector. Partly because of these predictions, the institutions quickly set about putting their houses in order. (p. 2)

Corrallo and O'Conor (1973) registered this improvement in their findings and so did others (Minter & H. R. Bowen, 1976; Wing & Mercer, 1978) even though some institutions continued to lose ground (Nielsen, 1980) and closed (Jonsen, Bogue, & Chambers, 1981) while others held their ground (Hughes, 1980). Van Alstyne and Coldren (1976) suggested that different conclusions of financial health were attributable to differences in the methods of financial analysis, short data intervals which ignored economic cycles, and unvalidated indicators that lacked consensus as well as norms (Stich, 1979). There was also a traditional view that higher education should not be subjected to financial measurement which was slow to subside. Also, these indicators were not applicable to public institutions (Collier, 1976; Stenner, 1978) when based on the brink concept of instability (Minter, 1978) nor did they predict institutional closure (J. P. O'Neill, 1981).

Jellema (1973b) described the nature of deficits in private institutions in the early 1970s which he attributed to excess student-aid expenditures. However, he indicated that there were also curtailed activities and creativity that were hidden behind these deficits which Cheit (1971) used in his qualitative definition of financial health. Furthermore, if a capital charge was included, there would have been many more reported deficits (Hughes & Wynn, 1980). With deficits, these institutions were limited in their options (Schipper, 1981) to spread the effect of environmental changes in order to maintain financial stability. Therefore, they were affected to different degrees and needed to respond accordingly. With surplus funds, private institutions had more ability to absorb shocks and to venture (Jellema, 1973a) as well as maintain financial stability (Wilkinson, 1973).

Some of the initial effort in the private sector has recently filtered over to the public sector as represented by the work of

Gomberg and Atelsek (1980). A major impetus for this was the Lupton et al. (1976) study which accelerated the pace on the conceptual and statistical effort to develop financial indicators (Coldren et al., 1979) and was an initial attempt to validate indicators (Collier, 1979). However, the lack of permissible deficits (Wing, 1979b) eliminated one key indicator for the public sector. However, financially weak institutions often (1) used resources less effectively, (2) compromised services and quality to make ends meet, and (3) drained resources out of an institutional system. If a state was unwilling to provide additional resources, decreased services in response would prevent the achievement of desired objectives. Part of the increased concern for the development and use of indicators was by the states themselves (Kramer, 1982) to know whether one sector was faring better or worse than another in achieving its mission (Farmer, 1978; Law, 1979) as well as for policy analysis (Brubaker, 1979) and decision making on salary and tuition levels (Dickmeyer, 1978) which were often in conflict (Hughes, 1978).

The continued use of governmental accounting by institutions with its many allocation problems (Beatty, Gulko, & Sheehan, 1974), especially in the public sector (Drucker, 1967), did not aid the process of developing indicators (Gambino, 1979). It only served to exacerbate the problem of developing adequate measures. Accounting for resources received and used (Taylor, 1974) rather than profit determination has been the primary objective of college and university accounting and reporting (AICPA, 1973). Therefore, no net income figure has been presented for fear of incorrect interpretation (Skousen et al., 1975) which have led to proposals for a statement of changes in fund balance (Conger, 1978). Also, manipulation was possible in the current funds statement which detracted from the usefulness of a deficit or surplus as an indicator of financial health. Furthermore, the classification of restricted funds often changed over time (Collier & Mertins, 1975; Wilkinson, 1976) and transfers were largely discretionary (Bastable, 1973; Warshauer, 1978). Therefore, attention has been focused on an institution's total operating resources versus balance sheet data (Lupton et al., 1976), which were not subject to uniform definitions among different funds (Wilkinson, 1973), to determine if an institution remained healthy. This emphasis reflected interest toward resource use accountability rather than fiduciary accountability (Konrath, 1976).

A recent change in the reporting requirements (AICPA, 1973) was a first step toward generating financial data that were comparable across institutions (Kramer, 1982) even though this data were not predictive of financial distress (NACUBO & ACE, 1981). However, aggregate data from non-comparable institutions could yield invalid results (Brubaker, 1979). Also, institutions were not comparable in their unique potential (Kramer, 1982) which supported the need to assess individual institutions (Cheit, 1971).

A measure of financial stability has usually been a composite score based upon multiple measures (Robinson, 1975) or ratios (Truitt, 1975) that considered various critical dimensions (Collier, 1979) of an institution's operations. No single statistic could successfully portray financial condition (Dickmeyer & Hughes, 1979; Finn, 1977; Mertins, 1978). In contrast, the AED (1979) argued that financial stability was a simple concept. However, their perception evaded the elusive concept of financial stability and its multiple dimensions. Also, indicators needed conceptual cohesiveness and had to be explainable (Truitt, 1975) to be understood (Collier, 1979). In other words, a definition of financial condition with its dimensions was necessary to properly identify and develop meaningful financial indicators (Collier & Patrick, 1978). Otherwise, progress would be delayed (Collier, 1979).

Collier (1979) recommended a distress-oriented focus for research on financial condition with emphasis on the "financial illnesses" of an institution in which various forms of financial distress, such as revenue distress, enrollment distress, and/or salary distress (Gilmartin, 1981), would be identified as dimensions for subsequent identification of indicators (The Center for Management of Public and Nonprofit Enterprise, 1981). Afterwards, recommended solutions may have been more effective in correcting the problem (Stenner, 1977). However, Dickmeyer (1979) recommended that quality and financial health indicators needed to be separated and that the latter reflect present conditions as well as trends toward insecurity. Measuring financial or nonfinancial resources, such as the number of faculty or programs, alone was not equal to measuring financial distress (Dickmeyer, 1980a) since the former was not informative of the success institutions had in managing fluctuations when they occurred. But, any decline in financial and academic resources for the public sector would trigger questions about effective resource allocation.

In the capstone report of the Financial Measures Project, Dickmeyer

(1983) referred to three systems: (1) the academic system, (2) the financial system, and (3) the competitive market system. Referring to the interaction of these three systems:

> As the financial system builds resources, the academic system may gain by obtaining more faculty, better pay, and better equipment. Also, an improved academic core can improve the institution's drawing power and improve its position in the market. Changes affecting the financial system can affect the academic system, which in turn can affect the marketing system. (p. 14)

His description of this interaction suggested that a change in the student-faculty ratio, which was change or stress in the financial system, could affect the other systems' responses to this stress. Dickmeyer developed a tier of stresses that contained these three systems. They were (1) marketing system stress, (2) financial system stress, and (3) academic system stress. The last system was supposedly buffered by the other two but more reserves were necessary if there was an uncertain environment since the first two systems were hypothesized to respond more rapidly to distressed conditions. However, some academic responses were adjustments to market needs. If the three systems were clearly linked and increased with more external pressure, stress in one system could have meant stress in the others. For instance, financial system stress could have lead to stress in the academic system and a response that decreased excellence and quality. Finally, Dickmeyer suggested that indicators could measure a condition of stress, responses to stress, or the current condition of an institution reflecting previous responses.

Cameron (1982) attributed a condition of decline to the external environment of an institution which could have been financial or enrollment related. If successful responses were employed to correctly perceived changes, an institution may have avoided decline (Zammuto, 1982a). Coldren et al. (1979) emphasized that financial indicators needed to reflect the results of institutional responses to decline, such as salary distress (Jenny, 1979b), that could have led to further financial difficulty (Cheit, 1971) and/or prohibited the achievement of valued objectives (Jenny 1979b; Van Alstyne & Coldren, 1976; Wenk, 1979). In the past, a variety of purposes resulted in a variety of financial indicators and frameworks (Brubaker, 1979). One such framework was that taken by the AED (1979) which was simplistic and was only concerned with the manner in which an institution's current operating budget was balanced. When current expenditures exceeded current revenues, they viewed this as indicative of financial instability. However, this framework did not reflect multiple dimensions nor possible responses to revenue distress which should be included in an assessment of institutional financial stability.

Validating indicators of financial stability. Once a set of indicators had been developed that were derived from a conceptual framework that considered the resources and system condition of an institution, the stresses on these resources, and the responses to these stresses (Dickmeyer, 1983), the next step was to validate the indicators and select those that discriminated between strong and weak institutions (Collier & Patrick, 1978). Collier and Patrick followed several steps to validate their indicators. These steps included: (1) calculating each proposed indicator separately for public four-year and private four-year institutions, (2) calculating summary descriptive statistics for each indicator by institutional type, (3) selecting institutions considered by experts to be in decidedly strong or weak financial condition for use in determining the discriminating ability of the indicators after applying a t-test between the means of these two groups (Gilmartin, 1981), and (4) coding institutions rated in strong or weak financial condition for use as a dependent variable in a discriminant analysis. Reassessing this earlier effort, Collier (1979) stated that:

> Validation must be carried out if indicators are to be developed which can be used in assessing the condition of multiple institutions. While the self-assessment approach . . . is certainly a valid and useful way for individual institutions to look at their own financial condition, this same approach is not useful for the aggregate-level policy-maker. (pp. 27-28).

Minter and H. R. Bowen (1978) cautioned that there were also intangible factors, such as the ability to raise money, the quality of the institution, or the level of deferred maintenance, which also influenced the financial stability of an institution but were seldom reflected in measures based upon financial data. The latter may have showed that an institution was bankrupt but the institution's ability to survive may have emanated from its reputation, faculty loyalty, and/or program excellence (Minter & H. R. Bowen, 1980a) despite its need for retrenchment. Therefore, financial and nonfinancial data were necessary to assess financial stability (Jenny, 1979c; Peat, Marwick, Mitchell & Co., 1980) and overall institutional health (Collier, 1973). With both of these, a better assessment of an institution's ability to perform its tasks (Jenny, 1979c) could be conducted.

Relatedly, Collier (1979) distinguished between financial health and financial condition and used the latter in an earlier study (Collier & Patrick, 1978). According to Collier (1979), financial health was a broader concept which included enrollments and other factors (Collier, 1976) but was narrower than overall condition (Collier & Patrick, 1978). However, financial health was difficult to evaluate (Dickmeyer & Hughes, 1979a) with the interrelationships that existed between financial and other resources and earlier assessments were viewed as a primitive art (Minter & H. R. Bowen, 1978). Minter and Conger (1979c) added that working only with HEGIS financial data was not sufficient to reach a conclusion in which to base sound public policy. Nevertheless, a determination of financial stability was normally based upon financial indicators with supplemental consideration of nonfinancial indicators such as enrollment trends (Hughes, 1980).

In Minter and H. R. Bowen's (1976) analysis of the private sector, they emphasized change indicators. However, trends in a sector were often estimated without including all possible symptoms (Dickmeyer, 1980a) provided validated indicators were used (Truitt, 1975). According to Dickmeyer (1980a), financial indicator changes generally registered institutional distress trends more quickly than quality or mission measures. Because administrators were reluctant to change the quality and offerings of an institution in response to external pressures even though this likelihood was increased with continued erosion of financial support (H. Smith, 1980), financial health could have been affected from events such as enrollment distress, inflation, or revenue distress which were readily measured (Dickmeyer, 1979). Therefore, Dickmeyer emphasized the diagnosis of financial health trends. This was also the emphasis in his self-assessment analysis (Dickmeyer & Hughes, 1979a). Consequently, if there was ever consensus on validated indicators, the framework for their development may also be useful to develop adequate responses to distress (Collier & Patrick, 1978).

Bowen's law of higher education costs. One of Bowen's (1980) law of higher education costs stated that:

> In quest of excellence, prestige, and influence, there is virtually no limit to the amount of money an institution could spend. . . . Whatever level of expenditure is attained is seldom considered enough. Institutions tend, therefore, to spend up to the very limit of their means. As a result, the financial problems of rich institutions are about as severe as those of all but the most impoverished institutions. (p. 20)

However, some institutions were more financially healthy than others (SREB, 1971) as suggested by Mark's (1980) findings for community colleges. He found that larger institutions were under more financial pressure from extensive enrollment growth since expenditures increased but less than inflation and achieved economies of scale. Meeth (1974) asserted that enrollment growth was not a cure for small private institutions if there were not sufficient additional resources to support this growth. Also, an institution may have been assessed to be financially stable (Lanier & Anderson, 1975) when selected measures did not reflect the amount of economizing in deferred maintenance (Altobello, 1978; Campbell, 1982) and other resources (Frances, 1980a) which implied worsened financial condition. Dickmeyer (1980a) distinguished between the various uses and meanings of indicators which may have explained this oversight. According to him, certain potential indicators may have (1) predicted a particular condition based on current trends, (2) correlated with a particular condition, (3) approximated a measure of a particular condition, or (4) been related by definition to a particular condition. Furthermore, Collier and Patrick (1978) found that weak institutions were less flexible, were more dependent, and took more risks. Despite their rating, most institutions were hesitant to admit they were in poor financial health except for Title III institutions (Hodgkinson, 1974) who were seeking further aid.

If institutions spent to their limits as H. R. Bowen (1980) suggested, it was conceivable that the financial health of Virginia's public colleges and universities could have been strained, even if not drastically altered, during recent years as inflation coupled with a slowdown in the growth of state revenues exerted their influence (Furman, 1981). Gilmartin (1981) identified this condition as revenue distress (See Appendix A). The AED (1979) suggested that this condition would lead to financial instability unless expenditures were concomitantly reduced even though H. R. Bowen's theory suggested that there was no relation between per unit costs and financial stability. The AED (1981) attributed revenue distress to enrollment distress and the reduction in resources from enrollment-driven formulas as well as any loss in state subsidies. If expenses were difficult to control, Dickmeyer and Hughes (1979a) added that it would take longer to adjust to revenue distress conditions which could erode the creative health of institutions (Kramer, 1980).

With less available resources, institutional health could have deteriorated, remained stable, or improved depending upon whether or not greater efficiency in the management of resources was achieved and the institutional responses taken to declining resources. Dickmeyer and Hughes (1979a) suggested that the level of financial resources would determine the flexibility and protection an institution had from adverse trends. Greater fixed costs or volatile income sources required more financial resources as buffers. Otherwise, institutions would have less flexibility to respond to distressed conditions.

Responding to declining conditions. Wiles (1977) warned of further revenue distress conditions where the best adaptation appeared to be resource reallocation (Gray, 1981) in order to recapture control of an institution's destiny. However, decline was not a condition that most administrators were willing to face since they were socialized toward adapting through growth (Boulding, 1975; Dougherty, 1981) even though the former may have increased an institution's flexibility to respond to new demands. Furthermore, higher-priority programs could have been strengthened by eliminating lower-priority ones under conditions of revenue distress. But, faculty morale had to be substained through strong leadership to demonstrate that effective use of resources did not mean quality reductions but enhanced flexibility. Otherwise, it would be difficult to increase productivity (Levine, 1980c) and creative innovation was less likely.

There were a number of problems that institutions faced during a cutback (Levine, 1980a). They included: (1) an institution could not reduce itself piece by piece in the same order it was built, (2) there was the free exit problem of key managers, (3) there was the initial stage of decline when few people believed the talk of cuts was real and permanent, (4) improvements in productivity often required up front money, (5) there were institutional mandates to add services without any additional appropriated funds, and (6) the most efficient suffered more adversely if they were cut in order to lower expenditures. Therefore, institutions were slow to adapt, through their responses, to changing environmental conditions that threatened the achievement of institutional goals (Rubin, 1979). Rubin (1980) also found that increased uncertainty during a declining period often blocked the successful reversal of decline and thwarted the maximization of goal achievement.

Institutions often chose an efficiency approach as their response to decline (Whetten, 1981). The reasons for this included: (1) distress triggered a conservative effect in which administrators were more likely to select across-the-board cuts in existing services versus a long-term assessment of an institution's mission, (2) the trained incapacity of administrators who were geared to growth and used past successful solutions to solve new problems which made institutions more vulnerable to decline (Boulding, 1975), (3) the innovation-resistant organizational structure which was biased against change, (4) it was difficult to measure the effectiveness of institutional programs while it was relatively simple to measure their efficiency, and (5) a crisis led to the espousal of traditional values while innovation was blamed as a scapegoat. Also, some attempts to increase efficiency could have hindered the achievement of effectiveness.

Whetten (1980) indicated that little was available on the causes, the responses, or the effect of decline in institutions. Therefore, management frequently took inappropriate actions in response that may have increased the chance of failure (Lapovsky, 1979). Researchers needed to improve the conceptual clarity of decline by distinguishing between (1) decline-as-stagnation and (2) decline-as-cutback. The first was attributed to poor management while the second was attributed to environmental scarcity which could affect any institution (Gillis, 1982). To lessen the influence of decline, Glenny and F. M. Bowen (1980) suggested that institutions needed to be prepared to adjust (Marks, 1980). How Virginia's colleges and universities responded to stressful conditions would also determine higher education health in this state (Mullen, 1981/1982). If there was a reduction in slack with no decrease in full-time faculty, there would be less flexibility to respond (F. M. Bowen & Glenny, 1981a) in a manner that could salvage an institution (Glenny & F. M. Bowen, 1980). However, institutions responded differently to different types of distress (Frances, 1982b) and the significance of the response also varied. According to Collier (1979):

> It is the nature of these responses that causes one situation to be considered more significant than the other. . . . One type of institutional response will be deemed more or less significant than another because it will have different impacts on the ability of the institution to accomplish certain objectives. (p. 20)

A change in the student-faculty ratio in the budget formula would create revenue distress and the institutional response could have implications on the accomplishment of state objectives and institutional health (Levine, 1980c). Furthermore, all institutions did not respond in the same manner to revenue distress (AED, 1979) nor did they face the same degree of distress (Levine, 1980b) from a changing environment. Institutions could have eliminated programs or reduced their quality through faculty retrenchment (Skousen, et al., 1975) even though there have been reductions without affecting quality (Mingle & Norris, 1981). Craven (1981) suggested that the management of faculty resources would largely determine an institution's overall health during the present decade.

Dickmeyer (1982) suggested that revenue distress could deplete resources to the point that core activities, defined as those necessary for institutional survival and the preservation of an institution's mission, were affected. An institution had to decide whether to use revenue resources to build core activities and take risks or buffer its core from fluctuations. Active buffers could absorb unplanned detrimental fluctuations of revenues or expenditures. Examples included an institution that cut part-time faculty in response to enrollment distress or increased revenues in other areas to buffer its core. Passive buffers could protect core activities from fluctuation without requiring expenditure reductions. In the process of assessing tradeoffs between building buffers against risk versus using resources to fulfill academic strategies, staffing ratios, faculty salary levels, and the condition of buildings needed monitoring to determine what revenues were available to employ as financial reserves if there was a likelihood of decline.

Some potential responses to decline included: (1) the addition or deletion (McGuire, 1978) of courses or programs, (2) the increased use of part-time faculty to improve productivity and efficiency which could decrease per unit costs but also decrease effectiveness or quality, (3) an increase in class size (Doty, 1982; Wattenbarger, 1978) which was an adaptation (Babcock, 1981/1982), (4) the retrenchment of personnel (Barak, 1981; Strohm, 1981), (5) the recruiting of new students (Chambers, 1981) which may have been achieved by decreasing standards (H. R. Bowen, 1974), (6) the deferral of maintenance (Stich, 1980), (7) an increase in tuition (McCloskey, 1972) which was more difficult for public institutions (Silber, 1977), (8) inadequate salary increases or salary distress (Haywood, 1979; Wittstruck, 1982), (9) the management of reduced scale through contraction (McGill, 1972), and (10) to borrow money (Jellema, 1972). However, to maintain quality in existing priority programs when there was revenue distress, some activities and programs needed to be eliminated (Hyer, 1981; Reinert, 1972) that were of lower priority (Alfred, 1978b; DeCosmo, 1978; Terrell, 1977) or resources needed reallocating (Shirley, 1982) even though no one strategy should have been completely relied upon (Mingle & Norris, 1981).

Finding the correct balance between short-range and long-range planning was important when responding to declining conditions. Tucker (1978) indicated that excess emphasis on long-range planning could be detrimental to short-term budgetary control. In contrast, Rubin (1979) reported that when short-range planning dominated, administrators did what they could to sustain budget levels regardless of later consequences (Glenny, 1982) that could be harmful (Zammuto, 1982a). Reallocating resources to high growth departments, without concern for priorities, ignored long-range needs.

Under declining conditions, administrators often treated them as resource allocation or efficiency problems and took conservative responses which could impede successful turnaround under certain conditions (Babcock, 1981/1982; Cameron, 1982). Some reasons this behavior pattern occurred included: (1) distress from decline led to conservatism and self-protective behaviors, (2) the difficulty of reaching a consensus from a group because conflict increased with declining conditions, and (3) efficiency was the easiest to measure and received attention. In comparing declining and growing institutions, Cameron (1982) found that the former emphasized budgeting and fiscal concerns versus public relations and services. The effect of these responses could hurt an institution in the long-run. Also, efficiency responses, such as increasing the staffing ratio, had their upper limits (Hopkins & Massy, 1981) as a viable response. Discontinuing programs could improve efficiency but also weaken financial stability under certain conditions (Skousen et al., 1975). Many cutback decisions were permeated by politics that triggered short-range responses (Levine, 1980b) but a balance needed to be obtained between achieving fiscal solvency and providing adequate services.

Depending on the response, the level of services and access could be adversely affected (Maxwell, 1980) when there was erosion in the academic system (Dickmeyer, 1983) which was one of the valued objectives of many state educational systems. Minter and H. R. Bowen (1980b) argued that the stability of the public institutions had been achieved by changes in budget priorities and expenditures of human and financial capital. If so, the states needed to be aware of these conditions in order to assess the policy implications that this effect has had on the higher educational system.

Part of the purpose of research on decline has been to determine which institutional responses were successful, despite their other effects, in turning around a declining condition. Zammuto (1982b) pointed out that institutional characteristics influenced the extent and severity of decline as well as survival. He identified (1) slack, (2) flexibility, and (3) variety as three institutional characteristics that were associated with institutional adaptability and the incidence and severity of enrollment and revenue decline in order to help determine the causes and typical responses to decline. The more differentiated an institution was in its program offerings and revenue sources, the better able it was to respond to environmental shifts. Incidentally, if both of these characteristics were low, they could be a cause of decline under changing conditions. This suggested that less complex institutions were more efficient but less adaptable to a change in the shape of a niche (Zammuto, Whetten, & Cameron, 1983). These institutions achieved more economies from higher staffing ratios and a concomitantly lower cost per student unit.

In contrast, generalist institutions performed better when the environment changed. Therefore, they were less susceptible to decline from shifting enrollments. Due to the stabilizing effects of diversity, they were buffered from more severe forms of decline. If there was a need to respond, these institutions could have either employed (1) slack innovation which was the external search for new products and services in an attempt to alter the environment (Zammuto & Cameron, 1983) or (2) distress innovation which was a major change in an organization's internal structure and personnel. The latter response was not as likely to help an institution recover from decline and could have furthered the declining condition. However, Zammuto (1982b) was referring to a decline from enrollment distress rather than revenue distress. Therefore, these differences needed to be considered when examining prescriptive responses to decline (Frances, 1982b) which reflected different underlying causes of decline (Zammuto & Cameron, 1983). Zammuto's (1982b) prescription for an institution undergoing enrollment distress was to be offensive in order to bring its programs into line with new demands through adaptation (Mingle & Norris, 1981). Increasing efficiency along could aid in the short-run but did not resolve the problems of an institution. He did recommend an efficiency approach along with consolidation if there was a quantitative change (Zammuto, 1982a) in the size of a niche (Zammuto & Cameron, 1983) versus its shape.

Delving deeper into the nature of decline, Cameron (1982) recommended that:

> By thinking about strategies in terms of their emphasis on domain defense, offense, and creation, administrators are able to determine appropriate responses to conditions of decline that are more consistent with theoretical prescriptions and that have a long-term potential for success. (p. 24)

Institutions needed to think outward toward altering the environment for a different type of response or domain offense to increase their effectiveness and seek new resources to avoid excess specialization in a declining area. Otherwise, inappropriate institutional responses could be a further cause of decline (Zammuto, 1982b). However, Chaffee (1982) indicated that excess diversification, as a response to decline, could erode an institution's sense of purpose and alienate current resource providers if it was not already diverse (Chaffee, 1983). Therefore, the cause of decline could be different from what kept an institution under conditions of decline.

In her results, Chaffee (1982) found that institutions which recovered from revenue decline: (1) increased their number of students, (2) were younger in age, (3) were less complex and were slightly less likely to add new programs, (4) experienced a smaller drop in instruction to educational and general expenditures, and (5) depended on fewer sources of revenue. This last point contrasted with Zammuto (1982b) but he was referring to this conditions as a cause of decline versus a response once an institution was already in a declining condition. In contrast, the institutions that did not recover from decline in Chaffee's (1982) study: (1) experienced increased expenditures per student which was concomitant with an enrollment decline, (2) were more selective, and (3) were more likely to add master's programs. Overall, her results suggested that management affected the ability of an institution to recover from decline especially when change was managed (D. L. Johnson, 1972). On most dimensions, institutions that recovered changed less than those that did not do so. This result favored a consolidation versus diversification response for private institutions.

Inspecting Campbell's (1982) results, institutions that responded more successfully to environmental changes employed more effective use of resources, identified priority programs, and cut others. His financial indicators did detect stressful conditions as they existed but could not predict the future since successful responses succeeded in turning things around. This reflected a limitation on the success of indicators in predicting future conditions. It also pointed out that if institutions strategically planned their responses to decline, they could successfully defeat the problem (Frances, 1980a).

Summary of the Research

Educational institutions have operated much like an independent sector. In the past, there was little incentive to achieve efficiency in productivity, consequently, educational costs rose with increases in enrollment, even with inflation factored out. Many states have recently employed student-faculty ratios, or some similar measure, in their budget formulas that were enrollment driven in support of additional funding. These formulas have served to set institutional guidelines on productivity, but gave an institution internal flexibility during a growth period whereby productive programs could offset unproductive ones. As financial resources became scarcer, the need for accountability expressed through quantitative measures, which were easier to apply and better understood by state legislatures than qualitative measures, increased in popularity as a means of state economizing and budgetary control to rising costs.

The labor intensiveness of higher education was a primary factor causing educational costs to soar. Overall, industry achieved productivity increases to offset rising labor costs. However, higher education was forced to compete for more expensive personnel while productivity lagged. Unless educational institutions achieved productivity gains, the plight seemed to be for continually increasing educational costs. However, rising costs led to a state cost squeeze when there were less available revenues. With revenue distress from state funding cutbacks, instructional costs per student unit should have been reduced but some costs were sticky and would not immediately decline especially if a state buffered certain institutions from declining resources through such devices as funding floors. Also, the type of institutional response to revenue decline would influence the length of time it took institutions to reduce instructional costs per student unit. Therefore, the real issue was determining the length of time it took institutions to effectively respond to revenue distress conditions by reducing per unit costs which was a central concern in this study. Efficiency responses were found to be more effective in adapting to revenue distress but perhaps at the expense and quality of institutions' academic systems and their achievement of valued objectives due to unforeseen effects from their responses which needed better documentation.

Maynard's (1971) threshold level principle suggested that economies of scale in educational productivity existed up to the point where enrollments supported the threshold level of faculty staffing. At this point, there were enough students to cover the minimum number of programs and courses necessary to operate. Although not conclusive, this range was somewhere between 3,000 to 5,500 students. Below this point, diseconomies existed when the threshold level was not reached. Above this point, it was likely that complexity or the addition of programs masked further achievement of economies of scale and may have lead to diseconomies in research universities with their vast range of functions and expensive graduate programs. However, there was a smaller chance of this in the community college sector. Depending upon the institutional response to revenue distress, the pattern of institutional complexity and the threshold level of enrollment may have been altered.

Most existing cost studies have concentrated on the short-range implications of tightened resources and needed improvements in productivity (Moss & Gaither, 1976) rather than the long-range implications of improving institutional effectiveness. Available studies have not analyzed the impact upon the educational system and institutional complexity after there has been a change in the student-faculty ratio used in a state budget formula. In addition, assessments of institutional financial stability as well as empirical accounts of institutions' responses to revenue distress after an increase in the student-faculty ratio have been lacking for use in future policy development.

To maintain financial stability, an institution needed to successfully respond to decline to counteract its influence while remaining effective. Inappropriate responses could weaken an institution's financial stability and its ability to adequately fulfill valued objectives. Recent research has suggested that an efficiency and/or reallocation type of response was more successful in responding to revenue distress conditions. However, all efficiency responses did not achieve the best long-range interests of an institution and some may have also weakened its financial stability.

A detailed study of the responses to revenue distress and their effect on financial stability would yield positive results to be used in long-range planning for future policy determination within a state educational system. Failure to study these institutional responses could prove costly through wasted resources, which will not be as plentiful to higher education as in previous decades (Gambino, 1979), to an impairment of institutional quality and valued objectives (Hodgkinson, 1981), and/or an impairment in the ability of an institution to successfully respond to declining conditions. Furthermore, a state's attitude toward the funding of higher education could have predicted as well as unintended effects which needed proper identification and consideration by policy makers.

CHAPTER III

METHODOLOGY

This chapter consists of five sections. The first section describes the population of institutions and the method of categorizing them into two sectors. The second section reports the methods and procedures necessary to gather and refine the data. Descriptions of data coding and conversions used in the study are included. In the third section, the design of the study is presented. The fourth section advances the specific hypotheses that are tested in this study. Finally, in the fifth section the analysis of the data is described along with an identification of the dependent and independent variables.

Population

The population for this study consisted of the 39 public colleges and universities located within the Commonwealth of Virginia. These institutions were organized into two sectors for comparative purposes (Collier, 1973). They were (1) 24 community colleges, and (2) 15 senior-level institutions (See Appendix C). These two sectors were used in order to have an adequate sample size within each sector. These two categories have been used by SCHEV for differentiating the percentage of state support provided.

These two sectors differed widely in their missions (Coldren et al., 1979) and objectives. Public community colleges differed in their distribution of revenues by source (Hyde, 1982) and expenditures by function (Broomall et al., 1978). Differentiation factors mentioned for consideration by Coldren et al. (1979) were: (1) the level of educational offering, (2) the number of degree programs (Weldon, 1977), (3) the size of the institution, (4) the reliance on particular types of funding, and (5) the proportion of part-time enrollment. According to Minter and H. R. Bowen (1980b), different sectors followed different trends and faced different futures. In regard to assessing financial stability, Collier and Patrick (1978) pointed out that the same dimension could have different normative values between sectors. Ryland (1981c) suggested that sources and uses of institutional revenues needed to be considered to avoid categories of institutions that were significantly dissimilar. But, Ryland (1981b) cautioned that certain institutions did not fit into a classification based upon program differences.

Each of these two categories was progressively more complex (Gomberg & Atelsek, 1981) as reflected by the number of program offerings at different academic levels. However, Dickmeyer (1980c) cautioned that:

> There is no way to establish truly homogeneous peer groups for community colleges. Major factors such as mission, location, academic preparation of entering students, local area salary levels, local nonsalary costs, and methods of financing create unique financial and operating patterns. (p. 22)

In addition, the senior-level institutions had a sizable percentage of graduate to undergraduate students which also suggested further complexity, but there was diversity even within this sector (Hyatt & Thompson, 1980).

Maynard (1971) indicated that institutional comparisons were better under homogeneous outside influences but revenue-raising conditions differed considerably among the states to caution against interstate comparisons. Spence (1975) considered the factors of quality, affiliation, degree level, and type of student body when studying homogeneous institutions. Smith and Henderson (1976) found that sponsored research had the greatest effect of distinguishing private institutions. Also, a high tuition level for the private sector or a large amount of state revenues for the public sector successfully differentiated institutions. In either case, the key factors related to revenues and public policy which was a classification scheme suggested by Jenny (1977) for student-related revenues.

Virginia has been somewhat atypical of other states in its composition of institutions. Only one category of senior-level institutions was used. Otherwise, there were not enough institutions in each of the two sectors for an adequate analysis. Virginia's doctoral-granting universities were smaller than some of the leading research institutions in other states and were not as global in their offerings. Factors used to differentiate institutions were analyzed by these two and other potential sectors with the *t*-test procedure and have been reported in Table 3.1. The state revenue percentage, the tuition percentage, complexity, and the staffing ratio were similar between four-year and doctoral-granting universities, but differed significantly between this combined sector of senior-level institutions and the community colleges. However, the four-year and doctoral-granting universities did differ in size and consequently the number of faculty and programs as well as on the level of faculty salaries. But, these were not revenue-related variables. Furthermore, these variables differed even more between the two sectors chosen for this study. It was interesting to find that

TABLE 3.1

COMPARISON BY SECTOR OF DIFFERENTIATING VARIABLES USED TO CLASSIFY INSTITUTIONS

	Comparison of Sectors			
Variables	1 and 2[a,b]	1 and 3[a,c]	1 and 4[a,d]	3 and 4[c,d]
State Rev. %	4.57****	3.09**	6.19****	1.46
Tuition %	-4.06***	-3.42**	-2.20	0.39
Complexity	5.51****	4.70****	6.38****	1.58
Staffing Ratio	5.07****	4.63****	2.75*	-1.52
Average Salary	-7.23****	-9.77****	-5.94**	-2.76*
Size	-2.94**	-1.21	-4.07**	-3.48*
# of Faculty	-3.77**	-3.03**	-4.74**	-3.56**
# of Programs	-2.61*	-1.25	-3.28*	-2.87*
Instructional Costs/Stud.	-1.17	-0.31	-1.14	-1.08
Inst. Exp. %	-0.47	0.93	0.37	0.92

Note: The *t* values were based on 1975-1976 data.

[a] *n* = 24 for community colleges or sector 1

[b] *n* = 15 for senior-level institutions or sector 2

[c] *n* = 9 for four-year universities or sector 3

[d] *n* = 6 for doctoral-granting universities or sector 4

*p < .05; **p < .01; ***p < .001; ****p < .0001

neither the level of per unit instructional costs nor the instructional expenditure proportion were significantly different between any of these potential sectors. Therefore, the combined senior-level institutions sector was different from the community college sector on most of the differentiating variables.

Consequently, Virginia was well suited for this type of study based upon two sectors. It did not differentiate directly between these two sectors nor for various institutional sizes in its budget formula as found in many other states. A change in the budget formula may or may not have affected these two sectors in an equivalent manner. Therefore, they were analyzed aggregately and separately throughout the study.

Procedures

The procedures to be employed in the study are discussed in this section. Included are descriptions of data gathering, computing FTE's, factoring out inflation, recoding for fringe benefits, determining institutional complexity, and analyzing financial stability.

Data gathering. The data were collected from archival files that were a part of the public record. The primary source of data were the Financial and Salaries, Tenure, & Fringe Benefits of Full-Time Instructional Faculty Survey statistics from the Higher Education General Information Survey (HEGIS) (National Center for Education Statistics, 1976) as compiled from data tapes. WESTAT (1979) referred to HEGIS as a coordinated effort which encouraged consistent, compatible, and universal categories and definitions of higher education data. Despite this favorable definition, HEGIS data, especially the financial data base, had its share of critics (Budig, 1982a) over the years since its inception even though its use for financial condition analysis continued (Minter & Conger, 1979a) despite its lack of timeliness (Cammack, 1980). However, there have been improvements in the data since then (Patrick & Collier, 1979) to make it more accurate on an aggregate basis for use in policy analysis and the development of financial indicators (Hyatt & Dickmeyer, 1980).

Virginia's public colleges and universities were not audited in earlier years to validate the HEGIS data against or use as a replacement. HEGIS data were the only information available. Earlier expenditure data variations were partially attributed to the failure of many institutions to distribute staff benefits and college work-study funds to the appropriate functional categories (Minter & Conger, 1979a). However, this should have been less critical in one state's public educational system (Brinkman, 1982) with specific state reporting requirements. There were also problems with earlier balance sheet data (Minter & Conger, 1979b). In a separate validity study on HEGIS, Patrick and Collier (1979) found that on an aggregate basis most of the 1976-1977 statistics they used were similar to HEGIS data. This suggested that the data had become more accurate. Furthermore, HEGIS data have been used in Illinois to compare faculty compensation and to analyze private institutions' financial condition on a macro basis (Lingenfelter, 1982). The data were accurate from their findings when employed for this purpose. HEGIS has also been used in Maryland for per unit cost and revenue comparisons to support arguments of inadequate funding (Lapovsky, 1980). Van Alstyne (1976a) indicated that HEGIS was the only data nationally available and efforts to replicate it for consistency would be too expensive.

According to Ryland (1978), the Financial Survey was most often selected with requests for faculty salary and degrees conferred data close behind. For this study, enrollment data by academic level, which were necessary for determining instructional costs per student unit were gathered from the Student Data Module (SDM) reports and yearly enrollment projections. There were two output reports from the SDM. These were the Consumption Report and the Contribution Report (SCHEV, 1980c). The Consumption Report, which reported credit hours consumed by student level, was used for the available years (SCHEV, 1979c, 1980b). However, this was changed to course level during the 1978-1980 biennium. This was supplemented with actual enrollment data from the enrollment projections (SCHEV, 1975, 1978b, 1980a, 1981a, 1982b). For the community colleges, enrollment data were gathered from the Virginia Community College System (VCCS) Annual Enrollment reports (VCCS, 1977a, 1978a, 1979a, 1979c, 1980a, 1981). According to Berdahl (1977), the VCCS treated unclassified students the same as the more expensive occupational-technical students. The SDM and enrollment projections computed student enrollment data on an annualized FTE basis. In contrast, the HEGIS Fall Enrollment Survey was based only on fall enrollment. Jenny (1979c) asserted that enrollment information was necessary for institutional financial stability assessment based upon annualized net change data which related to annualized financial data. The use of the HEGIS Fall Enrollment Survey did not permit this with its inconsistencies (Eisner, 1978).

The data were collected from 1975-1976 which was the most recent year that complete data were available. SCHEV authorized access to the requested HEGIS data tapes, SDM summary reports, and yearly enrollment projections for all of Virginia's public colleges and universities. In addition, the VCCS authorized access to the HEGIS financial data and enrollment reports for the 23 community colleges in this system.

Another potential source of data was the audited financial statements of public colleges and universities performed by the Auditor of Public Accounts in Virginia. However, these reports were not complete for all years nor for all institutions. Furthermore, they were not always comparable between states (Ryland, 1981c). Also, comparative financial data needed to be uniformly classified (Walker, 1966) even though they were seldom comparable in earlier years (Skousen et al., 1975). It was because of this concern that the financial data for the academic years 1979-1981 had to be adjusted for the treatment of fringe benefits to make them comparable to the first three years as subsequently described.

There was a substantial change in the reporting format for institutions with the passage of the AICPA's Audit Guide (1973). This improved financial data from greater uniformity (Taylor, 1974), through a revised classification of revenues and expenditures (Skousen et al., 1975), which led to greater comparability (Robinson, 1975). Subsequent to this, the HEGIS Financial Survey was revised in academic years 1974-1975 to reflect these changes (Coldren et al., 1979) and differentiated restricted from unrestricted funds (Smith & Henderson, 1976). This hindered comparability with previous years but improved the subsequent reliability of HEGIS data to make them suitable for the development of indicators on the condition of higher education (Gilmartin, 1981) along with trends (Brubaker, 1979). Despite previous concerns of inconsistency, Marks (1980) used HEGIS financial data from 1972-1977 in his study but discounted the inconsistency concern since research was not a major function of the community colleges. Nonetheless, his data were less comparable than subsequent years' data (Gilmartin, 1981).

Relatedly, many institutions were late in converting to the newly prescribed reporting format. This was especially true for public institutions (Green, 1971) which had taken many years to fully achieve standardization in their state accounting systems (Stumph, 1970/1971). This obstructed earlier attempts of institutional comparisons (Taylor, 1974). Because of this concern, financial data for this study were gathered from the HEGIS Financial Survey versus the institutional audit reports.

Measurement considerations: FTE's and the concept of the student unit. All students have not attended on a full-time basis and were not counted equally among institutions (Minter & H. R. Bowen, 1980b). Therefore, dividing total instructional costs by the number of students enrolled yielded a unit cost figure, but one that was not comparable across institutions nor within an institution between years (Mullen, 1981/1982). Therefore, the concept of FTE students was developed (Cavanaugh, 1969) to improve comparisons of instructional costs (Maynard, 1971).

To compute FTE students in Virginia, 30 semester hours were used for undergraduates and 24 semester hours for graduate students (SCHEV, 1964). Summer session FTE was converted using annual FTE values (SCHEV, 1980c) as recommended by Maynard (1971). In contrast, Millett (1974) computed FTE students by dividing fall-term enrollment credit hours by 15, dividing summer enrollment credit hours by 30, and added this to the regular-term count to equal a full-year count of FTE. However, this approach did not consider any major attrition in enrollment between the fall and spring semesters. Inconsistencies existed in computing FTE's among the states (Wattenbarger & Starnes, 1973). There were also differences in funding emphasis among the states which included: (1) the level of enrollment, (2) the institutional type, (3) the number of student-credit hours, (4) the number of FTE students, and (5) the curricular program. However, FTE's have often been used along with student-faculty ratios, reflecting differences by academic level, to determine the need for faculty staffing (Halstead, 1974).

Since students were enrolled at various academic levels, there was another problem when FTE's did not reflect instructional cost differences between academic levels (Halstead, 1974). Freshman were less expensive to educate when concentrated in large classes versus upper-level undergraduates (Bell, Brownlee, & Mood, 1972; Jellema, 1973). But, J. O'Neill (1971) cautioned that costs by academic level could differ over time. According to Hubbard (1962), student academic levels typically included: (1) freshman and sophomore, (2) junior and senior, (3) masters, (4) doctors, and (5) graduate-professional students. The student course levels used in the SDM for Virginia included: (1) foundation, (2) lower-division, (3) upper-division, (4) first professional, (5) first graduate, and (6) advanced graduate (SCHEV, 1980c). During the 1980-1982 biennium in the Commonwealth of Virginia, FTE's were completely computed by level of instruction rather than by student level as previously counted (SCHEV, 1979b).

To improve cost comparisons between colleges and universities with different missions, the concept of the "student unit" has been developed as identified by H. R. Bowen (1980):

> Costs tend to be higher as students advance up the academic ladder. The educational cost per student therefore tends to be greater in institutions with a high proportion of advanced students. . . . To standardize the units in which teaching loads are measured, heavier weights must be assigned to advanced students. . . . Thus, to obtain a satisfactory measure of the teaching load of an institution it is necessary to express the enrollment in full-time equivalents weighted according to the academic level of students. The resulting adjusted enrollment is expressed in what I call "student units"--each unit being the equivalent of one full-time freshman or sophomore student. (p. 4-5)

For comparative purposes across institutions, the cost per student unit was calculated which controlled for variations in revenue related to enrollment-level changes (Lanier & Anderson, 1975). H. R. Bowen (1980) used a weighting procedure to compute student units which was also employed in this study (See Appendix D). These weights were:

1.	Lower-division students	1.0
2.	Upper-division students	1.5
3.	Professional students	2.5
4.	Graduate students: first year	2.1
5.	Graduate students: beyond first year	3.0.

<u>Measurement considerations: Controlling for inflation</u>. When studying the relationship between instructional costs per student unit

and size over several years, the effect of inflation had to be considered. Otherwise, inflation would cause instructional costs per student unit to be noncomparable in different years. Halstead (1980) indicated that expenditures needed to be adjusted to constant dollars to permit comparisons of the real purchasing power of funding levels. In short, did spending keep pace with inflation? If not, then a decline occurred in educational inputs to students and perhaps to quality (H. R. Bowen, 1980) due to the response of curtailing programs or achieving greater efficiency in order to reduce per student unit costs (Halstead, 1975). Also, revenues needed to be deflated by a price index to determine the trend in the real purchasing power of funding sources. Was there revenue distress or did revenues keep pace with inflation (Halstead, 1980)? This could be performed for state appropriations (Halstead, 1975) to determine if this source increased to offset inflation's affect on institutional purchasing power. Frances (1982b) suggested that educators have not taken adequate consideration of resource erosion from inflation. Furthermore, the trend of inflation largely determined the future financial problems in higher education.

To factor out the effects of inflation for higher educational institutions' expenditures, Halstead (1975) developed a Higher Education Price Index (HEPI). Although this index was a more accurate assessment of higher educational expenditures than the Consumer Price Index (CPI), it was based on objects of expenditures (Coldren et al., 1979) rather than expenditure functions as reported by HEGIS. Before Halstead's index, there was a tendency to overestimate price increases and underestimate quality improvement (J. O'Neill, 1971). More recently, non-wage items have substantially risen with a change in the budget structure (Jenny, 1979c). However, this varied depending on the research emphasis and mission of an institution (AED, 1979) and would have decreased when institutions had to economize by concentrating funds on faculty salaries (Halstead, 1975) which was an adjustment Halstead made in the HEPI. According to Halstead (1978):

> Variance in spending patterns of individual institutions from these national averages reduces only slightly the applicability of the HEPI to any given institutional situation. Modest differences in the weights attached to expenditure categories have little effect on overall index values. This is because the HEPI is dominated by the trend in faculty salaries. (p. 5)

Nonetheless, he did not discourage the development of a price index based on selected price series and different weights based upon a particular expenditure pattern.

Because the HEPI was based on objects, there was need to make a further adjustment in order to factor out the effects of inflation from the functional category of instructional expenditures. To do this, a technique employed by Babcock (1981/1982) was used. In her recent study, several components of the HEPI were used to develop her own price index for departmental expenditures. Babcock supported the use of the HEPI for the total university, but not for internal colleges. She excluded fringe benefits, equipment, books and periodicals, and utilities to develop her own composite price index. Personnel compensation was weighted for 87.1% of the total department costs while services and supplies were weighted for 12.9% of the total costs. This weighting reflected the labor-intensive nature of instructional expenditures. In contrast, Halstead's (1975) HEPI adjusted weighted averages were 79.3% for personnel compensation and 20.7% for contracted services, supplies, and equipment.

A weighting procedure similar to Babcock's (1981/1982) was also used in this study to develop a composite index based on price indexes from the HEPI (See Appendix E). In this study, professional salaries were weighted 79.5% and nonprofessional wages and salaries were weighted 20.5% for the personnel compensation subindexes in order to develop a composite index for this component. Fringe benefits were not used since these costs had been removed from all expenditure data. In Table 3.2, the HEPI for each of these subindexes as well as for the total component of personnel compensation has been listed for the years under study. As this table illustrated, nonprofessional wages and salaries were rising more sharply than professional wages during this time period.

For the contracted services, supplies, and equipment component, the subindexes of services, supplies and materials, and equipment were used (Hyatt, 1982) since the emphasis in this study was on instructional expenditures. These were the subindexes most likely to be incurred for the rest of the expenditures in this object code. In this study, services were weighted 54.9%, supplies and materials were weighted 26.3%, and equipment was weighted 18.8% to develop a composite index for this component. In Table 3.3, the HEPI for each subindex as well as for the component of contracted services, supplies and materials, and equipment has been listed for the years under study. As this table illustrated, inflation in these subindexes was more evident after

TABLE 3.2

COMPOSITE INDEX FOR PERSONNEL COMPENSATION SUBINDEX

Fiscal Year	Professional Salaries[a,c]	Nonprofessional Wages and Salaries[b,c]	Personnel Compensation	Composite Index
1976	5.2	8.1	5.8	100.0
1977	4.7	6.5	5.1	105.1
1978	5.1	7.8	5.7	111.1
1979	6.1	7.9	6.5	118.3
1980	7.1	9.2	7.5	127.2
1981	8.8	9.3	8.9	138.5

[a]Weighted 79.5%

[b]Weighted 20.5%

[c]Data from Research Associates of Washington, 1982

TABLE 3.3

COMPOSITE INDEX FOR CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT SUBINDEX

Fiscal Year	Services[a,d]	Supplies and Materials[b,d]	Equipment[c,d]	Contracted Services, Supplies, and Equipment	Composite Index
1976	4.8	4.6	5.9	5.0	100.0
1977	5.9	5.1	6.9	5.9	105.9
1978	5.6	4.3	7.9	5.7	111.9
1979	6.0	7.6	9.2	7.0	119.7
1980	8.1	18.1	9.8	11.0	132.9
1981	11.6	13.0	7.6	11.2	147.8

[a]Weighted 54.9%

[b]Weighted 26.3%

[c]Weighted 18.8%

[d]Data from Research Associates of Washington, 1982

fiscal year 1979.

After these components were computed, they were combined to form an overall composite index for instructional expenditures with personnel compensation weighted 84.6% and contracted services, supplies, and equipment weighted 15.4%. Therefore, personnel compensation was weighted between Halstead's (1975) and Babcock's (1981/1982) weights. In Table 3.4, the HEPI for each of these components as well as for the composite index has been listed for the years under study. This index was used to factor out inflation from instructional costs per student unit (See Appendix F). This adjustment was only necessary when making interyear comparisons of cost data.

In addition, the HEPI was used to factor out inflation from state appropriation revenues as recommended by Skousen et al. (1975). In Table 3.5, the overall HEPI for each year as well as the index for the six years used in this study has been listed. After inflation was factored out, financial data were used to make comparisons across the years.

Finally, to reflect the faculty perspective, the CPI was used to factor out inflation from average faculty salaries as suggested by Gilmartin (1981). In Table 3.6, the overall CPI for each year as well as the index for the six years used in this study has been listed. After inflation was factored out, faculty salary data were used to make comparisons across the years.

Measurement considerations: The problem of fringe benefits. The treatment of fringe benefits in the Commonwealth of Virginia has been inconsistent across the six-year period used in this study. From

TABLE 3.4

COMPOSITE INDEX FOR INSTRUCTIONAL EXPENDITURES

Fiscal Year	Personnel Compensation[a,c] Subindex	Total Contracted Services, Supplies, and Equipment[b,c] Subindex	Total Composite	Instructional Expenditures Index
1976	5.8	5.0	5.7	100.0
1977	5.1	5.9	5.2	105.2
1978	5.7	5.7	5.7	111.2
1979	6.5	7.0	6.6	118.5
1980	7.5	11.0	8.0	128.0
1981	8.9	11.2	9.3	139.9

[a]Weighted 84.6%

[b]Weighted 15.4%

[c]Data from Research Associates of Washington, 1982

TABLE 3.5

HEPI FOR STATE APPROPRIATION REVENUES

Fiscal Year	HEPI[a]	State Appropriation Revenues Index
1976	6.6	100.0
1977	6.5	106.5
1978	6.7	113.6
1979	7.7	122.4
1980	9.9	134.5
1981	10.7	148.9

[a]Data from Research Associates of Washington, 1982

TABLE 3.6

CPI FOR FACULTY SALARY EXPENDITURES

Fiscal Year	CPI[a]	Faculty Salaries Index
1976	7.1	100.0
1977	5.8	105.8
1978	6.8	113.0
1979	9.3	123.5
1980	13.3	139.9
1981	11.6	156.1

[a]Data from Research Associates of Washington, 1982

academic years 1976-1978, fringe benefits were centrally appropriated and were not reflected in institutional expenditure accounts nor state appropriations to institutions except for sponsored programs. Beginning in academic year 1979, fringe benefits were appropriated to each individual institution as a part of state appropriations and were also reflected in each functional expenditure account. Therefore, the data were not comparable across the years.

To adjust for this inconsistency, fringe benefits were removed from academic years 1979-1981 HEGIS data in order to derive comparable data. They were removed from these years' data since institutional data by functional expenditure account were available. The same data were not available to add fringe benefits back to the first three fiscal years' data. Therefore, from 1979 to 1981 each institution's HEGIS Finance Survey form was recoded purging the amount of fringe benefits out of each functional expenditure account such as instruction or public service. To do this, the Commonwealth of Virginia's budget was consulted (VDPB, 1980) for fiscal year 1978-1979. Data from the Commonwealth of Virginia's accounting system were consulted for fiscal years 1979-1980 and 1980-1981 (Virginia, Department of Accounts, 1980, 1981). Except for sponsored programs which included fringe benefits in all years, fringe benefits were removed from each functional expenditure account while total educational and general expenditures were also recoded for the total amount removed from each of these expenditure categories.

It was also necessary to recode state appropriation revenues to remove the amount of fringe benefits that were included in appropriations for these years. Consequently, total current fund revenues were also recoded to remove the amount of fringe benefit appropriations that were purged out of state appropriation revenues. Therefore, the data for all six years used in this study did not include employee's fringe benefits, except for sponsored programs, to achieve data comparability. It was for this reason that the composite price index developed in this study for instructional expenditures did not include fringe benefits.

Measurement considerations: Determining institutional complexity. In order to determine the number of programs offered in Virginia's colleges and universities, data were gathered from SCHEV (1975c, 1977, 1978a, 1979a, 1979e, 1982a, 1982c). In addition, for the community college sector, the same type of information was gathered from the VCCS (1974, 1976, 1977b, 1978b, 1979b, 1980b).

Many of the programs were continually offered across the six-year period used in this study. However, some programs were deleted, others were consolidated, and new ones were introduced as some institutions became more complex in the number of programs offered as well as by the type of programs offered. For programs, such as foreign languages, that were consolidated, it was necessary to retroactively recode them for all years in order to prevent a distortion in complexity during the year of consolidation. Otherwise, there would have been inconsistencies across the years when counting the number of programs offered. As institutions broadened their missions, some of them added a number of new graduate programs. Even though the total number of programs offered may have remained the same, the mix of programs could have changed as more expensive graduate programs were introduced when there were available funds for their support which represented respent economies for the instructional function and an increasing instructional expenditure proportion. Once the number of programs offered by an institution was determined (See Appendix G), it was divided by FTE size and multipled by 100 to give the operational definition of complexity which was the number of programs offered per 100 FTE students (See Appendix H).

Measurement considerations: Analyzing institutional financial stability. To measure the financial stability of institutions over time, several steps were necessary. The first was to establish benchmark data for financial strength for a selected year for each institution (Minter & H. R. Bowen, 1980b) and then to determine trends based on changes across the years (Kramer, 1978; Updegrove, 1978) with consideration for inflation (Brubaker, 1979). To be consistent, a trend needed to have the same meaning for comparable institutions and for different levels (Kramer, 1982). Minter and H. R. Bowen (1976) used this type of approach when developing their series of indicators for the private sector.

More recently, Gilmartin (1981) and Minter and H. R. Bowen (1980b) have developed indicators that were applicable to the public sector. In this study, the following ratios, derived from the literature review and a conceptual framework for financial stability which reflected stresses, institutional responses, and current institutional conditions (Dickmeyer, 1983), were used as static indicators of financial stability:

	ITEM	CHARACTERISTIC MEASURED
1.	FTE students	Enrollment level
2.	Average salary of faculty	Adequacy of academic resources
3.	Full-time faculty	Academic opportunity
4.	Staffing ratio	Level of academic resources
5.	Instruction/total e & g exp.	Academic emphasis.

In his study, Gilmartin (1981) found that institutions in distress had fewer students. Schipper's (1981) findings were comparable. A low level of students limited an institution's ability to withstand any serious enrollment decline (Andrew & Friedman, 1976). This also made institutions more dependent on revenues (Collier & Patrick, 1978). Smaller institutions also had lower enrollment growth rates and therefore more financial pressure (Marks, 1980) along with less flexibility (Hughes, 1979).

Gilmartin (1981) found the average faculty salary level to be lower in distressed institutions which have remained viable at the expense of their faculty. In essence, these institutions have reduced their academic resources as a response to distress versus reallocating resources within the instructional function. A continuation of this trend could reduce the flexibility of an institution to respond to any other environmental changes or to compete for faculty with less academic resources. However, Lingenfelter (1982) warned that different faculty mixes among ranks could yield a high average all rank salary, while individual ranks were lower, that was misleading for comparison purposes. For this reason, each rank was separately assessed in this study. Also, the range of faculty salaries could influence the competency of the staff (Russell & Doi, 1956c) which could be lower, along with the average salary, when there were more faculty in the upper ranks. There could also be a tradeoff between average salaries and the staffing ratio which would mask a change in one of them. A higher staffing ratio would mean less faculty were needed and they could be paid a higher salary if there were the same level of resources while more faculty often meant lower average salaries. In essence, the faculty paid the price for small classes or a reduced workload.

Distressed institutions had fewer faculty and lower staffing ratios (Gilmartin, 1981). Therefore, they were faced with inadequate academic resources. These institutions were not as efficient (Truitt, 1975) as those not in distress. Relatedly, Russell and Doi (1956d) suggested that an improvement in the staffing ratio should be achieved by increasing class sizes versus increasing teaching loads. The staffing ratio indicated the degree an institution was committed to providing an adequate staff to meet its needs (Bolin & McMurrain, 1969). Dickmeyer (1980a) implied that these two indicators were also measures of institutional academic opportunity. When there were less faculty, there was less diversity of opportunity for students. This suggested that there would be less complexity or programs offered.

The percentage of educational expenditures devoted to instruction conveyed an institution's priority upon the instructional function as an academic resource (Dickmeyer & Hughes, 1979a). Smaller institutions had to cover their fixed costs which left a smaller percentage of their budget to be devoted to their academic missions (Dickmeyer, 1980a). This same condition could also have occurred during a budgetary crisis when other costs were rising more rapidly (Boyer, 1981). On several of these indicators, a position too far from the mainstream would trigger questions about the quality of an institution as well as its ability to respond to changes in the environment and would be signals of distress (Glenny & F. M. Bowen, 1980).

After calculating the indicators, three categories were used to rank institutions. They were: (1) strong, (2) stable, and (3) weak. Financially distressed institutions usually had extreme values for some of these indicators (Collier & Patrick, 1978). One composite score (Gilmartin, 1981) was computed from these indicators to assess the current financial stability of colleges and universities in Virginia. Minter and H. R. Bowen (1976) have used this approach to develop a single index of strength or weakness. Institutions that were rated as strong had sufficient resources to conduct high-quality programs and had managed their resources effectively. In short, they were flexible to respond to changes in the environment. Gilmartin (1981) used standard scores with a mean of zero and minus one standard deviation to classify institutions, by sector, that were in distress. The purpose of this approach was to identify institutions with patterns of indicator values similar to those that had experienced decline.

The determination of financial stability was made for 1980-1981, which was the most recent academic year that complete data were available, as well as for the preceding five years which included three years before any change in the budget formula. Unlike the private sector, public institutions could have been financially weak (Dickmeyer, 1983) but not prone to bankruptcy (Minter & H. R. Bowen, 1980b) since they had the resources of a state backing them even though they may have needed additional venture capital (Kramer, 1980). However, Dickmeyer (1983) added that:

> The degree of linkage of the system depends on whether the institution is public or independent. . . . In institutions with tightly linked systems, any declines in enrollment-driven or other revenues are directly felt, first by financial reserves and then by the academic system. Institutions that have exhausted their marketing and financial reserves are more likely to feel the heaviest environmental stress in their academic system. . . . Many states have funding floors or other forms of protection. All this may be changing, however. As states become less able to support higher education, they may be becoming less able to protect institutions from stressful fluctuations. (p. 20-21)

Traditionally, established support levels have tended to maintain themselves (Marks, 1980). However, there was no guarantee that a state would strengthen its support through increased appropriations if an institution became financially troubled (Lupton et al., 1976) or suffered an erosion of institutional quality especially if a state was undergoing financial strain (Halstead & McCoy, 1978). Furthermore, under these conditions, institutional autonomy in decision making could be threatened by increased centralization of authority to the state level from demands for greater accountability (Breneman, 1981). Finally, an institution's flexibility to successfully respond to declining conditions could be limited.

Some state institutions have been kept afloat by political choice (Breneman, 1981). Mingle, Berdahl, and Peterson (1981) suggested that closures of public institutions would be a rare event due to political opposition and concern of providing access to isolated regions. Even though the brink concept did not apply to public institutions, they were still experiencing several forms of distress (Collier, 1979) which could be measured even though the indicators differed from the private sector and related to state appropriations and budgetary cutbacks (Lupton et al., 1976) as well as financial stability, versus the balance sheet (Minter & H. R. Bowen, 1980b).

The second step necessary to complete the analysis of institutional financial stability was to determine where individual institutions were headed between years (Collier & Patrick, 1978). For adequate financial analysis, several years of data were necessary (Coldren, 1978) to discern trends (Robinson, 1975) about an indicator which was often more revealing than the indicator itself (Truitt, 1975). Jenny (1979a) suggested that three to five years would be a sufficient time to reflect the implementation and response to planning for change. Furthermore, previous validation efforts have identified different change indicators versus static indicators (Gilmartin, 1981).

An institution may have been in financial trouble in one year but subsequently responded to revenue or enrollment distress to improve its financial stability (Frances, 1982b; Minter & H. R. Bowen, 1980b) and/or ameliorate its distress. On the other hand, an institution's position may have worsened (Coldren et al., 1979) due to responses such as the addition of new programs that would not register immediate improvement but benefit the future of an institution. Furthermore, an individual institution may have declined or the whole sector could face the same condition (Brubaker, 1979).

The financial stability of institutions may have varied across sectors (Balderston, 1972b; Campbell, 1982; Zammuto, 1982c) as well as the effectiveness of their responses (Lanier & Anderson, 1975). The community colleges have not faced the same external environment and pressure as some of the comprehensive institutions (Minter & H. R. Bowen, 1980b). This study did not attempt to establish causality between a change in the student-faculty ratio and institutional financial stability even though there could have been a relationship (Alwin & Hauser, 1975). There were too many other intervening variables (Feldman, 1971; Weathersby, 1977) and responses that influenced an institution's susceptibility to decline. However, a relational trend surrounding a change in the budget formula could emerge from this process of analyzing the financial stability of Virginia's colleges and universities which would be of interest to policy makers (Collier & Patrick, 1978).

Minter and H. R. Bowen (1980b) and Gilmartin (1981) have developed a series of indicators to assess any change across the years. In this study, the following ratios, derived from the literature and a conceptual framework for financial stability, were used as indicators of the change in financial stability:

ITEM	CHARACTERISTIC MEASURED
1. % change in avg. faculty salary	Salary distress
2. % change in FTE enrollment	Enrollment distress
3. % change in total revenues	Revenue distress
4. % change in inst. cost/stud. unit	Academic resource distress
5. % change in inst./total e & g	Academic emphasis distress.

In his study, Gilmartin (1981) found that institutions in distress had lower constant average faculty salaries. They allowed compensation to fall behind inflation rather than retrench staff (Minter & H. R. Bowen, 1980a) which resulted in salary distress. This responsive change reflected the ability and willingness of an institution to maintain salaries commensurate with inflation (Dickmeyer & Hughes, 1979a). If this trend continued, it would reduce an institution's flexibility to respond to a changing environment (Gomberg & Atelsek, 1981) and lower the morale of its faculty which was an academic resource.

If either revenues (Peterson, 1981) or enrollments (Hughes, 1980; Marks, 1980) were declining, these were signals for institutions to monitor. According to Minter (1979b), the trend in revenues was a vital financial sign since any decrease meant that a revenue source was not growing to cover higher costs (Heim, 1972). According to the AED (1979), enrollment instability could contribute to financial instability because of declining income which required one of the following responses: (1) to increase income, (2) to cut expenditures, or (3) to alter programs. Enrollments could decline or shift between programs which would require a reallocation of resources. Zammuto (1982c) suggested that a change of five percent would have implications for management and for the financial stability of an institution. Between 1973-1976, more private than public institutions experienced enrollment declines, but the reverse was true between 1976-1979. Most institutions did have increasing revenues which meant they witnessed enrollment declines before revenue declines. During the latter period, a greater proportion of community colleges reported enrollment declines along with declining revenues. Public institutions also lost income during this period but this was not as severe in advanced degree-level institutions. This pattern suggested an interaction effect among sectors.

An institution needed to respond to either revenue or enrollment distress to remain healthy but more affluent institutions had more slack to cut (Minter & H. R. Bowen, 1976). If revenues continued to lag behind inflation, quality could suffer depending on the type of chosen response to declining conditions. In many cases, revenue distress was related to enrollment distress (AED, 1979; Smith, 1981). This would occur if there was a decline in enrollment followed by a reduction in state appropriations from an enrollment-driven budget formula and lost tuition revenue. However, there could be enrollment distress without revenue distress (Dickmeyer, 1983; Zammuto, 1982c). J. O'Neill (1971) suggested that expenditures could not be quickly adapted to enrollment changes with fixed commitments which made it difficult to respond to decline and could have weakened institutional financial stability. The need to offer required courses also hindered attempts to improve efficiency (Babcock, 1981/1982). There were some institutions that were successful in stabilizing finances under declining enrollment conditions (Zammuto, 1982c). The AED (1979) suggested that costs could be cut to achieve stability but by less than the enrollment-related revenue loss due to the incurrence of fixed costs. Furthermore, more complex institutions were less susceptible to enrollment shifts because of the ability to make resource reallocations. Therefore, they may have suffered less severe forms of enrollment decline (Zammuto, 1982c).

If revenues were from more diverse sources, an institution was less likely to experience revenue decline (Zammuto, 1982c). However, there could have been revenue distress without any enrollment distress due to budgetary cutbacks (UCB, 1979) or rapid enrollment increases (Cheit, 1971; Babcock, 1981/1982; Richardson, 1982). This would have occurred after there was a change in the student-faculty ratio used in a budget formula. This often resulted in institutional deficits which triggered a response to increase enrollment but only at the right rate to be successful (Jellema, 1973b). Zammuto (1982c) found that there was a greater proportion of institutions experiencing stable revenues and declining enrollments. This may have been explained by the buffering of public institutions from more severe forms of decline. Perhaps, there was also a lag in the adjustment of revenues. Recently, there have been more widespread budgetary cutbacks to create further revenue distress conditions.

Extreme deviations in these two indicators would threaten an institution's ability to effectively operate and would require successful responses to avoid a deterioration in the educational quality of an institution (Glenny & F. M. Bowen, 1980) due to stop-gap measures, inefficiencies, and/or reallocations away from central programs when better efficiency was needed (Halstead, 1975). However, institutions were less prepared for decline and were not likely to retrench from minor occurrences when their past experiences were based upon growth conditions (Zammuto, 1982c).

The real change in institutional costs per student unit, net of inflation, represented the ability of an institution to maintain its support for instruction (Dickmeyer & Hughes, 1979a) in relation to other functions. Changes in this indicator could also reflect improvements in efficiency (Halstead, 1975), economies of scale (Marks, 1980), and/or rapid enrollment increases (Lanier & Anderson, 1975). According to Dickmeyer (1983), this indicator attempted to identify those institutions where financial difficulties had severely affected students. If other expenditures were rising more rapidly than per unit instructional costs, this would leave less resources to be devoted to instruction (Marks, 1980) and was often achieved by the response of salary distress which Minter & H. R. Bowen (1980b) regarded as a misplaced priority as well as a sign of financial difficulty.

When combined with the change in the instructional expenditure proportion indicator (AED,1979), the total effect of financial distress on the pattern of institutional expenditures could be assessed (Lanier & Anderson, 1975). A decline in state funding coupled with increases in other costs has lead to a decrease in this indicator (Babcock, 1981/1982) through reallocations to other functional areas. However, this indicator was influenced by institutional size and institutional type (Lanier & Anderson, 1975). Nonetheless, these last two change indicators were used by Marks (1980) to assess institutional condition changes within the community college sector.

After calculating these indicators, three categories were used to rank the change in institutional financial stability. They were: (1) those institutions that were resilient, (2) those that were stable, and (3) those that had declined.

When these two procedures were combined into an overall assessment, there was a better indication of the financial stability of Virginia's colleges and universities and where they were headed. If an institution had declined in recent years relative to other institutions in a state, this information should be available for use in planning and developing policy for the future viability of institutions and an effective higher educational system in Virginia.

The characteristic differences in private and public institutions made comparisons nearly impossible between them (Gomberg & Atelsek, 1981) when different indicators were likely to be applicable (Coldren et al., 1979). This was true when making comparisons of aggregate groups of institutions with dissimilar characteristics (Kramer, 1982). Part of this comparison problem related to the degree of importance attached to the balance sheet. In the public sector, the balance sheet was less significant in assessing financial stability (Minter & H. R. Bowen, 1980b) and reflected variations in state accounting practices. Furthermore, the HEGIS Financial Survey did not collect complete balance sheet information (Coldren et al., 1979). For investment decision in business, access to the balance sheet was important to have a complete understanding of cash flows and liquidity in order to assess the likelihood of receiving an adequate return on investment (SREB, 1959). For educational institutions, expenditures were first considered; then revenues were sought (H. R. Bowen, 1980). Thus, revenue and expenditure data were critical in understanding an institution's financial operations.

Balance sheet indicators have been used to assess the risk of financial instability in the private sector whereas income statement indicators have been used to determine the probability that financial instability was occurring in the public sector (Coldren et al., 1979). Ratios that dealt with endowments or reserves (Zammuto, 1982b) were not significant for the public sector (Hopkins & Massy, 1981) and were not included with the indicators used to assess financial stability. Instead, there was greater emphasis on the growth rates of revenues, expenditures, and enrollments.

In the Commonwealth of Virginia, a public institution had to revert appropriations back to the general fund of the state at the end of a fiscal year if not spent or through errors in projected enrollment forecasts. This type of "budget lapse" was also practiced in Georgia (SCOPHEF, 1982) which encouraged institutional spending for any year-end purchase despite its priority with no incentive to build reserves (Zammuto, 1982b) or reallocate resources to priority programs (Cheit, 1971). As an alternative, SCOPHEF (1982) recommended the carry forward for one year of year-end balances for nonrecurring items to encourage more efficiency in institutions. Budget lapse would not have affected research universities in the public sector as severely with their greater amount of restricted funds which could have carried over to the next year (H. R. Bowen, 1980). In contrast, other institutions were penalized for any accumulated fund balances (Dickmeyer, 1983) and spent what was allocated. Therefore, indicators that measured the level of fund balance were not significant for the public sector (Gomberg & Atelsek, 1981) and did not reflect possible manipulations of current fund balances (Minter & H. R. Bowen, 1976). The University of Wisconsin System was also penalized for not achieving projected enrollments (Mortimer, 1981). In contrast, the University of Toledo lost revenues it was entitled to under a formula when its actual enrollments exceeded projections (Schroeder, 1978).

With these concerns, public institutions have begun new revenue-raising efforts to obtain more adequacy in funding, which was to replace the erosion of state support, in order to maintain essential programs (Peat, Marwick, Mitchell, & Co., and Rothschild, Unterberg, Towbin, 1982). Even though public institutions have undergone a financial strain in recent years when undersupported, their existence was still expected to continue (F. M. Bowen & Glenny, 1980).

Design

This study was ex post facto. The observed treatment was an upward change in the budget formula for instruction which had already occurred and was not subject to manipulation by the investigator (Kerlinger & Pedhazur, 1973). This was brought about through a legislative change adjusting certain ratios upward during the 1978-1980 biennium (See Appendix B) from their adoption in Appendix M for the 1974-1976 biennium. This study examined the impact of this change in the student-faculty ratio and institutions' responses to revenue distress. Through a longitudinal design comparing the data in years before the time of change in the budget formula with subsequent years' data for all public institutions in the Commonwealth of Virginia, the pattern of change or impact on instructional costs per student unit, institutional complexity, and financial stability, which were the dependent variables, was analyzed.

There were several premises underlying this design. One related to H. R. Bowen's (1980) revenue theory of cost. If changes in a budget formula lowered revenue allocations to an institution, the impact upon instructional costs per student unit should not have been long in forthcoming. An institution could have responded to this change by increasing its enrollment. However, relating instructional costs on a per student unit basis would have controlled for this reaction. In short, the impact on instructional costs should have been somewhat immediate and had a downward effect unless an institution's response altered the outcome or it was more difficult to adjust costs than attributed by H. R. Bowen's theory.

If changes in the budget formula depressed instructional costs per student unit, they could have affected institutional complexity differently. There usually was a time lag in phasing out a program once it had been identified for deletion. However, this change in policy could delay the addition of new programs if there was a reduction in an institution's venture capital. In some cases, this could affect the ability of an institution to respond to decline. Using a time-series analysis to study the relationship of institutional complexity to a change in the budget formula would provide a measure of the responsiveness of an institution.

Relatedly, a budget formula change may not have evenly affected all higher education sectors. Therefore, another purpose of this study was to determine whether this change affected both sectors similarly throughout the Commonwealth of Virginia. This was conducted by testing interactions between the sectors to determine if they significantly differed on the dependent variables.

An outline of this design was as follows:

	1976	1977	1978	1979	1980	1981
Community Colleges	0_1	0_2	0_3	0_4	0_5	0_6
Senior-Level Institutions	0_7	0_8	0_9	0_{10}	0_{11}	0_{12}
Change in Budget Formula				X_1		
All Public Institutions	0_{13}	0_{14}	0_{15}	0_{16}	0_{17}	0_{18}

Kerlinger (1973) identified this as a "one-group repeated trials design." It was a longitudinal design pooling time and cross-sectional data which increased the number of observations and has been used by Powel and Lamson (1972) and Zammuto and Krakower (1983) for this purpose. The population of institutions was observed yearly before and after the change in budgetary policy. The groups were matched in order to eliminate the variance due to individual observations. In this study, institutions were analyzed separately by sector as well as for both sectors together. When using a longitudinal design, the use of graphs has been recommended (Kerlinger, 1973) in order to visually describe relations and any interactions.

Data preceding the change in policy were included to reflect trends before and after the time of change. This would allow time for any change to be observed and to be distinguished from other events that could influence the dependent variables used in this study. Kerlinger (1973) identified the "history effect" as one potential problem with a before-after type of design. When a time design was used in conjunction with data graphs, this would help illuminate the history problem that could have been attributed to (1) program shifts, (2) a slow erosion of state support before a policy change, (3) achieved economies from scale, (4) rapid enrollment growth or decline, (5) inconsistent definitions for the instructional function across time, (6) state buffering after a change in policy, or (7) the response to decline.

Specific Hypotheses

The hypotheses for this study have been listed below:

1. There was no difference in the level of instructional costs per student unit over time following a change in the student-faculty ratio within or between the two educational sectors.

2. There were no changes among predictor variables that determined the variance in instructional costs per student unit over time following a change in the student-faculty ratio within or between the two educational sectors.

3. There was no difference in the level of institutional complexity over time following a change in the student-faculty ratio within or between the two educational sectors.

4. There was no difference in the current level of financial stability over time following a change in the student-faculty ratio within or between the two educational sectors.

The hypotheses have been stated in their null form where they could be tested against chance expectation (Kerlinger, 1973). If the null hypotheses were rejected, they should have been due to systematic variation rather than by chance. A significant $\underline{F}$ ratio would lead to a rejection of the null hypothesis of no relation between predictor and criterion variables (Kerlinger & Pedhazur, 1973).

Statistical Analysis

Multiple regression was employed as the primary method of analysis. Kerlinger and Pedhazur (1973) suggested that this method was appropriate for nonexperimental educational research to predict or explain criterion variables as well as to develop and test theory. In addition, the stepwise regression technique has been used for predictive analysis (Fickett, 1977). The advantages from the use of multiple regression analysis included: (1) it could handle any kind and number of independent variables, (2) it was usually the best analytical method for nonexperimental data, (3) it yielded statistics useful in interpreting data, and (4) it fit the basic purpose of science which was to explain phenomenon (Kerlinger & Pedhazur, 1973). In contrast, the weaknesses from the use of multiple regression analysis included: (1) the unreliability of regression weights, (2) the changing nature of squared semipartial correlations with different entry orders of independent variables, and (3) the difficulty of estimating the importance of independent variables' contribution to the variance of the dependent variable (Kerlinger & Pedhazur, 1973).

The assumptions of multiple regression as suggested by Kerlinger and Pedhazur (1973) were generally met by the data used in this study. However, the $\underline{F}$ ratio was usually a robust statistic that was resistant to the violation of assumptions. If the error terms were correlated over time, then they were autocorrelated (Ostrom, 1978). This could have led to the acceptance of an erroneous alternative hypothesis because of overestimated fit of the model. If there was serial correlation, the error term was underestimated which made it easier to find statistical significance. However, the data in this study did not suggest a strong trend for autocorrelation as indicated by the Durbin-

Watson statistic.

Despite these concerns, multiple regression has been the prevailing method used in higher education cost studies during recent years. Brinkman (1982), Kress (1977), and Fickett (1977) have used multiple regression analysis in their cost studies. Thus, there was precedent for the use of this methodology. This method will be included in the following discussion of analysis relating to the specific hypotheses.

The level of instructional costs per student unit over time. Per H. R. Bowen's (1980) revenue theory of cost, a change in the student-faculty ratio should have forced a downward adjustment in instructional costs per student unit. Since this was a comparison of costs over time, inflation had to be factored out of the results to reflect its affect on real spending (Jenny, 1979b). Otherwise, a spurious or true difference could have been confounded by the effect of inflation.

Since this was a pooled cross-sectional time-series design, it was necessary to add 38 dummy variables, which were initially entered (Zammuto & Krakower, 1983), for cross-sectional observations using the covariance model (Pindyck & Rubinfeld, 1981) to remove the effect of the variance from repeated measures. This made it easier to find statistical significance by reducing the unexplained variance from cross-sectional observations. The cost levels before and after the policy change were analyzed to determine if there was any significant difference. To achieve this objective, time was also employed as a dummy variable. Furthermore, there may have been an interaction between time and sectors. To test this, the cross product of the time and sector variables was coded as another dummy variable. However, the sector variable was not used in this analysis. After coding the dummy variables for matched groups to remove the source of variance from pooled observations, this procedure also removed the between sector variance. Consequently, there was no remaining between sector variance in the cross-sectional observations. However, it was expected that the sectors would vary to some extent and could have moved in different directions over time. Therefore, each sector was also individually analyzed. Afterwards, this relationship was graphically illustrated for all institutions and for each sector as recommended by Kerlinger and Pedhazur (1973).

Pooled cross-sectional time-series multiple regression analysis was used to compare all institutions and the two sectors for any significant differences over time in instructional costs per student unit. This methodology was also recently used by Zammuto and Krakower (1983).

The determination of the variance in instructional costs per student unit over time. One objective of this study was to determine which predictor variables explained the variance in instructional costs per student unit in Virginia's colleges and universities. Adams, Hankins, and Schroeder (1978) identified this approach as relational analysis. Wing and Williams (1977) suggested that identifying these variables could result in adjusted operations to bring about improved efficiency and more effective use of resources.

Possible explanatory predictor variables included: (1) size, (2) institutional complexity (Carter, 1978), (3) the staffing ratio (Hough, 1970), (4) the average faculty salary (Tyndall & Barnes, 1962), (5) the mix of graduate to undergraduate students, (6) the instructional expenditure proportion, (7) total institutional revenues, (8) time when there was a change in policy, (9) a nonlinear trend for size, (10) interactions between time and other independent variables especially when the affect of continuous variables were not the same after a change in policy, and (11) the interaction between a nonlinear trend for size and time. To be selected as an instructional cost variable, Fickett's (1977) criteria included: (1) it must have been valid, (2) it must have been reliable, (3) data should have been available for the years needed, and (4) previous research should have employed the variable.

In his study on community colleges, Mullen (1981/1982) looked at trends in size to explain educational and general costs per student. Based on a literature review and expected relationships of costs and volume, six cost curves were tested. For average costs, a nonlinear curve explained the highest variance. However, for instructional costs per student, a hyperbolic curve, where there was a lack of scale of economies beyond a minimum enrollment level, was the best fit. Average costs decreased rapidly to 1,000 FTE's but were linear over much of the range which suggested that average and marginal costs were collinear. Since budget formulas were linear, his findings followed expectations.

After reviewing the literature, Fickett (1977) selected independent variables by program area, using stepwise regression, on a fiscal year basis. Direct instructional cost per student semester hour was the dependent variable. The predictor variables used, which varied in order of selection by program, included: (1) average class size, (2) annual FTE faculty, (3) FTE students, and (4) average annual salary per FTE faculty. He found that workload variables had negative coefficients while average faculty salary's coefficient was positive.

Wing and Williams (1977) used a model to explain total instructional and departmental research expenditures. Based on regression coefficients for research universities, state and tuition revenues, the ratio of graduate to undergraduate students, and size were all positively related while the staffing ratio was negatively related to expenditures. For doctoral-granting universities, no factors were directly related to students who were put in a secondary position to research. However, total faculty and state revenues were positively related while other services was negatively related to expenditures. The formula approach was more dominant for the doctoral-granting universities which suggested different spending patterns between these two groups of institutions. However, the explanatory factors were complex and were the function of more than a few variables. Nonetheless, the cost functions for both institutional types were probably less accurate, with the joint production process, than for the community colleges (Brinkman, 1982). The multidimensional aspect of the explanatory variables was considered in this study in order to reduce the problems that could result in interpretation as indicated by Wing and Williams (1977).

Brinkman (1982) warned of the regression fallacy in a cross-sectional study when average costs were driven downward in larger size institutions which could have overestimated scale economies and underestimated marginal costs. He used a linear cost function to estimate total instructional costs for research and doctoral-granting universities and found that graduate enrollment was a significant factor. However, average faculty salary was not significant but there were similarities among research and doctoral-granting universities after he controlled for differences in enrollment and program emphasis. Based on total costs, he suggested that marginal costs were rather constant with scale since they decreased quickly then levelled rapidly.

To increase sample size, it was necessary to pool years and cross-sectional observations (Kerlinger & Pedhazur, 1973). Multicollinearity among independent variables has been one problem in the use of multiple regression analysis since the order of entry influenced the amount of variance attributed to each variable. Because of the multicollinearity concern, intercorrelations between the independent variables were analyzed.

If specifying the entry order was impossible or less important for predictive equations, the stepwise regression technique was available to select the entry order of variables and was the approach used in this study. For explanatory analysis, the theory behind the problem and practical experience should have guided the order of entry. The data were analyzed by using Statistical Analysis System (SAS) (Helwig & Council, 1979) procedures.

Another objective of this study was to determine if a change in the student-faculty ratio altered the relationship among independent variables and their amount of explained variance in instructional costs per student unit which was the dependent variable. Did these variables' relationships to the dependent variable remain unchanged over time?

Pooled cross-sectional time-series multiple regression analysis was the approach used to examine these relationships. A stepwise multiple regression of independent variables influencing the variance in instructional costs per student unit was run for the years included in this study. A separate equation was run for each sector and for all institutions. Variables for time's interaction with other predictors were included to determine if their influence on instructional costs per student unit changed over time. These were included after coding the dummy vectors for the cross-sectional observations.

Fringe benefits have been removed from the latter three years' data for consistency. In addition, inflation has also been factored out of instructional costs per student unit, average faculty salaries, and educational and general revenues to reflect the real level of these variables across the years. Otherwise, per unit instructional costs and these other independent variables would have increased due to the inflation effect.

In the process of conducting this analysis, certain other relationships among the variables were considered. One example was the instructional expenditure proportion and its change over time to determine if it was maintained (Cavanaugh, 1969) in response to changing conditions or to identify reallocations to other functional areas. By using correlational and regression analysis, the relationship between instructional costs per student unit and size was also analyzed. Per Maynard's (1971) threshold theory, an increase in the staffing ratio should have increased the threshold level where economies of scale were achieved. If this response was taken, the amount of explained variance and correlation between these variables could have changed as demonstrated by a significant interaction between time and the nonlinear trend of size with the dependent variable.

Correlational and regression analysis were also used to study the relationship between institutional complexity and size. A change in the budget formula could have altered this relationship. Since the staffing ratio influenced the number of programs (McLaughlin et al., 1980), any retrenchment in the number of faculty in response to revenue distress could have reduced the pressure to add new programs. If so, the amount of explained variance and correlation between these variables could have changed as demonstrated by a significant interaction between time and size with institutional complexity.

The level of institutional complexity over time. If institutional complexity was influenced by the staffing ratio, a change in the student-faculty ratio could have brought about an adjustment in the level of this variable in response to revenue distress. To determine if there was any significant difference, the institutional complexity levels before and after the policy change were analyzed. For the pooled cross-sectional time-series analysis, 38 dummy variables were added to remove the effect of the variance from repeated measures. A dummy vector was also used for time. The dummy vectors for the pooled cross-sectional time-series multiple regression analysis were entered first to remove the variance due to matched observations. This made it easier to find statistical significance by reducing the unexplained variance. Afterwards, the dummy variable for time was entered to test the effect of the change in policy. After performing the same analysis for each individual sector, this relationship was graphically illustrated for all institutions and for each sector.

The determination of the level of financial stability over time. To determine the current financial stability of institutions, *z* scores were computed in the manner used by Minter and H. R. Bowen (1976, 1978) for each of the previously identified static indicators. This was based upon peer comparisons by sector (Dickmeyer, 1979). Comparing each institution's score with the mean score of all institutions and dividing that amount by the standard deviation displayed the extent of deviation on a standardized basis from peer institutions within a state (Coldren et al., 1979). This would reveal if certain institutions were more adversely affected by changing conditions and was also the approach used by Truitt (1975). This reflected an institution's distance from the group average.

A score one standard deviation above the mean was used as an indication of financial strength while a score one standard deviation below the mean was used as an indication of financial weakness. The *z* scores for all indicators were averaged to yield one composite score that was used to assess the current financial stability of Virginia's colleges and universities. An institution more than one standard deviation away from the mean was different from 84% of the institutions in that group.

Each change indicator's *z* scores were also computed to determine the direction institutions were headed between years. Minter and H. R. Bowen (1978) used a three-year change but weighted the most recent year the heaviest to chart the progress of an individual institution compared to a peer group to determine if it was improving relative to the group. These $\underline{z}$ scores were averaged in the same manner previously described to yield a composite measure of the change in financial stability over time. The results of these two procedural assessments were separately presented for each of the years under consideration in this study.

There were a number of factors that could have influenced the financial stability of an institution. Some were largely within the control of an institution; others were not. A change in the student-faculty ratio may have affected institutional financial stability because of revenue distress but this would depend upon institutional responses to decline. In Virginia, an institution still had flexibility to determine internal allocations of appropriated revenues. The approach used for this analysis was empirical rather than prescriptive. One objective of this study was to identify the present and past financial stability as well as the trend in Virginia's public colleges and universities. To do so, some base was necessary for comparison purposes. By studying the financial stability of institutions in earlier years with their current trends, an evaluation could be made of the direction institutions were headed before and after a change in budgetary policy. In addition, sector comparisons may have revealed distress in one particular sector of institutions.

For long-range planning, it was necessary to have a clear indication of where colleges and universities were financially headed. While the Commonwealth of Virginia was trying to economize on available resources, what happened to the plight of its educational institutions? If institutions remained stable despite the change in the budget formula, the state's action could be supported provided that institutional quality did not suffer from institutional responses to distress. If financial stability or quality deteriorated, this would suggest the need for further study to determine the causes and responses that brought about this outcome. Furthermore, there would be a need to consider which policies were best to implement during a period of declining resources and to identify institutional responses that should be implemented under declining conditions to preserve the achievement of valued objectives.

H. R. Bowen's (1980) revenue theory of cost suggested that there would be no relationship between a change in policy and institutional financial stability since all but the most impoverished institutions were in the same relative financial health. To determine if there was any significant difference, the institutional financial levels before and after the policy change were analyzed. For the pooled cross-sectional time-series analysis, 38 dummy variables were added to remove the effect of the variance from matched observations. A dummy vector was also used for time. The dummy vectors for the pooled cross-sectional time-series multiple regression analysis were entered first to remove the variance due to repeated measures. This made it easier to find statistical significance by reducing the unexplained variance. Afterwards, the dummy variable for time was entered to test the effect of the change in policy. This was graphically illustrated for all institutions.

Correlational and pooled cross-sectional time-series regression analysis were also used to study the relationship between instructional costs per student unit and the current level of institutional financial stability. H. R. Bowen's (1980) revenue theory of cost suggested that there was no relationship between these two variables since institutions spent up to the limit of their ability. However, some institutions were more financially stable in comparison to others (Dickmeyer, 1979). To reduce instructional costs per student unit, an institutional response was needed that may have weakened financial stability. If so, the amount of explained variance and correlation between these variables could have changed as demonstrated by a significant interaction between time and instructional costs per student unit with institutional financial stability.

Size, instructional costs per student unit, institutional complexity, or the instructional expenditure proportion could have been related to the level of financial stability among Virginia's colleges and universities. If complexity was significant and was affected through responses from a change in the student-faculty ratio, institutional financial stability may have been stable or improved provided there was efficiency in the management of resources. If instructional costs per student unit was significant and was affected through responses from a change in the student-faculty ratio as suggested by H. R. Bowen (1980), increased efficiency may have prevented a deterioration in the financial plight of Virginia's institutions although the instructional expenditure proportion may have declined. If more economies of scale were achieved, size could have been a more important variable than attributed by H. R. Bowen's (1980) revenue theory of costs from a different threshold level. Increasing the student-faculty ratio may have led to these results or other responses could have stabilized or weakened institutional financial stability.

All institutions would not want to increase their size as an institutional response to revenue decline but may want to consider a response such as the reallocation of resources to priority growth areas (Larimore, 1974). A large size with limited program offerings and low instructional costs per student unit would yield an efficient higher educational system but certainly not an effective one to respond to all types of decline. Certain programs needed to be maintained for institutional effectiveness (F. M. Bowen & Glenny, 1980) even though they were costly (Williams, 1959) and had to be subsidized from profitable programs (Larimore, 1974). On the other hand, accelerated ad hoc actions taken by external agencies were also not likely to yield an effective higher educational system.

It would be best for institutions to be offensive, by understanding their strengths and weaknesses during a declining period, in order to plan for the future versus to be defensive to weaknesses exposed by external authorities (Campbell, 1982) who have less tolerance in seeking effective versus immediate solutions (Millard, 1976). One objective of this study was to identify critical variables in the higher educational cost and financial structures which could improve a policy maker's understanding of the peculiar economic behavior of higher educational institutions during and after a change in the budget formula for instruction.

The time for internal solutions was running out (Green, 1971) as higher education entered a decade that promised tighter resources (AED,

1979) and requests for increased efficiency from some legislatures (Albright, 1982). If public institutions did not undertake their own vigorous evaluation, it could be done for them through increased controls and reduced resources. External agencies could impose solutions which would threaten the autonomy of institutions (AED, 1979) unless institutional performance and effective responses were emphasized in order to maintain a quality educational system and to be accountable (Albright, 1982).

Summary of Methodology

Financial and enrollment data were collected from archival records through the aid of SCHEV which granted permission to supply the data for the academic years 1975-1976 to 1980-1981. The specific sources of data were the Financial and Salaries, Tenure, and Fringe Benefits of Full-Time Instructional Faculty Surveys of HEGIS. In addition, enrollment data were gathered from the SDM files and enrollment projections.

The colleges and universities studied included all 39 public institutions located within the Commonwealth of Virginia. They were categorized as (1) senior-level institutions and (2) community colleges.

For all institutions as well as for each sector, correlational and pooled cross-sectional time-series multiple regression analysis were used to analyze the variables that explained the variance in instructional costs per student unit and for institutional complexity. Dummy vectors were included to remove the variance due to matched subjects. The levels of these variables were graphically illustrated across the years to identify trends that emerged following a change in the student-faculty ratio. The financial stability of each institution within the two sectors for each year as well as the change between years was assessed and summarized from a composite score based upon individual *z* scores of a series of financial and nonfinancial indicators. For all institutions, pooled cross-sectional time-series multiple regression analysis was also used to test if there was any significant difference in the current level of institutional financial stability after the policy change.

CHAPTER IV

ANALYSIS OF RESULTS

This chapter consists of five sections. The first section reports the results of multiple regression analysis on the contribution of time as a predictor variable's influence on instructional costs per student unit for all of the public colleges and universities in Virginia as well as for the community college sector and the senior-level institutions sector. The second section reports the results of multiple regression analysis on factors hypothesized to influence instructional costs per student unit for all of the public colleges and universities in Virginia as well as for each of the two sectors. The third section reports the results of multiple regression analysis on independent variables hypothesized to influence institutional complexity for all of the public colleges and universities in Virginia as well as for each of the two sectors. The fourth section reports the results of analyzing institutional financial stability by sector for all of Virginia's public colleges and universities. Finally, the fifth section presents a summary of the findings.

The Contribution of Time as a Predictor Variable

In this section, the importance of time and its contribution as a predictor variable of instructional costs per student unit is discussed. Initially, this analysis is conducted for all institutions combined. Afterwards, the same analysis is performed for each individual sector. Finally, an interaction analysis between time and sector is presented.

All institutions analysis. After coding in the dummy variables to remove the variance from matched observations, time was included as an independent variable to test if there was a significant difference in instructional costs per student unit for all institutions during the three-year period after the change in budgetary policy. As reported in Table 4.1, time, as an independent variable, was not significant in explaining any difference in instructional costs per student unit. After controlling for inflation, instructional costs per student unit increased slightly over the latter three-year period as indicated in Table 4.2. However, there was not a uniform movement across the years when viewed separately as indicated in Figure 4.1 since per unit costs decreased notably during the most recent year.

Community college sector analysis. This type of analysis was also performed for the community colleges. Dummy variables were coded to remove the variance from cross-sectional observations. As reported in Table 4.3, time was not significant in explaining any difference in instructional costs per student unit. The regression coefficient was positive which meant that per unit costs increased after the change in policy as indicated in Table 4.4. However, there was not a uniform pattern across the years as indicated in Figure 4.2. Instructional costs per student unit increased steadily after inflation through academic year 1978-1979 then fell rapidly even though it increased for the three-year period subsequent to the change in policy. Two factors could have contributed to this outcome. The Commonwealth of Virginia initially buffered smaller institutions from the full effects of the policy change. Furthermore, institutions may have taken longer to respond to revenue distress than attributed by H. R. Bowen's (1980)

TABLE 4.1

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	760.506	---	---	---
38 Dummy Variables	---	---	---	.7981
Time	8.344	.613	.0002	.7983

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 234; $\underline{F}$ = 19.69; $\underline{df}$ = 39/194; $\underline{p} < .0001$

TABLE 4.2

AVERAGE INSTRUCTIONAL COSTS PER STUDENT UNIT BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR ALL INSTITUTIONS

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Instructional Costs Per Student Unit	945.74	954.08

N = 234

FIGURE 4.1

INSTRUCTIONAL COSTS PER STUDENT UNIT AFTER INFLATION FOR ALL INSTITUTIONS

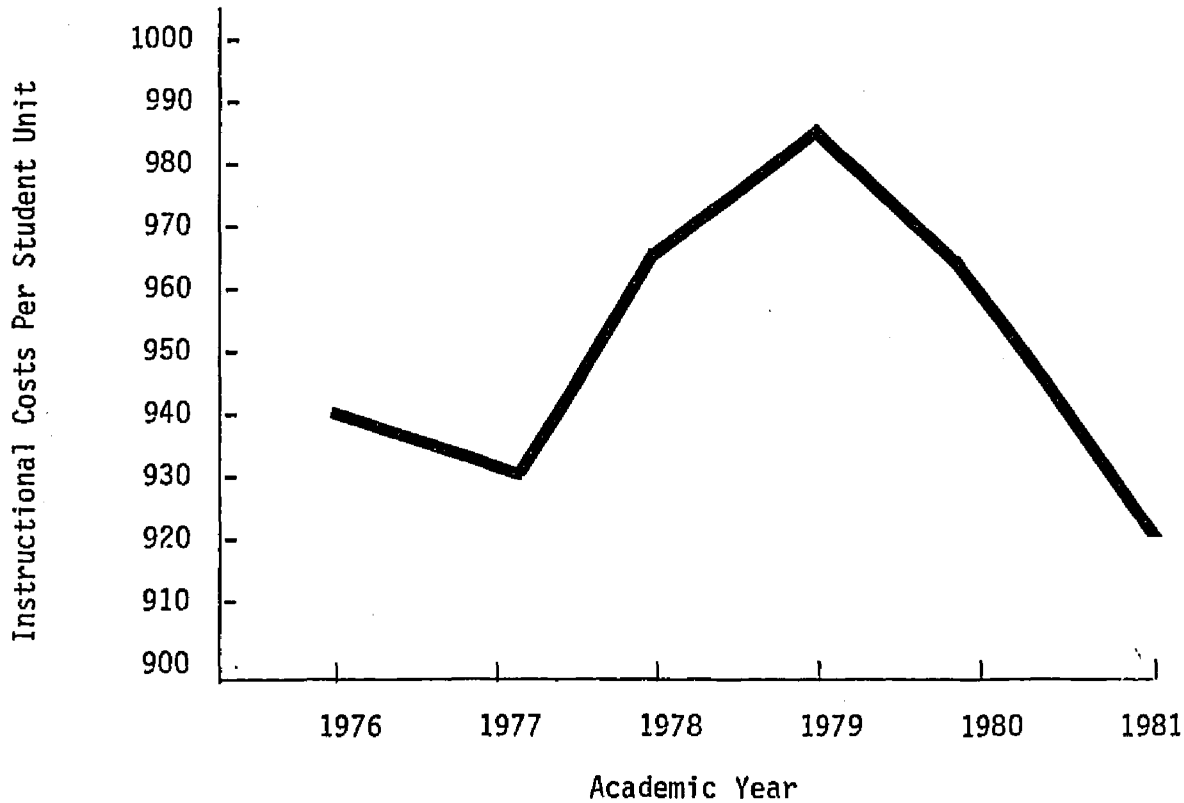


TABLE 4.3

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE COMMUNITY COLLEGE SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	751.970	---	---	---
23 Dummy Variables	---	---	---	.7500
Time	25.417	.291	.0024	.7524

Note: The 23 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 144; $\underline{F}$ = 15.07; $\underline{df}$ = 24/119; $\underline{p}$ < .0001

TABLE 4.4

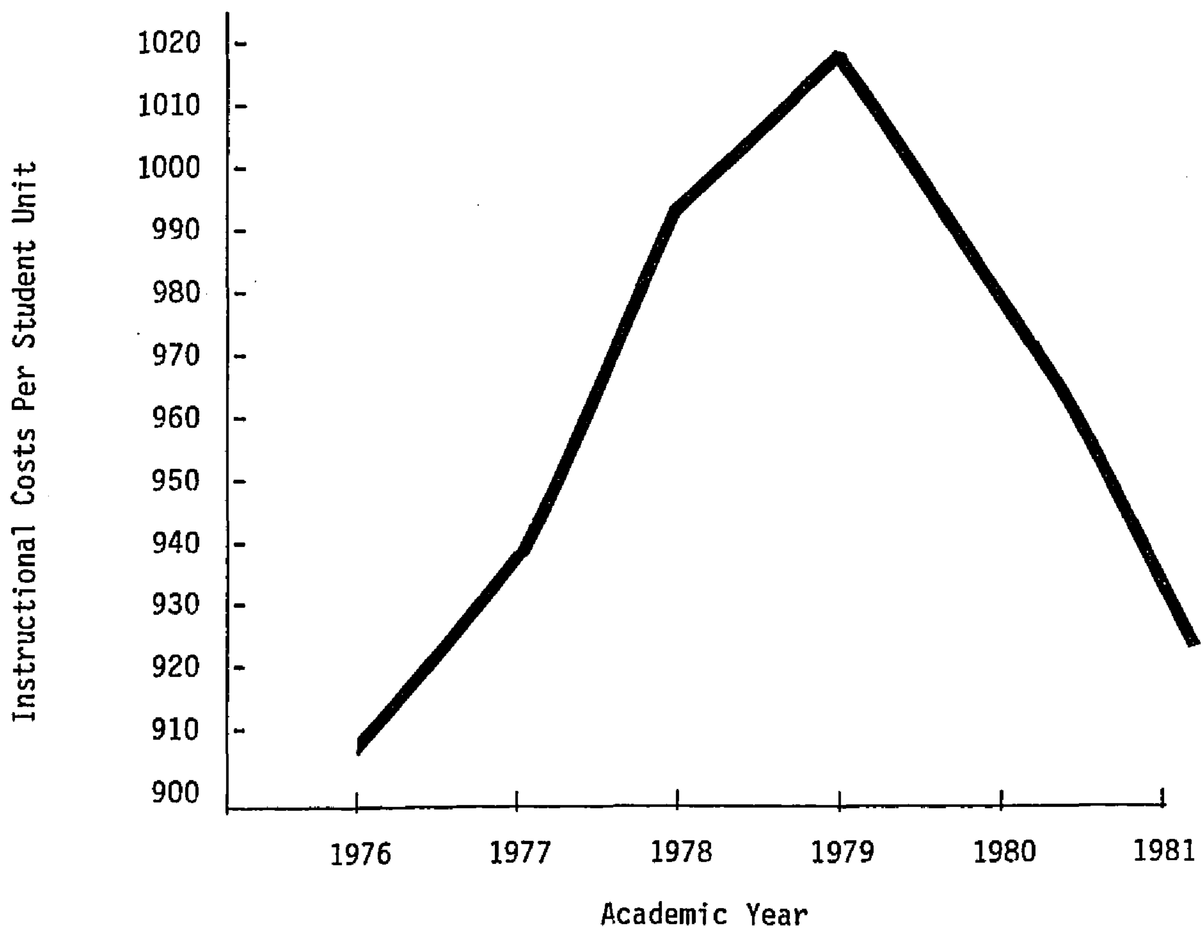
AVERAGE INSTRUCTIONAL COSTS PER STUDENT UNIT BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR THE COMMUNITY COLLEGE SECTOR

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Instructional Costs Per Student Unit	945.77	971.18

N = 144

FIGURE 4.2

INSTRUCTIONAL COSTS PER STUDENT UNIT AFTER INFLATION FOR THE COMMUNITY COLLEGE SECTOR



revenue theory of cost or were slower to respond if some of their costs were sticky under declining revenue conditions.

Senior-level institutions analysis. The same analysis was then performed for the senior-level institutions sector where a different pattern emerged. After coding the dummy variables to remove the variance due to matched observations, time was entered into the equation. As reported in Table 4.5, time was not significant in explaining any difference in instructional costs per student unit. However, the regression coefficient was negative which was the reverse from the other sector. This meant that per unit costs decreased after the change in policy as indicated in Table 4.6. As the case in the previous analysis, per unit costs did not decrease steadily across the years as indicated in Figure 4.3. There was a sharp drop in per unit costs during 1976-1977, when there was a budgetary cutback, then a rather stable level after inflation until 1980-1981 when there was another sizable decrease in per unit costs. In this sector, not as many institutions were buffered from the effects of the policy change. However, these institutions still did not immediately respond to the change in budgetary policy. It took several years for efficiency responses to be fully implemented.

Interaction analysis. Because of the differences in the regression coefficients for the time variable in the two individual sectors, an interaction hypothesis between time and sector was tested by including this variable in the all institutions analysis. As reported in Table 4.7, there was no significant interaction between time and educational sector. Thus, the effect of the change in policy was the same in both

TABLE 4.5

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	842.858	---	---	---
14 Dummy Variables	---	---	---	.8863
Time	-18.973	.320	.0015	.8878

Note: The 14 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N} = 90$; $\underline{F} = 39.05$; $\underline{df} = 15/74$; $\underline{p} < .0001$

TABLE 4.6

AVERAGE INSTRUCTIONAL COSTS PER STUDENT UNIT BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Instructional Costs Per Student Unit	945.70	926.73

N = 90

FIGURE 4.3

INSTRUCTIONAL COSTS PER STUDENT UNIT AFTER INFLATION FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

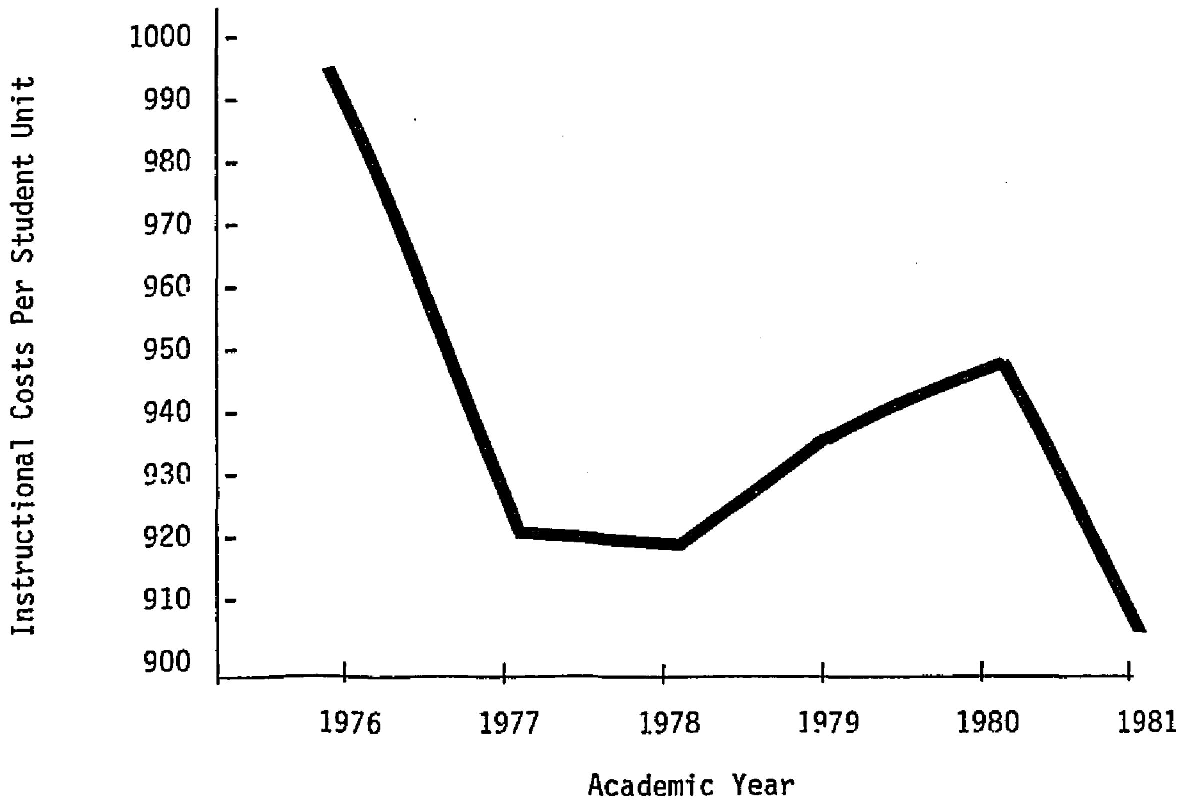


TABLE 4.7

MULTIPLE REGRESSION OF TIME AND ITS INTERACTION WITH SECTOR AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	751.970	---	---	---
38 Dummy Variables	---	---	---	.7981
Time	25.417	.227	.0002	.7983
Time*Sector	-44.390	.191	.0018	.8001

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 234; $\underline{F}$ = 19.31; $\underline{df}$ = 40/193; $\underline{p} < .0001$

sectors despite the differences for time in the regression coefficients. For both sectors, the effect was a reduction in instructional costs per student unit during 1980-1981 which was the most recent year included in this study. By this point, several adjustments had been made in the budgetary formula and institutions in both sectors had implemented efficiency responses to decrease their per unit expenditures. Since the community colleges relied on fewer sources of revenue, they were less able to buffer themselves from revenue distress in state appropriations and were under more pressure to cut costs and do so quickly as indicated in Figure 4.2.

Hypothesis one stated that there would be no difference in the level of instructional costs per student unit over time following a change in the student-faculty ratio within or between the two educational sectors. A pooled cross-sectional time-series multiple regression analysis was used to test this hypothesis. The p value of .613 for the independent variable time was not significant for all institutions. Thus, the null hypothesis was accepted. In addition, no interaction effect was discovered between the two educational sectors even though the regression coefficients for time differed. Thus, the hypothesis of no difference between the two educational sectors was also accepted. Furthermore, there was little difference in per student unit costs between the two educational sectors.

Multiple Regression Analysis of Instructional Costs Per Student Unit

In this section, the variance in instructional costs per student unit is analyzed. Hypothesized predictor variables and their contribution to the explanation of the variance in instructional costs per student unit are examined for all institutions. Afterwards, the same analysis is performed for each individual sector. Then an analysis is included that considers the relationship between instructional costs per student unit and size. Finally, an analysis that considers the relationship between the independent variables institutional complexity and size is included.

Predicting and explaining the variance in instructional costs per student unit for all institutions. After coding in the 38 dummy variables to remove the variance from matched observations, 20 independent variables were considered to explain the variance in instructional costs per student unit for all colleges and universities in Virginia. Because of the multicollinearity concern, an intercorrelation matrix table was included in Table 4.8 to report the correlations among all independent variables. Fickett (1977) used a criteria of .7 as an indication of multicollinearity in his study although he indicated that .8 had been used more often. Some of the higher correlations between independent variables included those involving educational and general revenues, programs, size, and the interactions. For variables such as size and educational and general revenues or the nonlinear trend for size, it was the expectation to find high positive correlations between them. There were indications of multicollinearity between these variables with correlations greater than .9. However, there was not an indication of multicollinearity between complexity or the staffing ratio and other independent variables. None of these variables were so highly intercorrelated across all independent variables to remove them from the analysis on this basis alone. Furthermore, some of the

TABLE 4.8

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR ALL INSTITUTIONS

	Time	Size	Staff Ratio	Complex.	Programs	Avg. Salary	E & G Revs.	Fac.	Inst. Percent	Size Sq.
Time	1.00									
Size	.03	1.00								
Staff Ratio	-.02	-.07	1.00							
Complex.	.02	-.55****	-.05	1.00						
Programs	.05	.94****	-.13*	-.42****	1.00					
Avg. Sal.	-.21**	.70****	-.44****	-.53****	.72****	1.00				
E & G Revs.	.03	.89****	-.23***	-.37****	.94****	.72****	1.00			
Faculty	.03	.95****	-.23***	-.45****	.93****	.72****	.92****	1.00		
Inst. Pc.	-.09	-.18**	.25****	.03	-.24***	-.29****	-.36****	-.24***	1.00	
Size Sq.	.03	.96****	-.09	-.40****	.94****	.67****	.93****	.94****	-.30****	1.00
T*Sector	.49****	.33****	-.33****	-.36****	.32****	.33****	.33****	.37****	-.28****	.27****
T*Size	.50****	.64****	-.08	-.34****	.61****	.30****	.60****	.63****	-.17**	.62****
T*Staff	.97****	.01	.15*	.01	.01	-.28****	-.03	-.02	-.03	-.01
T*Complex.	.76****	-.24***	-.05	.50****	-.16*	-.38****	-.15*	-.18**	-.01	-.17**
T*Size Sq.	.32****	.67****	-.10	-.27****	.64****	.36****	.68****	.69****	-.23***	.71****
T*Inst. Pc.	.98****	-.01	.02	.04	.01	-.25****	-.02	-.01	.04	-.02
T*Fac.	.47****	.62****	-.17**	-.27****	.61****	.33****	.64****	.68****	-.21***	.63****
T*Pgms.	.63****	.55****	-.12	-.23***	.58****	.23***	.57****	.57****	-.19**	.55****
T*E&G Revs.	.34****	.61****	-.19**	-.24***	.64****	.38****	.73****	.66****	-.27****	.64****
T*Avg. Sal.	.98****	.12	-.08	-.05	.14*	-.08	.14*	.14*	-.14*	.12

N = 234; *p < .05; **p < .01; ***p < .001; ****p < .0001

TABLE 4.8 (continued)

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR ALL INSTITUTIONS

	Time* Sector	Time* Size	Time* Staff.	Time* Complex.	Time* Size Sq.	Time* Inst. %	Time* Fac.	Time* Programs	Time* E&G Revs.	Time* Salary
T*Sector	1.00									
T*Size	.63****	1.00								
T*Staff	.35****	.46****	1.00							
T*Complex.	.05	.08	.72****	1.00						
T*Size Sq.	.48****	.94****	.27****	-.01	1.00					
T*Inst. Pc.	.42****	.46****	.97****	.76****	.26****	1.00				
T*Fac.	.64****	.96****	.39****	.11	.94****	.41****	1.00			
T*Pgms.	.63****	.95****	.57****	.27****	.88****	.59****	.94****	1.00		
T*E&G Revs.	.55****	.89****	.26****	.04	.93****	.27****	.92****	.89****	1.00	
T*Avg. Sal.	.61****	.61****	.92****	.68****	.43****	.95****	.58****	.73****	.47****	1.00

variables that displayed signs of multicollinearity were eliminated with the use of stepwise regression analysis and thus were not included in the regression equation since they added little additional predictive ability. The instructional expenditure proportion variable was weakly correlated with other independent variables. This added to its contribution as a predictor on the criterion variable. The correlations between predictor variables and the dependent variable of instructional costs per student unit have been included in Table 4.9. Complexity was most strongly correlated with the dependent variable. In addition, summary descriptive statistics about the 20 independent variables and the dependent variable have been included in Table 4.10.

Because of the number of potential independent variables and their intercorrelations, the STEPWISE regression procedure of SAS (Helwig & Council, 1979) was selected to identify those variables that significantly contributed to the explanation of the variance in the criterion variable and were successful predictors to trim the total number of variables in the regression equation. Even though 20 variables were selected as predictors, all of these were not expected to be significant in predicting the criterion variable since they were intercorrelated. The basis for the decision to include the predictor variable in the regression equation was its significance when entered last into the multiple regression equation. Using this procedure, a variable that initially entered the regression equation would have been removed if it subsequently became insignificant after controlling for other entered variables thereby indicating that most of the removed variable's influence was indirect.

TABLE 4.9

CORRELATIONS AMONG THE INDEPENDENT VARIABLES AND INSTRUCTIONAL COSTS PER STUDENT UNIT FOR ALL INSTITUTIONS

Independent Variable	
Time	.02
Size	.10
Staffing Ratio	-.40****
Complexity	.42****
Programs	.15
Average Faculty Salary	.12
Educational and General Revenues	.31****
Faculty	.19**
Instructional Percentage	.02
Size Squared	.19**
Time*Sector	-.04
Time*Size	.08
Time*Staffing Ratio	-.07
Time*Complexity	.26****
Time*Size Squared	.15*
Time*Instructional Percentage	.02
Time*Faculty	.14*
Time*Programs	.11
Time*Educational and General Revenues	.24**
Time*Average Faculty Salary	.03

$\underline{N}$ = 234; *$\underline{p} < .05$; **$\underline{p} < .01$; ***$\underline{p} < .001$; ****$\underline{p} < .0001$

TABLE 4.10

DESCRIPTIVE STATISTICS FOR THE DEPENDENT AND INDEPENDENT VARIABLES FOR ALL INSTITUTIONS

Variable	Mean	Standard Deviation	Minimum	Maximum
Inst. Cost	949.912	256.180	618.870	2061.530
Time	0.500	0.501	0.000	1.000
Inst. Pc.	49.590	6.784	29.940	63.280
Complexity	1.687	0.995	0.407	5.405
Staff Ratio	23.407	4.716	13.060	38.950
Size	4395.632	5362.777	222.000	22624.000
Size Sq.	47958058.786	103388584.927	49284.000	511845376.000
E & G Revs.	13011316.615	25165173.517	755648.000	110221561.000
Programs	44.705	39.991	3.000	197.000
Faculty	200.791	264.669	13.000	1402.000
Avg. Sal.	13077.932	1913.980	10022.000	20822.000
T*Sector	0.192	0.395	0.000	1.000
T*Size	2266.047	4497.664	0.000	22624.000
T*Staff	11.657	12.080	0.000	35.610
T*Complex.	0.855	1.129	0.000	5.405
T*Size Sq.	25277501.679	80210729.181	0.000	511845376.000
T*Inst. Pc.	24.490	24.972	0.000	58.540
T*Faculty	104.979	225.492	0.000	1402.000
T*Programs	23.265	36.810	0.000	197.000
T*E&G Revs.	6939003.662	20510306.593	0.000	110221561.000
T*Avg. Sal.	6341.427	6477.008	0.000	19419.000

$\underline{N}$ = 234

The 38 dummy variables were initially coded and included to remove over 79% of the variance in the dependent variable that was attributed to matched observations. Thus, the residual variance was reduced which left less that was unexplained in the multiple regression equation. The results of the stepwise multiple regression analysis have been included in Table 4.11. After the dummy variables were included, the instructional expenditure proportion was the most significant variable and was initially selected by the STEPWISE procedure. Due to its low correlation with other independent variables, it was quite significant as a predictor variable. Its positive regression coefficient indicated that those institutions that spent more on the instructional function had higher expenditures per student unit.

The staffing ratio, the level of institutional complexity, the amount of educational and general revenues, the number of programs, and the interaction of time and sector were then selected as significant predictor variables. The regression coefficient for the staffing ratio was negative as expected for a workload measure. It was positive for institutional complexity which indicated that those institutions that were more complex had higher instructional costs per student unit. The regression coefficient for educational and general revenues was positive which supported H. R. Bowen's (1980) revenue theory that costs followed revenues. After controlling for the entrance of these variables, the number of programs had a negative coefficient which indicated that those institutions with the most programs had lower per unit costs. The interaction of time and sector had a positive regression coefficient which indicated that after the change in policy, institutions had

TABLE 4.11

STEPWISE REGRESSION OF INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	-106.554	---	---	---
38 Dummy Variables	---	---	---	.7981
Inst. Percent	23.656	.001	.0808	.8789
Staff Ratio	-10.206	.001	.0318	.9108
Complexity	228.569	.001	.0213	.9321
E & G Revs.	0.001	.008	.0045	.9366
Programs	-3.660	.005	.0012	.9378
Time*Sector	43.192	.022	.0024	.9402
Time*Complex	9.334	.066	.0011	.9413

Note: The 38 dummy variables for cross-sectional observations were entered first or included to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them. Afterwards, 20 predictor variables were inputted into the stepwise regression analysis for selection.

$\underline{N} = 234$; $\underline{F} = 66.99$; $\underline{df} = 45/188$; $\underline{p} < .0001$

higher per unit costs but this interacted differently between the two sectors where the relationships among these variables were not the same as previously reported. Because of the nature of this interaction variable, each sector was separately examined to determine if there were any major differences between them.

The last variable selected from the STEPWISE procedure was the interaction between time and institutional complexity. This variable was not significant at the .05 level but was above the cutoff point of .15 used in the STEPWISE procedure. The positive regression coefficient indicated that, after the change in policy, the relationship of complexity to the dependent variable had changed as institutions were more complex. None of the other interaction variables, which displayed signs of multicollinearity, entered the stepwise regression equation which implied that they did not behave differently over time after a change in budgetary policy. Institutional responses to revenue decline apparently were effective in not changing these relationships.

After these variables were selected for entry, 94.1% of the variance in instructional costs per student unit had been explained. $\underline{F}$ was equal to 66.99 which was significant for the overall regression equation at the .0001 level. Thus, this equation was significant in explaining the relationship between predictor variables and instructional costs per student unit. But, there was only one significant interaction with time among the predictor variables. It must be emphasized that under the stepwise regression procedure, these variables were significant only for this entry order. When the instructional expenditure proportion variable was entered immediately after the dummy variables, it controlled for a great deal of the indirect contribution from other independent variables' prediction of the criterion variable. The other significant independent variables displayed signs of multicollinearity with other independent variables not selected from the STEPWISE procedure.

The number of programs variable was entered even when institutional complexity was used since the former variable represented the absolute number of programs offered while the latter variable controlled for differences in institutional size. The complexity variable reflected a threshold number of programs that were necessary to operate despite institutional size. After this point, programs were added proportionately with increased institutional size even though some of these additions may have been more expensive which were supported from additional revenues as they became available.

Community college sector variance analysis. The same type of analysis was then performed for the community college sector. After coding in the dummy variables to remove the variance from matched observations, all but the sector variable were used as possible predictors of instructional costs per student unit. Because of the concern for multicollinearity, an intercorrelation matrix table was included in Table 4.12 to report the correlations between all independent variables. Some of the highest correlations between independent variables included those involving size and educational and general revenues although these variables were expected to be strongly correlated. However, all independent variables were kept and included as possible predictor variables in the stepwise regression equation where some of the highly

TABLE 4.12

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR THE COMMUNITY COLLEGE SECTOR

	Time	Size	Staff Ratio	Complex.	Programs	Avg. Salary	E & G Revs.	Fac.	Inst. Percent	Size Sq.
Time	1.00									
Size	.03	1.00								
Staff Ratio	-.08	.57****	1.00							
Complex.	.03	-.59****	-.66****	1.00						
Programs	.10	.86****	.55****	-.48****	1.00					
Avg. Sal.	-.41****	.21*	-.01	-.24**	.12	1.00				
E & G Revs.	.01	.99****	.54****	-.57****	.86****	.23**	1.00			
Faculty	.04	.99****	.52****	-.60****	.88****	.23**	.99****	1.00		
Inst. Pc.	-.01	.30***	.17*	-.22**	.42****	.10	.30***	.32****	1.00	
Size Sq.	.02	.96****	.47****	-.44****	.76****	.22**	.95****	.94****	.22**	1.00
T*Size	.44****	.67****	.31***	-.36****	.63****	-.05	.64****	.69****	.14	.66****
T*Staff	.98****	.12	.07	-.09	.19*	-.42****	.10	.13	.02	.10
T*Complex	.82****	-.21*	-.32****	.45****	-.12	-.43****	-.21*	-.21*	-.04	-.16
T*Size Sq.	.21**	.69****	.30***	-.30***	.57****	.06	.67****	.69****	.12	.74****
T*Pgms.	.80****	.40****	.16	-.18*	.54****	-.28***	.38****	.43****	.13	.36****
T*Avg. Sal.	.99****	.04	-.08	.01	.10	-.35****	.03	.06	.01	.04
T*Inst. Pc.	.99****	.05	-.07	.02	.12	-.40****	.04	.07	.07	.04
T*Fac.	.51****	.64****	.27**	-.36****	.63****	-.06	.62****	.67****	.15	.62****
T*E&G Revs.	.49****	.65****	.27**	-.34****	.62****	-.05	.63****	.67****	.15	.64****

$\underline{N} = 144$; *$\underline{p} < .05$; **$\underline{p} < .01$; ***$\underline{p} < .001$; ****$\underline{p} < .0001$

TABLE 4.12 (continued)

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR THE COMMUNITY COLLEGE SECTOR

	Time* Size	Time* Staff.	Time* Complex.	Time* Size Sq.	Time* Programs	Time* Avg. Sal.	Time* Inst. %	Time* Fac.	Time* E&G Rev.
T*Size	1.00								
T*Staff	.55****	1.00							
T*Complex.	.08	.71****	1.00						
T*Size Sq.	.93****	.32****	-.06	1.00					
T*Programs	.82****	.85****	.50****	.61****	1.00				
T*Avg. Sal.	.46****	.97****	.81****	.23**	.80****	1.00			
T*Inst. Pc.	.47****	.97****	.81****	.24**	.82****	.99****	1.00		
T*Fac.	.99****	.60****	.14	.90****	.86****	.52****	.53****	1.00	
T*E&G Revs.	.99****	.58****	.14	.92****	.84****	.51****	.51****	.99****	1.00

correlated variables were eliminated. Even to a greater extent than for all institutions, the instructional expenditure proportion variable was not strongly correlated with other predictor variables. This explained its significant contribution to the dependent variable when other independent variables were controlled. The correlations between predictor variables and the dependent variable of instructional costs per student unit have been included in Table 4.13. Complexity was most strongly correlated with the dependent variable and more so in this sector than for all institutions combined. In addition, summary descriptive statistics about the 19 independent variables and the dependent variable have been included in Table 4.14.

To refine the prediction equation, the STEPWISE regression procedure of SAS (Helwig & Council, 1979) was engaged to select those variables that significantly contributed to the explanation of the variance in the dependent variable and were successful predictors. After controlling for other variables already entered into the equation, an independent variable may not have made any further significant contribution. In addition, the independent variables selected in the all institutions analysis were not necessarily the ones expected to be chosen nor in the same order for the community college sector. If the variable was still significant when entered last into the multiple regression equation, it was kept in the equation.

The 23 dummy variables were coded and initially included to remove 75% of the variance in the dependent variable attributable to repeated measures. This reduced the residual term which left less unexplained variance in the multiple regression equation. The results of the

TABLE 4.13

CORRELATIONS AMONG THE INDEPENDENT VARIABLES AND INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE COMMUNITY COLLEGE SECTOR

Independent Variable	
Time	.05
Size	-.27**
Staffing Ratio	-.57****
Complexity	.65****
Programs	-.29***
Average Faculty Salary	-.08
Educational and General Revenues	-.22**
Faculty	-.27**
Instructional Percentage	.20*
Size Squared	-.17*
Time*Size	-.18*
Time*Staffing Ratio	-.06
Time*Complexity	.36****
Time*Size Squared	-.13
Time*Programs	-.12
Time*Average Faculty Salary	.05
Time*Instructional Percentage	.07
Time*Faculty	-.17*
Time*Educational and General Revenues	-.14

$\underline{N}$ = 144; *$\underline{p} < .05$; **$\underline{p} < .01$; ***$\underline{p} < .001$; ****$\underline{p} < .0001$

TABLE 4.14

DESCRIPTIVE STATISTICS FOR THE DEPENDENT AND INDEPENDENT VARIABLES FOR THE COMMUNITY COLLEGE SECTOR

Variable	Mean	Standard Deviation	Minimum	Maximum
Inst. Cost	958.474	263.456	680.450	2061.530
Time	0.500	0.502	0.000	1.000
Inst. Pc.	51.025	4.587	39.620	62.770
Complexity	2.149	1.007	0.407	5.405
Staff Ratio	25.583	4.389	13.060	38.950
Size	2275.493	3252.098	222.000	17308.000
Size Sq.	15680566.868	50809105.209	49284.000	299566864.000
E & G Revs.	3606405.125	4577627.106	755648.000	24216317.000
Programs	29.840	15.698	3.000	85.000
Faculty	80.424	96.718	13.000	506.000
Avg. Sal.	11941.125	760.884	10022.000	13569.000
T*Size	1177.632	2662.800	0.000	17308.000
T*Staff	12.622	12.983	0.000	35.610
T*Complex.	1.089	1.330	0.000	5.405
T*Size Sq.	8428082.632	39400999.090	0.000	299566864.000
T*Programs	15.667	19.752	0.000	85.000
T*Avg. Sal.	5815.444	5857.220	0.000	13465.000
T*Inst. Pc.	25.510	25.766	0.000	58.540
T*Faculty	42.313	83.889	0.000	506.000
T*E&G Revs.	1834500.139	3766549.044	0.000	24003601.000

N = 144

stepwise multiple regression analysis have been included in Table 4.15. As the case with the all institutions analysis, the instructional expenditure proportion was the most significant variable and was initially selected by the STEPWISE procedure. It correlated less with other independent variables and was a significant predictor. Its positive regression coefficient indicated that those institutions that spent more on the instructional function had higher expenditures per student unit.

The staffing ratio, the level of institutional complexity, the amount of educational and general revenues, the number of programs, and average faculty salaries were then selected as significant predictor variables. The regression coefficient for the staffing ratio was negative as expected for this workload measure. It was positive for institutional complexity which meant that institutions that were more complex had higher instructional costs per student unit. The regression coefficient for educational and general revenues was positive which again supported H. R. Bowen's (1980) revenue theory that costs followed revenues.

After controlling for these entered variables, the number of programs had a negative coefficient which indicated that those institutions with the most programs had lower per unit costs. This was attributed to the fact that smaller institutions had to offer a minimum number of programs regardless of enrollment which meant high instructional costs per student unit. Beyond the threshold level of faculty, programs, and enrollment, programs were added proportionately to enrollment increases. Of course, there was the possibility that some

TABLE 4.15

STEPWISE REGRESSION OF INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE COMMUNITY COLLEGE SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	-127.047	---	---	---
23 Dummy Variables	---	---	---	.7500
Inst. Percent	27.609	.001	.1057	.8577
Staff Ratio	-5.720	.043	.0410	.8967
Complexity	288.660	.001	.0268	.9235
E & G Revs.	0.001	.001	.0121	.9356
Programs	-10.952	.001	.0086	.9442
Avg. Salary	-0.032	.017	.0028	.9470

Note: The 23 dummy variables for cross-sectional observations were entered first or included to control the variance from repeated measures. Individual dummy variables were aggregated by the total R^2 contribution from them. Afterwards, 19 predictor variables were inputted into the stepwise regression analysis for selection.

$\underline{N} = 144$; $\underline{F} = 70.18$; $\underline{df} = 29/144$; $\underline{p} < .0001$

of these additions were more expensive in nature which were supported from greater availability of revenues and respent economies from scale. But this was a less likely expectation in the community college sector than would be the addition of expensive graduate programs in the senior-level institutions sector. The linear relationship between per unit cost and programs, beyond the threshold number needed to effectively operate, suggested that additions with scale were not significantly more expensive than those already offered. However, the true expense of these additions may have been masked by achieved economies from scale, which were respent for this purpose, resulting in a constant level of instructional costs per student unit beyond the threshold level despite the number of programs offered.

Average faculty salary was a different variable that was selected for the community college sector in contrast to all institutions. It had a negative coefficient which meant that higher average faculty salaries were paid in those institutions that had lower instructional costs per student unit. This finding indicated that institutions with high instructional costs per student unit had more difficulty allocating resources to faculty salaries to accumulate academic resources. Many institutions in this sector with high instructional costs per student unit were operating on a small scale below their threshold level of enrollment which represented greater fixed commitments in other areas. This finding suggested that as institutions grew in size, any achieved economies were reallocated for other purposes, such as instructional salaries, which also meant a higher proportion of expenditures were spent on the instructional function.

None of the interaction variables, including the interaction of the nonlinear trend of size and time, entered the stepwise regression equation. This suggested that they did not act differently over time after a change in budgetary policy. The nature of institutional responses to revenue distress did not change the relationships among these variables. This finding suggested that the threshold level did not change for this sector. Furthermore, there was not a significant decrease in the number of programs offered as one response to revenue distress.

After these variables were selected for entry, 94.7% of the variance in instructional costs per student unit had been explained. $\underline{F}$ was equal to 70.18 which was significant for this sector's overall regression equation at the .0001 level. Thus, this equation was significant in explaining the relationship between predictor variables and instructional costs per student unit. However, these predictor variables were significant only for this entry order. Due to the magnitude of the instructional expenditure proportion variable when it was entered, this also controlled for a large portion of the indirect contribution from other independent variables' prediction of the criterion variable.

Senior-level institutions variance analysis. The same type of analysis was then performed for the senior-level institutions sector. After coding in the dummy variables to remove the variance from repeated measures, all but the sector variable were used as possible predictors of instructional costs per student unit. Since many of these institutions had a sizable number of graduate students where there was an expectancy of more expensive programs and lower staffing ratios, the graduate student proportion was added as a new predictor variable. Because of the multicollinearity concern, an intercorrelation matrix table was included in Table 4.16 to report the correlations between all independent variables. Some of the highest correlations between independent variables included those involving size, educational and general revenues, and the number of programs although these variables were expected to be strongly correlated with each other. However, all independent variables were kept and included as possible predictor variables in the stepwise regression equation where some of the variables that displayed signs of multicollinearity were eliminated. Once again, the instructional expenditure proportion variable was not strongly correlated with other predictor variables. This explained its strong contribution to the dependent variable after other independent variables were controlled. In addition, the staffing ratio correlated minimally with any other predictor variable which was in sharp contrast to the community college sector. The addition of graduate programs with their concomitant low staffing ratios, as institutions increased in scale, explained this variable's low correlation with institutional size. The correlations between predictor variables and the criterion variable have been included in Table 4.17. The amount of educational and general revenues correlated most strongly with the dependent variable. In this sector, institutional complexity was actually negatively correlated with the dependent variable. Relatedly, size was positively correlated with the dependent variable. However, the largest institutions in this sector were also more research oriented. In addition, summary descriptive statistics on the 20 independent

TABLE 4.16

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

	Time	Size	Staff Ratio	Complex.	Pgms.	Avg. Salary	E & G Revs.	Fac.	Grad. Percent	Inst. Percent
Time	1.00									
Size	.04	1.00								
Staff Ratio	.11	.10	1.00							
Complex.	.04	-.34**	-.17	1.00						
Programs	.04	.97****	.08	-.18	1.00					
Avg. Sal.	-.30**	.70****	.02	-.31**	.73****	1.00				
E & G Revs.	.06	.93****	-.02	-.21*	.94****	.70****	1.00			
Faculty	.05	.98****	-.06	-.32**	.94****	.65****	.93****	1.00		
Grad. Pc.	-.01	.78****	.12	-.17	.83****	.78****	.79****	.71****	1.00	
Inst. Pc.	-.18	-.22*	.11	-.28**	-.28**	-.22*	-.36***	-.25*	-.16	1.00
Size Sq.	.04	.97****	.04	-.25*	.96****	.71****	.95****	.96****	.71****	-.35***
T*Complex.	.93****	-.06	.09	.31**	-.01	-.36***	-.01	-.04	-.06	-.25*
T*Staff	.98****	.01	.25*	.03	.02	-.32**	.02	.01	-.02	-.15
T*Size	.67****	.56****	-.02	-.17	.54****	.15	.57****	.59****	.39****	-.18
T*Size Sq.	.46****	.63****	-.09	-.17	.61****	.29**	.67****	.69****	.42****	-.25*
T*Avg. Sal.	.99****	.12	.09	.01	.13	-.19	.15	.14	.08	-.20
T*Pgms.	.69****	.53****	-.03	-.08	.54****	.15	.56****	.57****	.40****	-.22*
T*Inst. Pc.	.97****	.01	.14	-.02	.01	-.33**	.01	-.01	-.02	-.02
T*E&G Revs.	.49****	.60****	-.10	-.13	.59****	.27**	.70****	.64****	.47****	-.27*
T*Fac.	.64****	.57****	-.09	-.16	.55****	.16	.59****	.62****	.37***	-.21*

$\underline{N} = 90$; $*\underline{p} < .05$; $**\underline{p} < .01$; $***\underline{p} < .001$; $****\underline{p} < .0001$

TABLE 4.16 (continued)

INTERCORRELATION MATRIX AMONG INDEPENDENT VARIABLES FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

	Size Sq.	Time* Complex.	Time* Staff.	Time* Size	Time* Size Sq.	Time* Avg. Sal.	Time* Pgms.	Time* Inst. %	Time* E&G Revs.	Time* Fac.
Size Sq.	1.00									
T*Complex.	-.04	1.00								
T*Staff	.01	.91****	1.00							
T*Size	.55****	.52****	.63****	1.00						
T*Size Sq.	.67****	.33**	.41****	.95****	1.00					
T*Avg. Sal.	.12	.90****	.96****	.74****	.56****	1.00				
T*Pgms.	.53****	.59****	.65****	.99****	.93****	.77****	1.00			
T*Inst. Pc.	-.02	.87****	.96****	.62****	.38***	.95****	.63****	1.00		
T*E&G Revs.	.62****	.38***	.44****	.93****	.96****	.58****	.93****	.41****	1.00	
T*Fac.	.57****	.50****	.58****	.99****	.96****	.71****	.97****	.58****	.93****	1.00

TABLE 4.17

CORRELATIONS AMONG THE INDEPENDENT VARIABLES AND INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Independent Variable	
Time	-.04
Size	.52****
Staffing Ratio	-.41****
Complexity	-.22*
Programs	.50****
Average Faculty Salary	.49****
Educational and General Revenues	.69****
Faculty	.58****
Instructional Percentage	-.17
Graduate Student Percentage	.51****
Size Squared	.52****
Time*Complexity	-.10
Time*Staffing Ratio	-.10
Time*Size	.32**
Time*Size Squared	.39****
Time*Average Faculty Salary	.03
Time*Programs	.31**
Time* Instructional Percentage	-.09
Time*Educational and General Revenues	.49****
Time*Faculty	.35***

$\underline{N} = 90$; *$\underline{p} < .05$; **$\underline{p} < .01$; ***$\underline{p} < .001$; ****$\underline{p} < .0001$

variables and the dependent variable have been included in Table 4.18.

To refine the prediction equation, the STEPWISE regression procedure of SAS (Helwig & Council, 1979) was employed to identify those variables that significantly contributed to the explanation of the variance in the dependent variable and were successful predictors. The independent variables that were selected for all colleges and universities or for the community college sector were not necessarily the ones expected to be chosen nor in the same order for the senior-level institutions sector. If the variable was still significant when entered last into the multiple regression equation, it was kept in the equation.

The 14 dummy variables were coded and included to remove 88.6% of the variance in the dependent variable attributed to repeated observations or "noise" in order to examine the real variation in the data set. This reduced the residual variance which left less unexplained variance in the multiple regression equation. The results of the stepwise multiple regression analysis have been included in Table 4.19. As the case with the community college sector and the all institutions analysis, the instructional expenditure proportion was the most significant variable and was initially selected by the STEPWISE procedure although other variables entered the equation first after they were selected. It correlated less with other independent variables and was a significant predictor. Its positive regression coefficient, after controlling for other entered variables, indicated that those institutions that spent more on the instructional function had higher per unit expenditures.

TABLE 4.18

DESCRIPTIVE STATISTICS FOR THE DEPENDENT AND INDEPENDENT VARIABLES FOR THE SENIOR-LEVEL INSTITUTIONS

Variable	Mean	Standard Deviation	Minimum	Maximum
Inst. Cost	936.214	244.913	618.000	1840.250
Time	0.500	0.503	0.000	1.000
Inst. Pc.	47.295	8.833	29.940	63.280
Complex.	0.948	0.257	0.618	1.580
Staff Ratio	19.924	2.710	14.950	28.980
Size	7787.856	6276.066	824.000	22624.000
Size Sq.	99602045.856	139475586.141	678976.000	511845376.000
E & G Revs.	28059175.000	35385921.598	2156533.000	110221561.000
Programs	68.489	53.493	10.000	197.000
Faculty	393.378	327.736	41.000	1402.000
Avg. Sal.	14896.822	1795.488	12325.000	20822.000
Grad. Pc.	10.420	10.290	0.000	41.120
T*Complex.	0.480	0.518	0.000	1.580
T*Staff	10.112	10.358	0.000	28.980
T*Size	4007.511	6048.380	0.000	22624.000
T*Size Sq.	52236572.156	114694236.323	0.000	511845376.000
T*Avg. Sal.	7183.000	7317.245	0.000	19419.000
T*Programs	35.422	51.745	0.000	197.000
T*Inst. Pc.	22.857	23.697	0.000	58.090
T*E&G Revs.	15106209.300	31127259.290	0.000	110221561.000
T*Faculty	205.244	324.481	0.000	1402.000

N = 90

TABLE 4.19

STEPWISE REGRESSION OF INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	506.499	---	---	---
14 Dummy Variables	---	---	---	.8863
Complexity	152.823	.008	.0144	.9007
Staff Ratio	-22.143	.001	.0342	.9349
Time*Staff	13.640	.001	.0001	.9350
Time*Size Sq.	0.001	.005	.0060	.9410
Time*Avg. Sal.	-0.012	.009	.0008	.9418
Time*Inst. Pc.	-1.709	.116	.0001	.9419
Inst. Percent	18.724	.001	.0376	.9795
Grad. Percent	-7.896	.114	.0008	.9803

Note: The 14 dummy variables for cross-sectional observations were entered first or included to control the variance from repeated measures. Individual dummy variables were aggregated by the total R^2 contribution from them. Afterwards, 20 predictor variables were inputted into the stepwise regression analysis for selection.

$\underline{N} = 90$; $\underline{F} = 151.34$; $\underline{df} = 22/67$; $\underline{p} < .0001$

The level of institutional complexity, the staffing ratio, the interaction of time with the staffing ratio, the interaction of time with the nonlinear trend for size, the interaction of time with average faculty salaries, the interaction of time with the instructional expenditure proportion, and the graduate student proportion then were selected as significant predictor variables. However, the graduate student proportion and the interaction of time with the instructional expenditure proportion were not significant at the .05 level but were above the cutoff point of .15 used in the STEPWISE procedure. The regression coefficient for the staffing ratio was negative as expected for this workload measure. It was positive for institutional complexity, after controlling for the entrance of the dummy variables, which meant that institutions that were more complex had higher instructional costs per student unit. This time educational and general revenues did not enter the regression equation, after controlling for other entered variables, as a significant variable which did not support H. R. Bowen's (1980) revenue theory that costs followed revenues. However, there was a strong positive correlation between instructional costs per student unit and educational and general revenues as indicated in Table 4.17 which did support his theory even though much of this relationship must have been indirect or was attributed to multicollinearity between this variable and the graduate student proportion variable.

The graduate student proportion was an additional variable included in the senior-level institutions sector analysis. This variable had a negative coefficient, after controlling for other variables already entered into the equation, which meant that there were lower instructional costs per student unit with a higher proportion of graduate students. In contrast, the average faculty salary variable was not significant for this sector but also displayed signs of multicollinearity with the graduate student proportion variable. However, many of these institutions were larger in size and devoted more resources to faculty salaries once they had covered their fixed commitments as indicated in Table 4.16. This was also suggested by the significance of the instructional expenditure proportion variable. Apparently, any savings achieved from scale were respent for instructional purposes, such as improved faculty salaries, lower staffing ratios, and more graduate programs, which supported H. R. Bowen's (1980) revenue theory.

Even though the institutional complexity variable was selected for this sector, the number of programs variable was not significant although it was highly correlated with the graduate student proportion variable. This difference was attributed to the threshold effect where a minimum number of programs were needed to effectively operate and the addition of more expensive programs especially at the graduate level. These elements pulled in opposite directions in their relationship between programs and instructional costs per student unit. Thus, the program variable was not significant which meant that more programs did not necessarily lead to lower costs per student nor did fewer programs lead to higher costs per student. There was a strong positive correlation between programs and instructional costs per student unit but this was not uniform with greater levels of these variables. Perhaps, part of the increased effect of adding expensive programs was masked by achieved economies from scale that were respent for this purpose. If so, this resulted in a gradually rising, but not significant, amount of instructional costs per student unit from the addition of more expensive programs.

Unlike the community college sector, several interaction variables entered the stepwise regression equation which implied that their relationships were different over time after a change in budgetary policy. The interaction between time and the staffing ratio was significant which suggested that these variables differed over time in their relationship with instructional costs per student unit. The regression coefficient was positive which meant that this interaction variable had increased over time. This occurred from institutional responses to increase efficiency in their adaptation to revenue distress. This was largely achieved through the elimination of part-time faculty and small-sized classes since the total number of full-time faculty increased over time.

The interaction between time and average faculty salary was significant which meant that these variables' relationship to the dependent variable changed over time. The regression coefficient was negative which indicated that this interaction variable decreased over time subsequent to the change in budgetary policy. This occurred from salary distress, where real increases were less than inflation, as institutional responses to revenue distress. This was another efficiency-related response to revenue distress. Part of this outcome may have been attributed to the state's inability to fund salary increases commensurate with the rate of inflation.

Even though the interaction between time and the instructional expenditure proportion was not significant at the .05 level, it was selected to enter the stepwise regression equation. The regression coefficient was negative which indicated that this interaction variable decreased over time subsequent to the change in budgetary policy. In their attempt to cut instructional expenditures per student unit in response to revenue distress, institutions in this sector spent less on the instructional function after the change in policy. This supported H. R. Bowen's (1980) revenue theory which suggested that as institutions spent less, a smaller proportion of expenditures would be spent on the instructional function for items such as increased salaries or more generous staffing ratios. It also indicated that these institutions were trying to reduce this variable which was highly significant in its contribution to the prediction of the dependent variable and reflected attempts to increase efficiency after the policy change. This reduction was largely achieved through salary distress and increased staffing ratios. Thus, one type of institutional response to revenue decline was to reduce the level of academic resources which was needed to support one of the primary missions of these institutions.

The interaction of time and the nonlinear trend for size was significant indicating that the threshold level for this group of institutions changed. With the increase in the staffing ratio as an efficiency-related response to revenue distress, the range over which economies of scale were achieved was slightly greater after the change in policy as indicated by the positive regression coefficient. According to Maynard (1971), an increase in the staffing ratio meant that economies of scale were achieved over a larger range of enrollment before average costs became linear. Since most of Virginia's institutions in this sector were fairly large, they were already beyond the threshold level of enrollment while the Commonwealth of Virginia acted to buffer those institutions below this level.

After these variables were selected for entry, 98% of the variance in instructional costs per student unit had been explained. $\underline{F}$ was equal to 151.34 which was significant for this sector's overall regression equation at the .0001 level. Thus, this equation was significant in explaining the relationship between predictor variables and instructional costs per student unit. However, these predictor variables were significant only for this entry order. Due to the magnitude of the instructional expenditure proportion variable when entered, it also controlled for much of the indirect contribution from other independent variables. Thus, spending more for the instructional function tended to mask any achieved savings from scale. This supported H. R. Bowen's (1980) revenue theory which suggested that the availability of additional revenues would be spent, along with achieved economies from scale, for other educational purposes. This included the instructional function through the addition of programs even if faculty salaries did not increase.

Hypothesis two stated that there would be no changes among predictor variables that determined the variance in instructional costs per student unit over time following a change in the student-faculty ratio within or between the two educational sectors. A pooled cross-sectional time-series multiple regression analysis was used to test this hypothesis. Since there were no significant interactions between independent variables and time for all institutions, the null hypothesis was accepted. However, an interaction effect, that was significant, was discovered between the two educational sectors. Thus, the hypothesis of no difference between the two educational sectors was rejected. There were four interactions between time and the independent variables, including the nonlinear trend for size, in the senior-level institutions sector's regression equation which suggested that these variables' relationship to the dependent variable had changed subsequent to the change in policy. This was partly attributable to institutional responses from a condition of revenue distress. Nonetheless, these directional changes may have had other implications on institutions' financial stability after the change in budgetary policy.

The relationship between instructional costs per student unit and size. In the process of conducting this analysis, certain additional relationships among the dependent and independent variables were considered. One example was the relationship between instructional costs per student unit and size. This was examined for all institutions by coding the 38 dummy variables for matched observations and entering these into a multiple regression equation using the GLM procedure of SAS (Helwig & Council, 1979). Then size, the nonlinear trend for size, the interaction of time and size, and the interaction of time and the nonlinear trend for size were entered as predictor variables. The result of this analysis has been included in Table 4.20. Size and its nonlinear trend in the quadratic form were significant variables in explaining the variance in the criterion variable instructional costs per student unit. However, neither variable interacted significantly

TABLE 4.20

MULTIPLE REGRESSION OF THE LINEAR AND NONLINEAR TREND OF SIZE AND THEIR INTERACTIONS WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	938.991	---	---	---
38 Dummy Variables	---	---	---	.7981
Size	-0.239	.001	.0041	.8022
Size Sq.	0.001	.004	.0152	.8174
Time*Size	0.006	.475	.0017	.8191
Time*Size Sq.	-0.001	.812	.0001	.8192

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 234; $\underline{F}$ = 20.60; $\underline{df}$ = 42/191; $\underline{p} < .0001$

with time which suggested that there was no change in the shape of these relationships after a change in budgetary policy and institutional responses to revenue distress. The significance of the nonlinear trend for size indicated that the relation between these variables was curvilinear. Per unit costs initially declined with scale but then increased at higher levels as indicated by the positive regression coefficient which suggested that diseconomies existed with larger scale beyond an optimal range or size. The negative regression coefficient for size indicated that there were economies of scale with size.

The same analysis was then performed for the community college sector. The result of this analysis has been included in Table 4.21. The same relationships emerged for this sector as for the analysis of all institutions except that the interaction of time and size was closer to being significant. The negative regression coefficient for size was larger which meant that the degree of achieved economies from scale was greater in this sector.

The same analysis was then performed for the senior-level institutions sector. The result of this analysis has been included in Table 4.22. The same variables emerged as significant to the prediction of the dependent variable. However, the regression coefficient for the interaction of time and the nonlinear trend for size was positive which was the opposite from the community college sector. It was also the reverse for the interaction of time and size even though the interaction was not significant.

<u>The relationship between institutional complexity and size</u>. Another relationship considered during this analysis was between the

TABLE 4.21

MULTIPLE REGRESSION OF THE LINEAR AND NONLINEAR TREND OF SIZE AND THEIR INTERACTIONS WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE COMMUNITY-COLLEGE SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	1103.444	---	---	---
23 Dummy Variables	---	---	---	.7500
Size	-0.474	.001	.0108	.7608
Size Sq.	0.001	.014	.0115	.7723
Time*Size	0.030	.077	.0027	.7750
Time*Size Sq.	-0.001	.166	.0037	.7787

Note: The 23 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 144; $\underline{F}$ = 15.12; $\underline{df}$ = 27/116; $\underline{p} < .0001$

TABLE 4.22

MULTIPLE REGRESSION OF THE LINEAR AND NONLINEAR TREND OF SIZE AND THEIR INTERACTIONS WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTRUCTIONAL COSTS PER STUDENT UNIT FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	1378.409	---	---	---
14 Dummy Variables	---	---	---	.8863
Size	-0.142	.005	.0018	.8881
Size Sq.	0.001	.027	.0226	.9107
Time*Size	-0.003	.582	.0029	.9136
Time*Size Sq.	0.001	.264	.0015	.9151

Note: The 14 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 90; $\underline{F}$ = 42.50; $\underline{df}$ = 18/71; $\underline{p} < .0001$

independent variables institutional complexity and size. This was examined for all institutions by coding the 38 dummy variables for repeated measures and entering these into a multiple regression equation using the GLM procedure of SAS (Helwig & Council, 1979). Then size and its interaction with time were entered as predictor variables. The result of this analysis has been included in Table 4.23. Size was significant as a predictor of institutional complexity. The negative regression coefficient for size indicated the threshold effect. Extremely small institutions had to offer a minimum number of programs which meant their complexity levels were high. Beyond this threshold level, institutional complexity was linear to increased enrollment levels. Therefore, this relationship was stronger for smaller institutions with higher complexity levels.

There was also a significant interaction between time and size in relation to institutional complexity. This suggested that there was a change in the shape of these variables' relationship after a change in budgetary policy. The positive regression coefficient indicated that size had increased after the policy change. This meant that the threshold effect would have been extended over a greater scale before complexity became linear to size. The correlation coefficients for the relationship between these two independent variables and the dependent variable were both negative as reported in Table 4.8 which also suggested that the shape of the threshold effect had changed over time.

Relatedly, the number of faculty variable was significantly correlated with institutional complexity. This supported McLaughlin's et al. (1980) finding that the number of faculty influenced

TABLE 4.23

MULTIPLE REGRESSION OF SIZE AND ITS INTERACTION WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	0.583	---	---	---
38 Dummy Variables	---	---	---	.9618
Size	-0.001	.006	.0008	.9626
Time*Size	0.001	.049	.0007	.9633

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 234; $\underline{F}$ = 126.78; $\underline{df}$ = 40/193; $\underline{p} < .0001$

institutional complexity. However, the correlation was negative which contrasted with their results but this was attributed to those institutions below a threshold level. This relationship was linear beyond this range which indicated that institutions continued to add faculty at about the same rate with scale thus maintaining a constant level of institutional complexity in relation to faculty. Those institutions with high complexity levels were smaller without a threshold level of enrollment. This resulted in a smaller staffing ratio for these institutions when a threshold number of faculty were required to staff a minimum number of essential programs. Beyond this range, additional faculty meant that complexity did not fluctuate with increased scale as programs were proportionately added.

The same analysis was then performed for the community college sector. The result of this analysis has been included in Table 4.24. Size was significant as a predictor of institutional complexity. The negative regression coefficient for size indicated the threshold number of programs that had to be offered which meant high complexity levels when there were small enrollments. After this point, this relationship became linear to increased scale. There was also a significant interaction between time and size as a predictor of institutional complexity after controlling for the entrance of the size variable. This indicated that there was a change in the shape of these variables' relationship over time. The positive regression coefficient indicated that size had increased after the change in budgetary policy which would have extended the range of the threshold effect. The intercept was higher for this sector which reflected more smaller institutions with higher

TABLE 4.24

MULTIPLE REGRESSION OF SIZE AND ITS INTERACTION WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR THE COMMUNITY COLLEGE SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	0.793	---	---	---
23 Dummy Variables	---	---	---	.9437
Size	-0.001	.001	.0017	.9454
Time*Size	0.001	.009	.0031	.9485

Note: The 23 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 144; $\underline{F}$ = 86.87; $\underline{df}$ = 25/118; $\underline{p} < .0001$

institutional complexity levels.

The same analysis was then performed for the senior-level institutions sector. The result of this analysis has been included in Table 4.25. Size was also significant as a predictor of institutional complexity. The negative regression coefficient for size indicated the threshold number of programs that had to be offered despite enrollment. After this point, this relationship became linear to increased scale but then complexity increased again in the largest institutions as more graduate programs were offered which required additional faculty. This supported the previous finding that instructional costs per student unit were higher in the largest institutions for the senior-level institutions sector. This was attributed to their increased institutional complexity levels. There was not a significant interaction between time and size in relation to institutional complexity after controlling for the entrance of the size variable. However, it bordered as being significant at the .05 level. Thus, there was not a change in the shape of these variables' relationship after the change in budgetary policy. However, the correlation between these two variables was not as strong for this sector. These results suggested different behavior patterns between the sectors on the interaction variable. Size had proportionately increased more for the community college sector after the change in budgetary policy which may have been in response to revenue distress even though these institutions were also growing before the policy change.

Multiple Regression Analysis of Institutional Complexity

In this section, the importance of time and its contribution as a

TABLE 4.25

MULTIPLE REGRESSION OF SIZE AND ITS INTERACTION WITH TIME AS INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	1.518	---	---	---
14 Dummy Variables	---	---	---	.8921
Size	-0.001	.006	.0058	.8979
Time*Size	0.001	.054	.0051	.9030

Note: The 14 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 90; $\underline{F}$ = 42.49; $\underline{df}$ = 16/73; $\underline{p} < .0001$

predictor variable of institutional complexity is described. Initially, this analysis is performed for all institutions combined. Then this analysis is conducted for each individual sector.

All institutions analysis. After coding in the dummy variables to remove the variance from matched observations, time was included as an independent variable to test if there was a significant difference in institutional complexity during the three-year period after the change in budgetary policy for all institutions. As reported in Table 4.26, time, as an independent variable, was not significant in explaining any difference in institutional complexity. Actually, institutional complexity increased after the change in budgetary policy as indicated in Table 4.27. However, there was not a uniform movement across the years when viewed separately as indicated in Figure 4.4. This increase in institutional complexity may have been in response to distressed conditions as institutions added more programs in new areas to maintain or increase enrollments from increased competition for students and the revenues they brought to institutions both directly and indirectly.

Community college sector analysis. This analysis was also performed for the community college sector. Dummy variables were coded to remove the variance from cross-sectional observations. As reported in Table 4.28, time was not significant, as an independent variable, in explaining any difference in institutional complexity. The regression coefficient was positive which meant that institutional complexity increased after the change in policy as indicated in Table 4.29. However, there was not a uniform movement across the years as indicated in Figure 4.5. Adding programs along with increased size was a response

TABLE 4.26

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	0.462	---	---	---
38 Dummy Variables	---	---	---	.9618
Time	0.044	.116	.0005	.9623

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N} = 234$; $\underline{F} = 127.04$; $\underline{df} = 39/194$; $\underline{p} < .0001$

TABLE 4.27

AVERAGE INSTITUTIONAL COMPLEXITY BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR ALL INSTITUTIONS

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Institutional Complexity	1.6654	1.7091

N = 234

FIGURE 4.4

LEVEL OF INSTITUTIONAL COMPLEXITY FOR ALL INSTITUTIONS

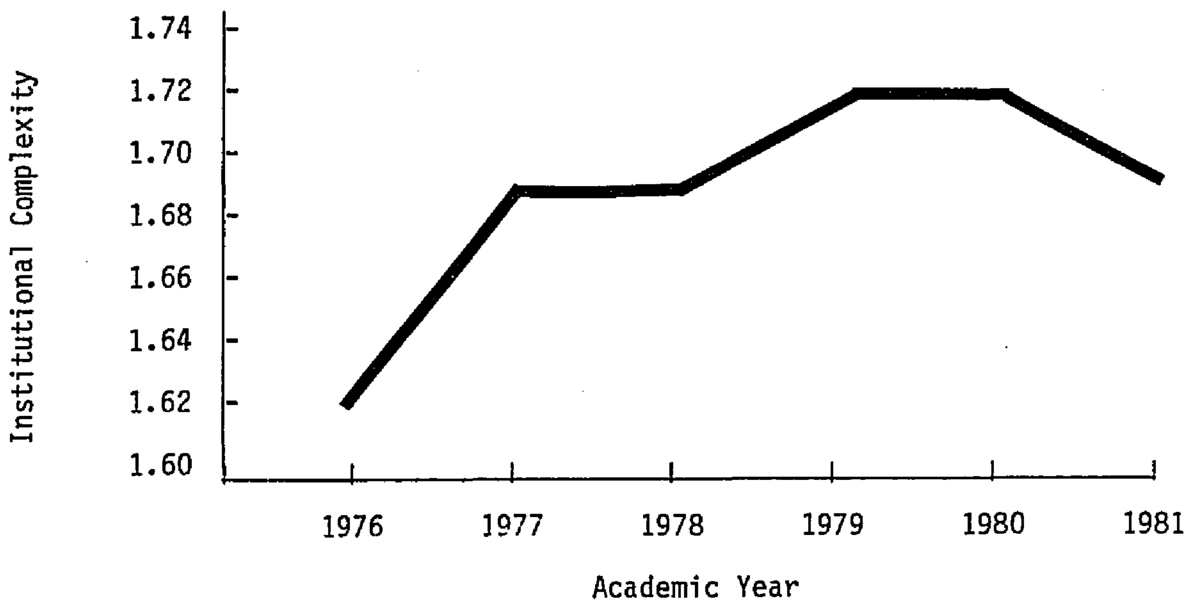


TABLE 4.28

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR THE COMMUNITY COLLEGE SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	0.455	---	---	---
23 Dummy Variables	---	---	---	.9437
Time	0.057	.190	.0008	.9445

Note: The 23 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 144; $\underline{F}$ = 84.34; $\underline{df}$ = 24/119; $\underline{p} < .0001$

TABLE 4.29

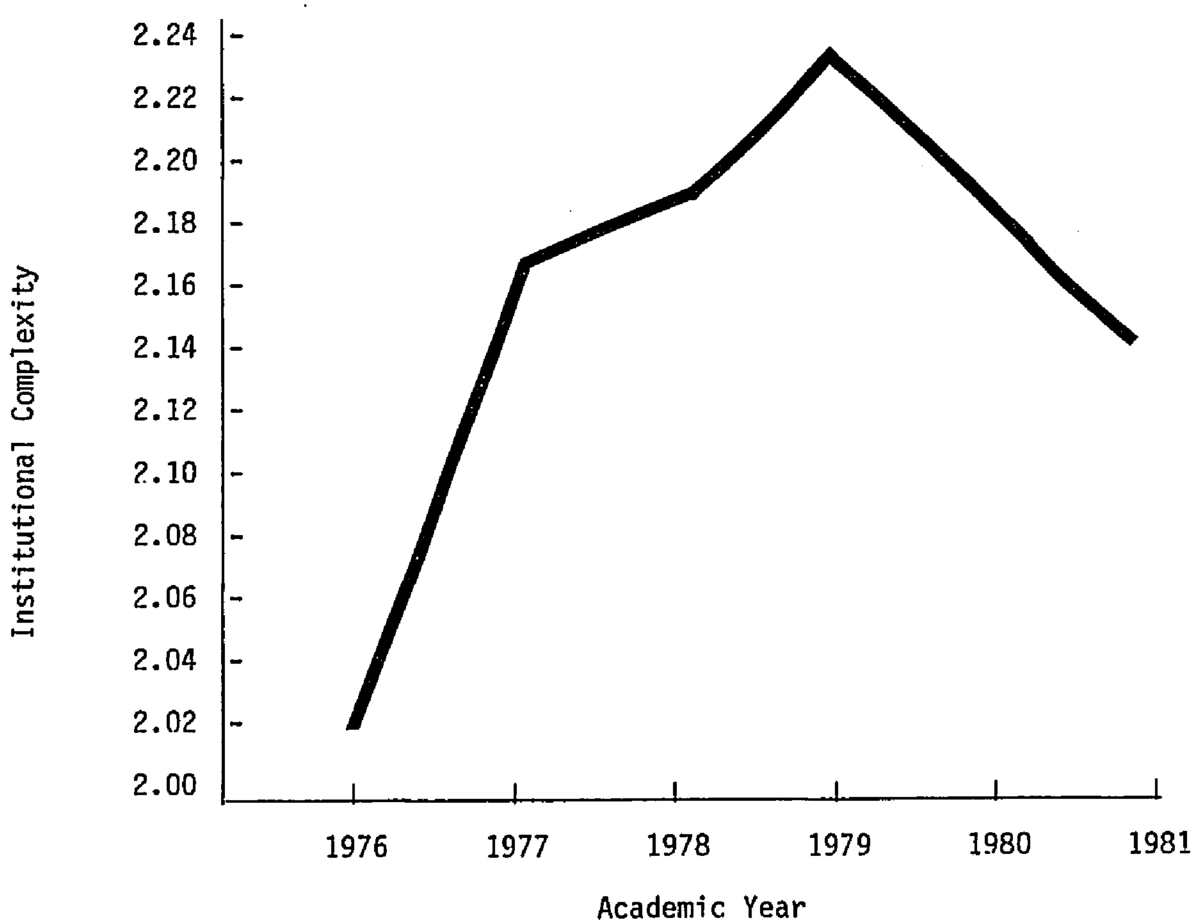
AVERAGE INSTITUTIONAL COMPLEXITY BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR THE COMMUNITY COLLEGE SECTOR

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Institutional Complexity	2.1205	2.1776

N = 144

FIGURE 4.5

LEVEL OF INSTITUTIONAL COMPLEXITY FOR THE COMMUNITY COLLEGE SECTOR



that community colleges also implemented before and during distressed conditions. However, one year after the change in policy, the level of institutional complexity declined for the next two years even though it increased for the three-year period subsequent to the change in policy. Since these institutions were still growing, this indicated that they did not add programs as rapidly to increased scale for these two years.

Senior-level institutions analysis. This analysis was then performed for the senior-level institutions sector. After coding the dummy variables to remove the variance from repeated measures, time was entered as an independent variable. As reported in Table 4.30, time was not significant, as an independent variable, in explaining any difference in institutional complexity. This variable also increased for this sector after the change in the budget formula as indicated in Table 4.31. However, there was not a uniform movement across the years as indicated in Figure 4.6. During the most recent year, there was a decrease in this variable.

Because the findings were the same for the two individual sectors, no interaction effect was suggested and was not tested. The effect of the change in policy was the same in both sectors. Since there had been no reduction in full-time faculty even though staffing ratios generally increased with scale, the level of institutional complexity remained unchanged as more programs were added than deleted. Thus, this variable remained linear to size once an institution reached its threshold level of enrollment.

Hypothesis three stated that there would be no difference in the level of institutional complexity over time following a change in the

TABLE 4.30

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF INSTITUTIONAL COMPLEXITY FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	1.220	---	---	---
14 Dummy Variables	---	---	---	.8921
Time	0.022	.254	.0019	.8940

Note: The 14 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N} = 90$; $\underline{F} = 41.62$; $\underline{df} = 15/74$; $\underline{p} < .0001$

TABLE 4.31

AVERAGE INSTITUTIONAL COMPLEXITY BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

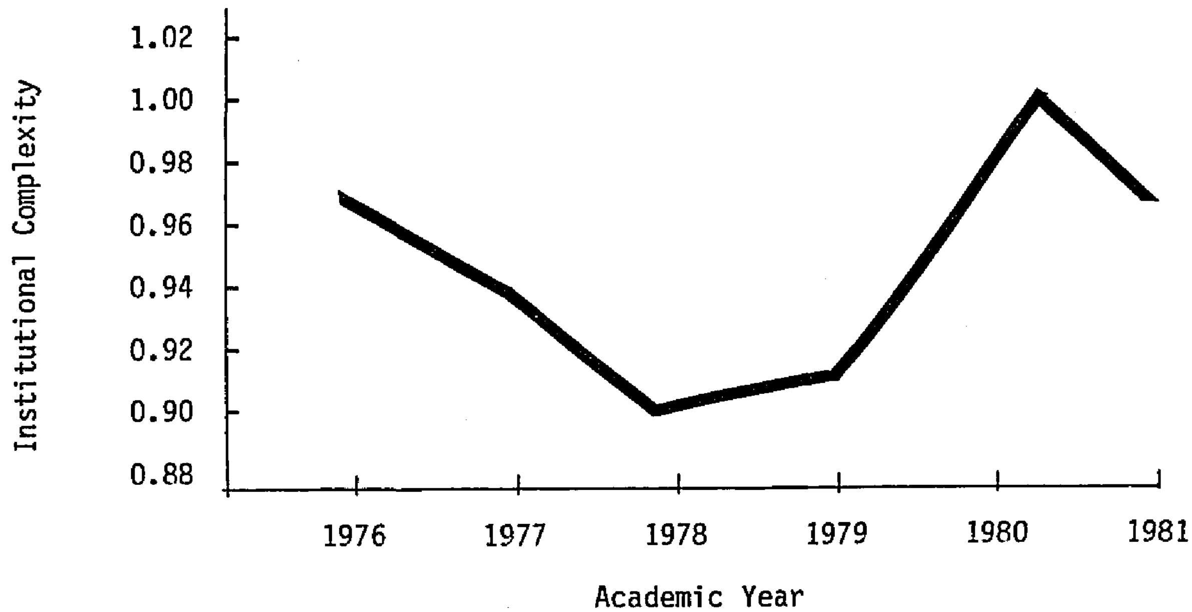
Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Institutional Complexity	0.9372	0.9595

N = 90

FIGURE 4.6

LEVEL OF INSTITUTIONAL COMPLEXITY FOR THE

SENIOR-LEVEL INSTITUTIONS SECTOR



student-faculty ratio within or between the two educational sectors. A pooled cross-sectional time-series multiple regression analysis was used to test this hypothesis. The *p* value of .116 for the independent variable time was not significant for all institutions. Thus, the null hypothesis was accepted. In addition, no interaction effect was suggested since the result of this analysis was the same for both individual sectors. Therefore, the hypothesis of no difference between the two educational sectors was also accepted.

Assessing Institutional Financial Stability

In this section, the assessment of institutional financial stability for each individual sector is presented. Initially, this assessment is presented for each sector's institutions based upon their static indicators. Then institutions are assessed by each sector based upon their change indicators. Afterwards, an analysis is included for all institutions that considers the relationship between current financial stability and time. Finally, an analysis that considers hypothesized predictor variables' contribution to the explanation of the variance in current institutional financial stability is included for all institutions.

Assessing the senior-level institutions sector based upon static indicators. For an adequate comparison, this analysis was performed separately for each sector. The findings from this analysis for static indicators in the senior-level institutions sector have been included in Table 4.32. For the three years before the change in budgetary policy, most of these institutions were in the stable category. Some institutions were weak on some of these indicators but when averaged;

TABLE 4.32

ASSESSMENT OF CURRENT FINANCIAL STABILITY BY INSTITUTION FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Position	1975-1976[a]	1976-1977	1977-1978	1978-1979	1979-1980	1980-1981
Strong[b]	1	1	0	0	0	0
Stable	14	13	15	15	15	15
Weak[c]	0	1	0	0	0	0

Note: The assessment was based upon a composite measure computed from the *z* scores of five static indicators for each institution.

[a] *N* = 15

[b] Reflects a composite *z* score of one or more standard deviations above the mean.

[c] Reflects a composite *z* score of one or more standard deviations below the mean.

weaknesses in some indicators were offset by strengths in others. The findings in Table 4.32 represent an assessment from an aggregate measure of financial stability. On any given indicator, it was expected that certain institutions would be below the mean. To prevent circularity in the analysis, a composite index was developed where strengths and weaknesses would be offset (See Appendix I). To be weak on the composite index, an institution had to be weak on most of the static indicators used to assess financial stability such as the staffing ratio.

Analyzing institutions before the change in policy was necessary to have an indication of where institutions were positioned before responses to revenue distress were implemented after the policy change. This way any deterioration in financial stability, as a response to revenue distress, could be separated from any trend towards deterioration from other influences before the policy change. If institutions were effective in responding to decline, then there should have been no change in financial stability.

For the first year included in this study, only one institution's financial stability was rated as strong. This was the flagship university for this state which was more diverse in its revenue sources and composition of programs. Therefore, it was not unexpected to find this institution's strong rating since it should have been more immune to declining conditions with its greater diversity. No institutions were rated in the weak category based on a standard score of more than one standard deviation below the mean. However, several institutions were close to this point. In 1976-1977, one institution had slipped into the weak category while it was stable during the preceding year. It was the smallest institution in this sector with less diversity of revenues. However, this institution pulled itself back into the stable category during the following year though there was not a great amount of improvement between these years.

Subsequent to the change in budgetary policy, no institutions in this sector were rated in the strong category. The flagship university had slipped out of this category during the year before the policy change. However, no institutions were in the weak category. All of these institutions remained in the stable category for all three years subsequent to the policy change. Some institutions did have lower composite scores in the most recent year even though they were still in the stable category. Using a standard deviation of plus or minus one as a cutoff for the three categories of financial stability, there was little movement by institutions in this sector and none after the change in policy. However, it should be pointed out that these indicators did not measure all dimensions. An institution's financial stability was an elusive concept to measure especially when there were many intangible factors that escaped quantification.

<u>Assessing the community college sector based upon static indicators</u>. The findings from this analysis for static indicators in the community college sector have been included in Table 4.33. These findings were also an assessment from an aggregate measure of financial stability. For the three years before the change in the budget formula, most of these institutions were in the stable category. One institution was consistently stronger than the others with a composite aggregate

TABLE 4.33

ASSESSMENT OF CURRENT FINANCIAL STABILITY BY INSTITUTION FOR THE COMMUNITY COLLEGE SECTOR

Position	1975-1976[a]	1976-1977	1977-1978	1978-1979	1979-1980	1980-1981
Strong[b]	1	2	1	2	1	2
Stable	23	21	23	22	23	22
Weak[c]	0	1	0	0	0	0

Note: The assessment was based upon a composite measure computed from the *z* scores of five static indicators for each institution.

[a] *N* = 24

[b] Reflects a composite *z* score of one or more standard deviations above the mean.

[c] Reflects a composite *z* score of one or more standard deviations below the mean.

score of over two standard deviations above the mean in each of these three years (See Appendix I). This institution was also much larger and more diverse in its programs, thus it was not unexpected to find its strong rating. During this interval, one other institution moved into and out of the strong category. However, its composite score was high for the stable category during the other two years. It was also the second largest institution in this sector. One institution had moved into the weak category during 1976-1977 but turned around and was solidly back into the stable category during the following year. This was achieved by a large increase in the instructional expenditure proportion for that year when there was a dramatic increase in revenues. This institution was also one of the smallest in this sector. Despite the overall stability of most institutions on their composite scores, some institutions were weak on some indicators but these were offset by strengths in others.

Subsequent to the change in policy, there was very little change among the ranking of institutions. The largest institution remained in the strong category while the second largest institution shifted between the strong and stable categories. However, no institutions were in the weak category. The rest of the institutions remained in the stable category for all three years subsequent to the change in budgetary policy. There was also not as strong a trend toward weakness for those institutions in the stable category for this sector. Using a standard deviation of plus or minus one as a cutoff for the three categories of financial stability as used by Minter and H. R. Bowen (1980b), there was little movement by institutions in this sector and there was only one institution that rotated between the strong and stable categories before and after the change in policy.

Assessing the senior-level institutions sector based upon change indicators. A similar type of analysis was also performed separately for each sector's change indicators. The findings from this analysis for change indicators in the senior-level institutions sector have been included in Table 4.34. Since 1975-1976 was the first year that complete data were available, no change assessment was performed for this academic year. However, changes between that year and 1976-1977 were assessed along with those in each of the four subsequent years. Thus, there were only two years of complete data for change indicators before the policy change. For the two years before the change in budgetary policy, most of these institutions were in the stable category. Some institutions were weak on some of these indicators but when averaged, weaknesses in some indicators were offset by strengths in others. The findings in Table 4.34 represented an assessment from an aggregate measure of financial stability. On any given indicator, it was expected that certain institutions would be below the mean. To prevent circularity in the analysis, a composite index was developed where strengths and weaknesses would be offset. To be weak on the composite index, an institution had to be weak on most of the change indicators used to assess financial stability such as the percentage change in FTE enrollment.

Analyzing institutions before the change in policy was necessary to develop a trend of the direction institutions were headed before responses to revenue distress were implemented after the change in

TABLE 4.34

ASSESSMENT OF CHANGE IN FINANCIAL STABILITY BY INSTITUTION FOR THE SENIOR-LEVEL INSTITUTIONS SECTOR

Position	1976-1977[a]	1977-1978	1978-1979	1979-1980	1980-1981
Resilient[b]	0	1	0	0	0
Stable	14	14	15	15	14
Declined[c]	1	0	0	0	1

Note: The assessment was based upon a composite measure computed from the *z* scores of five change indicators for each institution.

[a]*N* = 15

[b]Reflects a composite *z* score of one or more standard deviations above the mean.

[c]Reflects a composite *z* score of one or more standard deviations below the mean.

budgetary policy. This way, any erosion in financial stability, as a response to revenue distress, could be separated from any tendency towards deterioration from other influences before the policy change. If institutions were effective in responding to decline, then there should have been no change in direction in financial stability.

One of the change indicators used in this assessment was the change in average faculty salary. Instead of using the average change across all ranks, $\underline{z}$ scores were computed separately for the academic ranks of (1) professor, (2) associate professor, (3) assistant professor, and (4) instructor. These four $\underline{z}$ scores were combined into one composite indicator for the change in average faculty salary by dividing the average of the four ranks by the number of ranks. In this manner, a rank that was resilient would have been separately treated along with those that had declined. An institution may have made a commitment to enhance salaries in one rank in order to achieve excellence without making the same commitment for the other ranks. If so, this rank was equally weighted with the others in this assessment.

For 1976-1977, no institutions were rated as resilient while one was rated as declining based on a standard score of at least plus or minus one standard deviation from the mean. The institution that had declined was the smallest one in this sector with less diversity of revenue sources and programs. In 1977-1978, this institution had moved back into the stable category. In addition, one institution had moved into the resilient category. This was the state's land-grant university which offered a diversity of programs. These were the only changes before the policy change.

Subsequent to the change in budgetary policy, no institutions in this sector were rated in the resilient category. The land-grant university slipped back into the stable category after the policy change. For the first two years after the change in policy, no institutions were in the declining category. During 1980-1981, one institution slipped into this category when there was a sizable decrease in revenues after inflation. The rest of the institutions remained in the stable category across this three-year period subsequent to the change in policy.

Some institutions did have lower composite scores in the most recent year even though they were still in the stable category. But, this was not as pronounced for the change indicators as it was for the static indicators. Using a standard deviation of plus or minus one as the cutoff for the three change categories of financial stability, there was little movement by institutions in this sector and only one downward rating after the change in policy. Once again, it should be pointed out that these indicators did not measure all dimensions. Factors such as the morale of the faculty, the condition of the physical plant, or the ability to raise revenues were not directly reflected in these composite scores. Assessing the changes in an institution's financial stability was an elusive concept to measure especially when there were many intangible factors that eluded quantification.

<u>Assessing the community college sector based upon change indicators</u>. The results from this analysis for change indicators have been included in Table 4.35. These findings were also an assessment from an aggregate measure of financial stability. For the two years before the

TABLE 4.35

ASSESSMENT OF CHANGE IN FINANCIAL STABILITY BY INSTITUTION FOR THE COMMUNITY COLLEGE SECTOR

Position	1976-1977[a]	1977-1978	1978-1979	1979-1980	1980-1981
Resilient[b]	3	1	0	2	1
Stable	21	23	23	21	23
Declined[c]	0	0	1	1	0

Note: The assessment was based upon a composite measure computed from the *z* scores of five change indicators for each institution.

[a] *N* = 24

[b] Reflects a composite *z* score of one or more standard deviations above the mean.

[c] Reflects a composite *z* score of one or more standard deviations below the mean.

change in the budget formula, most of these institutions were in the stable category. For 1976-1977, three institutions were in the resilient category whereas only one institution was in this category during the following year. None of the three institutions that were in this category during the first year were in this category during the second year. Each had lost considerable ground when the change in revenues after inflation was considerably lower during the second year. The institution that was in the resilient category during the second year had been in the stable category during the preceding year. Its movement was attributed to a large increase in revenues after inflation during the second year. Thus, there was considerable movement for those institutions that switched categories. It appeared to be difficult to stay in the resilient category once an institution achieved this status. However, no institutions were in the declining category for either of these two years. Despite the overall stability of most institutions on their composite scores, some institutions were weak on some indicators but these were offset by strengths in others.

Subsequent to the change in budgetary policy, there was little shifting among the ranking of institutions. For the first year after the change in policy, no institutions in this sector were in the resilient category. During the following year, two institutions had moved into the resilient category when revenues increased, after inflation, above the average. During the most recent year, only one of these institutions remained in this category as the other had slipped back into the stable category when the change in revenues after inflation was lower than the average. Thus, it was still difficult for an institution to remain in the resilient category once it had achieved this status.

For the first two years after the change in policy, one institution was in the declining category. However, it was a different institution for each year. The institution in this category during the first year slipped from the stable category the preceding year when all of its indicators declined. However, by 1979-1980 it had moved back into the stable category even though its composite score was still low for this category. The institution in the declining category during the second year had slid from the stable category during the preceding year when there was a decline in enrollment. For the most recent year, this institution had moved back convincingly into the stable category when enrollments were once again increasing. Thus, it appeared that once an institution reached the declining category, it responded appropriately and quickly enough to move back into the stable category. The rest of the institutions remained in the stable category for all three years subsequent to the change in budgetary policy.

There was not a strong trend towards deterioration in the stable category for the community college sector. Using a standard deviation of plus or minus one as the cutoff for the three change categories of financial stability, there was little movement by institutions in this sector but more so than for the static indicators. Thus, most of Virginia's institutions had been able to maintain stability during a period of revenue distress. However, much of this stability had been achieved through the response of salary distress. Thus, academic resources were depleted which did not improve faculty morale nor the ability of institutions to attract quality faculty which was a valued objective of this state. There was a delicate position of financial stability among Virginia's colleges and universities since few institutions were in the resilient category. Furthermore, intangibles may have also been depleted which were not reflected in these composite scores.

<u>The relationship between current institutional financial stability and time</u>. In the process of conducting this assessment of institutional financial stability, certain additional relationships were considered. One example was the relationship between current financial stability, based on the composite score for static indicators, and time. This was examined for all institutions by coding the 38 dummy variables for repeated measures and entering these into a multiple regression equation using the GLM procedure of SAS (Helwig & Council, 1979). Then time was entered as an independent variable to test if there was a significant difference in financial stability during the three-year period after the change in budgetary policy. The result of this analysis has been included in Table 4.36. Time, as an independent variable, was not significant in explaining any difference in financial stability. The regression coefficient for time was positive which indicated that institutions' financial stability had improved slightly after the change in policy as indicated in Table 4.37. However, there was not a uniform movement across the years when viewed separately as indicated in Figure 4.7. From this finding and the previous assessment of financial stability, it appeared that Virginia's institutions were successful in maintaining their financial stability when responding to

TABLE 4.36

MULTIPLE REGRESSION OF TIME AS AN INDEPENDENT VARIABLE'S CONTRIBUTION TO THE PREDICTION OF CURRENT FINANCIAL STABILITY FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	-0.436	---	---	---
38 Dummy Variables	---	---	---	.9541
Time	0.007	.723	.0001	.9542

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N} = 234$; $\underline{F} = 103.48$; $\underline{df} = 39/194$; $\underline{p} < .0001$

TABLE 4.37

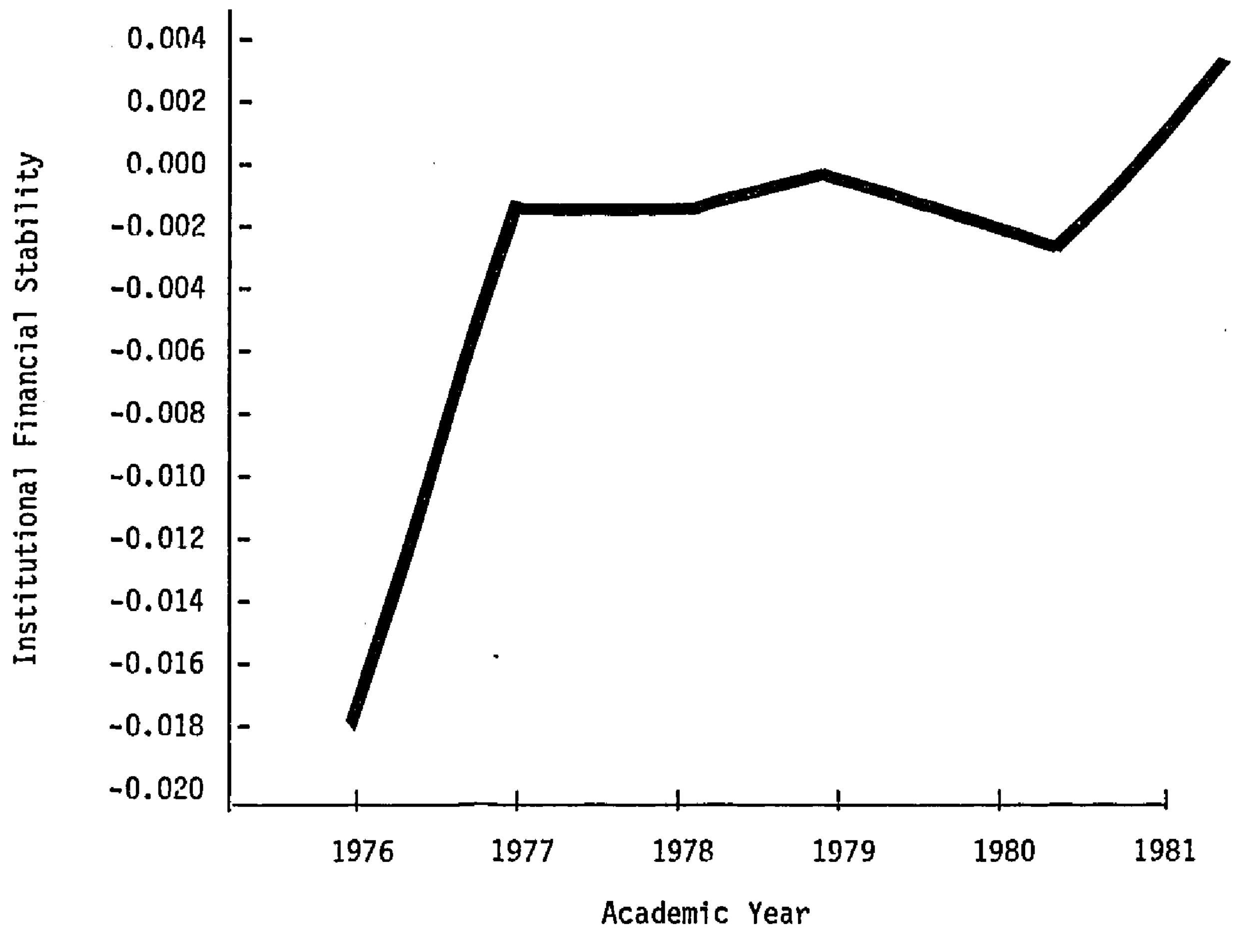
AVERAGE INSTITUTIONAL FINANCIAL STABILITY ASSESSMENT BASED UPON STATIC INDICATORS BEFORE AND AFTER A CHANGE IN THE STUDENT-FACULTY RATIO FOR ALL INSTITUTIONS

Variable	1975-1976 - 1977-1978 (Before)	1978-1979 - 1980-1981 (After)
Institutional Financial Stability	-0.0071	-0.0001

N = 234

FIGURE 4.7

CURRENT INSTITUTIONAL FINANCIAL STABILITY FOR ALL INSTITUTIONS



conditions of revenue distress. Since the assessment of financial stability between the sectors yielded similar results, this analysis was not conducted for each individual sector.

The relationship between current institutional financial stability and other independent variables. Another relationship considered in the analysis was between current institutional financial stability, based upon the composite score for static indicators, and size, instructional costs per student unit, institutional complexity, the instructional expenditure proportion, the interaction of time and sector, and the interaction of time and instructional costs per student unit. This was examined for all institutions by coding the 38 dummy variables for repeated measures and entering them into a multiple regression equation using the GLM procedure of SAS (Helwig & Council, 1979). Then these independent variables were entered as predictor variables. The result of this analysis has been included in Table 4.38. Size was significant as a predictor of financial stability. However, this variable was used as an indicator to assess current institutional financial stability. In addition, the instructional expenditure proportion was significant but was also used as an indicator to assess current institutional financial stability.

The independent variables instructional costs per student unit and institutional complexity were added to determine to what extent they influenced current institutional financial stability. After controlling for other variables already entered into the regression equation, instructional costs per student unit was not significant in predicting the criterion variable. However, institutional complexity was related

TABLE 4.38

MULTIPLE REGRESSION OF INDEPENDENT VARIABLES' CONTRIBUTION TO THE PREDICTION OF CURRENT FINANCIAL STABILITY FOR ALL INSTITUTIONS

Variable	B Value	Significance of Regression Coefficient	Incremental R^2	Total R^2
Intercept	-1.781	---	---	---
38 Dummy Variables	---	---	---	.9541
Size	0.001	.001	.0018	.9559
Inst. Cost	-0.001	.174	.0022	.9581
Complexity	-0.110	.034	.0043	.9624
Inst. Percent	0.034	.001	.0099	.9723
Time*Sector	0.045	.094	.0004	.9727
Time*Inst. Cost	0.001	.801	.0001	.9728

Note: The 38 dummy variables for cross-sectional observations were entered first to control the variance from repeated measures. Individual dummy variables were aggregated for the total R^2 contribution from them.

$\underline{N}$ = 234; $\underline{F}$ = 153.35; $\underline{df}$ = 44/189; $\underline{p} < .0001$

significantly to current institutional financial stability even after controlling for the entry of other independent variables. The regression coefficient was negative which suggested that the higher the level of institutional complexity, the lower an institution's current financial stability rating. This finding was not unexpected since more complex institutions were smaller in size which was one of the indicators used to assess current institutional financial stability.

The interaction of time and sector was not significantly related to institutional financial stability after controlling for the entry of the other predictor variables. Thus, the effect of the responses from the change in policy was the same in both sectors. However, there were different responses institutions in both sectors could have taken to achieve this same end result. After the policy change, one typical institutional response was in the form of salary distress rather than restraining institutional complexity since programs continued to expand with growth. Furthermore, there was not any noticeable reallocation of resources within the instructional function to maintain excellent programs. This could lead to a weaker higher educational system in future years. There was not a significant interaction between time and instructional costs per student unit in relation to institutional financial stability after controlling for the entrance of other predictor variables. This variable added little if any contribution to the explained variance in the multiple regression equation. Therefore, there was no change in these independent variables' relationship to the criterion variable after the change in budgetary policy.

Hypothesis four stated that there would be no difference in the current level of institutional financial stability over time following a change in the student-faculty ratio within or between the two educational sectors. A composite index calculated from _z_ scores of static and change indicators was developed for all static and all change indicators for each year covered by this study. Furthermore, a pooled cross-sectional time-series multiple regression analysis was also used to test this hypothesis. The _p_ value of .723 for time was not significant for all institutions. Also, there was little movement in individual institutions' financial stability assessment after the change in budgetary policy. Thus, the null hypothesis was accepted. In addition, no interaction effect was suggested since there was no major difference in the level of financial stability between the sectors. Therefore, the hypothesis of no difference between the two educational sectors was also accepted.

Summary of the Findings

Through the use of pooled cross-sectional multiple regression analysis, it was found that there was no significant difference in instructional costs per student unit after a change in the student-faculty ratio used in Virginia's budgetary formula. Even though there was revenue distress, per unit costs did not immediately begin to decrease as institutions needed time to adjust their expenditures in response to distressed conditions. However, for the most recent year, instructional costs per student unit after inflation had begun to decline notably in both educational sectors. Much of this later decrease was achieved through salary distress where educational inputs, in the form of faculty salaries, did not keep pace with the level of inflation.

The use of pooled stepwise multiple regression analysis identified seven significant predictor variables for all institutions that explained over 94% of the variance in instructional costs per student unit over the six-year period used in this study. These variables included: (1) the instructional expenditure proportion, (2) the staffing ratio, (3) the level of institutional complexity, (4) the amount of educational and general revenues, (5) the number of programs, (6) the interaction of time and sector, and (7) the interaction of time and institutional complexity. There was overlap between the two educational sectors in significant explanatory variables selected. However, there were no significant interaction variables selected for the community college sector while there were four significant interaction variables selected for the senior-level institutions sector. Thus, these variables did not behave the same in the two sectors after a change in budgetary policy. This supported the significant interaction found between time and sector for all institutions.

Through the use of pooled cross-sectional multiple regression analysis, it was found that there was no significant difference in institutional complexity after a change in the student-faculty ratio used in Virginia's budget formula. Even though institutions continued to grow in size, they continued to add faculty and programs. Thus, the level of institutional complexity remained approximately the same and linear to size beyond the threshold level of enrollment. Institutions did not initially respond to revenue distress by eliminating marginal programs to support new or existing ones nor by retrenching faculty personnel. However, for the most recent year, the level of institutional complexity had begun to decline in both educational sectors when faculty were not added proportionately to enrollment increases. Relatedly, instructional costs per student unit also declined in the most recent year when this occurred.

Aggregate composite scores from five static and five change indicators, based on individual $\underline{z}$ scores, were assembled to assess institutions' current financial stability as well as to assess what direction they were headed. After this assessment, the use of pooled cross-sectional time-series multiple regression analysis was employed to determine if there was any change in institutions' static composite scores over time. It was found that there was no significant difference in institutions' current financial stability after a change in the student-faculty ratio used in Virginia's budget formula. From the institutional assessment for the static and change indicators, it was found that most of Virginia's colleges and universities were in the stable category with little movement into or out of the other categories. Thus, this finding also suggested that there was little difference in the level of financial stability in Virginia's colleges and universities after the change in budgetary policy.

Even though there was revenue distress and these institutions were not able to adjust rapidly their per unit expenditures, their responses to distressed conditions were effective enough for them to maintain their current level of financial stability that had existed before the revenue distress introduced by the change in the budgetary policy. However, overreliance on the response of salary distress would make it difficult to attract quality faculty in future years which was a valued state objective. Furthermore, other intangibles may have been depleted, that would not be illuminated until future years, which were not measured by the indicators used in this study's assessment of financial stability. Virginia's colleges and universities were in stable financial condition but few showed signs of strength and some that were stable were close to the point of deteriorating into a weak position.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine whether a change in the student-faculty ratio used in Virginia's budget formula for its public colleges and universities had any impact over time on (1) the level of instructional costs per student unit as well as the relationships among predictor variables which explained its variance, (2) the level of institutional complexity, and/or (3) the level of institutional financial stability. The study was designed to determine if there were any differences between two educational sectors which would have suggested an interaction effect.

Summary

Soaring educational costs per student resulted from lagging productivity, the need to raise faculty salaries commensurate with those in industry without improved efficiency or productivity to offset this trend, and the addition of new functions and responsibilities. As long as there were available revenues, per unit costs continued to increase more rapidly than inflation.

Many states adopted enrollment-driven budget formulas as a means to achieve equity when revenues were insufficient to support institutional needs as well as to justify additional budgetary requests. Initially, these formulas successfully generated additional funding. However, as state resources became scarcer while demands increased, formulas turned into a budgetary control instrument and were often upwardly adjusted to match institutional requests with available resources. When there were less resources to conduct the same level of activity, revenue distress emerged. Unless institutions could successfully reduce their expenditures, a deterioration in institutional financial stability was a threat.

H. R. Bowen's (1980) revenue theory of cost suggested that the level of instructional costs per student unit depended upon available revenues. According to his theory, per unit costs should have decreased when there were upward revisions in the budget formula. However, the real issue was determining the length of time it took institutions to respond before this result was achieved. Some costs were sticky during revenue distress conditions and could not be immediately reduced. Furthermore, various states recognized this difficulty and made provisions in their formulas to buffer certain institutions, especially smaller ones, from the immediate affect of revenue distress. Finally, the type of institutional response to revenue distress also influenced institutions' ability to adjust rapidly their per unit costs. Thus, there were antipathetic arguments to H. R. Bowen's revenue theory.

Prescriptive responses to revenue distress have suggested that an efficiency approach was needed. However, if an institution chose a marketing-oriented response, this did not immediately decrease per unit costs. Also, the type of institutional response influenced whether institutional complexity and the threshold level changed which determined the range of achieved economies of scale.

Different responses to revenue distress would not have the same effect on an institution's level of financial stability. Inappropriate responses could have weakened an institution's financial stability and hindered its attempt to fulfill valued objectives. In contrast, other responses could have prevented or turned around a declining condition without affecting the level of institutional financial stability. However, there was the possibility of unintended long-range effects from particular responses that was not in higher education's best interests. This contingency suggested the need to assess the impact of a change in budgetary policy after institutions had responded.

Financial and enrollment data were collected, with permission from SCHEV, for the academic years 1975-1976 to 1980-1981. The primary source of data, compiled from the HEGIS data tapes, was the HEGIS Financial and Salaries, Tenure, and Fringe Benefits of Full-Time Instructional Faculty Surveys. This information was collected for all 39 public institutions located within the Commonwealth of Virginia. In the design of this study, these institutions were analyzed together as well as separately by two sectors: (1) senior-level institutions, and (2) community colleges.

Correlational and pooled time-series cross-sectional multiple regression analysis were employed to analyze the predictor variables, including time, that explained the variance in instructional costs per student unit, institutional complexity, and the current level of institutional financial stability. Dummy variables for cross-sectional observations were entered initially into the multiple regression equation to remove the variance in these dependent variables due to repeated measures. The STEPWISE regression procedure of SAS (Helwig & Council, 1979) was chosen to select variables that were significant in predicting instructional costs per student unit.

The current level of financial stability for each year as well as the change between years for each institution within the two sectors was assessed from a composite score based upon a series of financial and nonfinancial indicators. A standard deviation of plus or minus one was used to rank the composite scores into three categories that differentiated institutions that displayed signs of strength from those that were stable or weak.

Using multiple regression analysis, no significant difference was found in instructional costs per student unit after a change in the student-faculty ratio used in Virginia's budgetary formula. However, during the most recent year, instructional costs per student unit after inflation had begun to decline in both educational sectors while they were similar in amount. Much of the reduction in per unit costs was achieved through salary distress.

Seven significant independent variables identified from the stepwise multiple regression analysis for all institutions and the inclusion of the 38 dummy variables for cross-sectional observations explained 94% of the variance in instructional costs per student unit during a six-year time period. These independent variables were: (1) the instructional expenditure proportion, (2) the staffing ratio, (3) the level of institutional complexity, (4) the amount of educational and general revenues, (5) the number of programs, (6) the interaction of time and sector, and (7) the interaction of time and complexity.

Different independent variables were selected for each sector. Those significant for the community college sector were: (1) the instructional expenditure proportion, (2) the staffing ratio, (3) the level of institutional complexity, (4) the amount of educational and general revenues, (5) the number of programs, and (6) the average faculty salary.

Significant independent variables selected for the senior-level institutions sector included: (1) the level of institutional complexity, (2) the staffing ratio, (3) the interaction of time and the staffing ratio, (4) the interaction of time and the nonlinear trend for size, (5) the interaction of time and average faculty salary, (6) the interaction of time and the instructional expenditure proportion, (7) the instructional expenditure proportion, and (8) the graduate student proportion. The significant interactions between predictor variables and time after the change in the budget formula suggested that these variables' relationships did not remain the same in both sectors. This supported the finding of the significant interaction for the sector variable from the analysis of all institutions.

Employing multiple regression analysis, no significant difference was found in the level of institutional complexity after a change in the student-faculty ratio used in Virginia's budgetary formula. As institutions grew, they continued to add faculty and programs which did not change the level of complexity. However, during the most recent year, the level of institutional complexity declined in both sectors along with per unit costs. Since many of these institutions were still growing, they did not continue to add programs as rapidly as one response to revenue distress.

Based upon the assessment of current institutional financial stability from five static indicators, most institutions were in the stable category with little movement into or out of the other categories. Few institutions were in the strong category which meant there was a fragile stability. A continuation of revenue distress conditions could eventually erode these institutions until some slipped into the weak category. Furthermore, institutional intangibles were not assessed and may have been sacrificed in response to revenue distress.

Using multiple regression analysis, no significant difference was found in the current level of institutional financial stability after a change in the student-faculty ratio used in Virginia's budgetary formula. Even though these institutions did not immediately adapt to revenue distress by curtailing per unit costs, their responses were effective in maintaining current financial stability levels.

Based upon the assessment of institutional financial stability from five change indicators, most institutions were in the stable category with little movement into or out of the other categories as they struggled to maintain their present position. However, continued reliance upon salary distress as a response to revenue distress would make it difficult to attract quality faculty in the future which was a valued state objective and would limit institutions' flexibility unless a reallocation of resources to strengthen priority programs was considered.

Conclusions

The findings from the four statistical hypotheses tested for all institutions and by each sector coupled with the assessment of institutional financial stability generated the following conclusions:

1. Virginia's colleges and universities did not immediately re-

duce their instructional expenditures per student unit after an upward adjustment in the budget formula which triggered revenue distress conditions. However, per unit costs had begun to decline in both educational sectors during the most recent year. Therefore, institutional fixed commitments delayed effective responses to distressed conditions.

2. Institutional complexity continued to be a significant predictor variable for instructional costs per student unit. However, there was little reduction in this variable in response to revenue distress except during the most recent year. As they continued to achieve their objectives, Virginia's colleges and universities did not initially terminate programs in response to revenue distress in order to reallocate resources.
3. The most significant predictor variable explaining the variance in instructional costs per student unit for Virginia's colleges and universities was the instructional expenditure proportion. It was not strongly correlated with other independent variables. In the community college sector, this variable was positively related to the amount of available revenues and size. As institutions grew and received more resources, they spent a larger proportion on the instructional function which masked any achieved economies. In the senior-level institutions sector, there was an opposite effect. As institutions grew and received more resources, they spent a smaller proportion on the instructional function but a larger proportion for research and public service. In order to

reduce instructional expenditures per student unit in response to revenue distress, it was necessary to consider the behavior of the instructional expenditure proportion variable by sector in relation to growth or decline in enrollments and/or resources.

4. Different predictor variables were significant in explaining the variance in instructional costs per student unit between the two sectors. Only the proportion of expenditures spent for instruction, the staffing ratio, and the level of institutional complexity overlapped. In the senior-level institutions sector, there were four significant interactions between predictor variables and time which suggested that these variables' relationships differed after the change in the budgetary formula. In the community college sector, there were no significant interactions. Therefore, these independent variables were more sensitive to changes from responses in the senior-level institutions sector. However, institutions in this sector were larger and more diverse than those in the community college sector which were smaller and less flexible. Since certain responses may have affected nonsignificant independent variables in a particular educational sector, it was necessary to consider these differences when debating the implementation of prescriptive responses to revenue distress.
5. Virginia's colleges and universities were resilient in responding to a condition of revenue stress and maintained their current level of financial stability. Even though there was

not a deterioration in the level of institutional financial stability as a result of this state's need to economize, there was no improvement and effective responses were necessary to maintain the current level. Furthermore, the indicators used in this study did not assess all dimensions of an institution's condition. Financial stability still remained an elusive concept with many nonquantifiable intangibles, such as the ability of institutions to raise money, that were not assessed. Any weaknesses that occurred in these areas would not be uncovered immediately but nevertheless would have long-range implications on the financial stability of Virginia's institutions which should be considered by policy makers. Relatedly, a continuation of revenue distress conditions would eventually require more drastic types of responses that could prevent the achievement of valued objectives.

6. The Commonwealth of Virginia's decision to buffer smaller institutions from the immediate effects of revenue decline was justified and necessary. Even though institutions spent all additional revenues raised, they had difficulty reversing the tide when revenues decreased. Smaller institutions were even more vulnerable to declining conditions since they were less flexible with a threshold level of programs and faculty that were necessary to effectively operate. Therefore, they had special difficulty implementing efficiency-related responses to revenue distress such as retrenching faculty or terminating programs. Even with the state's action to buffer them from

revenue distress, they barely maintained a stable current and change position. Without the state's protection, more of these institutions would have declined and not maintained their stable position. In addition, variable/fixed cost analysis needed to be conducted before proposing other changes in budgetary funding policy.

7. The initial response to revenue distress and much of the reduction in per unit costs achieved during the most recent year was through salary distress. Faculty lost purchasing power since their salary increases were less than the rate of inflation. A continuation of this trend would lower faculty morale. In a state higher educational system, part of this distress was attributable to deficiencies in funding for salary increases. In addition, there was no reduction in the level of full-time faculty. Furthermore, there was no major increase in the student-faculty ratio nor in the threshold level which would have implied greater efficiency. Therefore, awarded salary increases were allocated to a growing number of faculty with expanded scale. The analysis of faculty salaries by academic rank revealed that salary distress was more severe in certain ranks. It was also more acute in the senior-level institutions sector. Excess reliance on this response lowered institutions' flexibility to respond under continued conditions of revenue distress.

8. There was less reallocation of resources among programs than prescribed under revenue distress conditions as demonstrated

by the addition of programs and the constant level of institutional complexity with scale. Given the influence of complexity and the instructional expenditure proportion variables on instructional costs per student unit, institutions had difficulty reducing per unit costs after the change in the budgetary formula when relying on salary distress which was not a significant predictor variable. Since the level of full-time faculty increased, any gain in efficiency from an increase in the staffing ratio was achieved primarily by retrenching part-time faculty.

9. Maintaining the same level of faculty meant that institutions continued to offer academic opportunity to their students. However, resources were thinly spread among programs especially when equipment and supply purchases were postponed, part-time personnel were retrenched, and travel was eliminated in order to devote more resources to faculty salaries. This weakened priority programs that were central in achieving institutional missions which did not meet this state's objective of providing high-quality programs. To achieve this objective, weaker programs needed to be evaluated to determine if enough resources were available to support them without jeopardizing the quality of institutions' priority programs. Without any reduction in faculty, institutions lost flexibility to respond to future distress and were less able to venture.

10. As institutional revenues declined as a result of the upward

change in the budget formula, a smaller proportion of expenditures was devoted to instruction in response to this condition especially for the senior-level institutions sector. Other functional areas, such as administration and plant with their fixed commitments, required a larger allocation of revenues which was a signal of financial pressure. Therefore, another effect from the change in the budget formula was a reduction in resources devoted to the instructional function which was the core or primary mission of most educational institutions. This was an allocation decision which meant less academic resources were available to spend for educational programs. Therefore, stress in the financial system affected the academic system which did not meet this state's objective of providing instructional quality.

Discussion

H. R. Bowen's (1980) revenue theory of cost suggested that instructional costs per student unit varied according to the amount of available institutional revenues. After an upward revision in the student-faculty ratio used in Virginia's budget formula for instruction, less revenues were generated for the same level of output except for those smaller institutions buffered from the immediate effects of this change. According to H. R. Bowen's theory, instructional costs per student unit would have declined after the change in policy since there were less available revenues from the state which was the primary revenue source for these institutions.

H. R. Bowen's (1980) revenue theory implied that institutions would be able to rapidly reduce their per unit costs. However, other researchers, such as Dickmeyer (1980b), suggested that institutions could not adapt quickly to declining conditions especially when they were enrollment related. The findings from this study demonstrated that Virginia's institutions could not immediately reduce their instructional costs per student unit after a change in budgetary policy. In fact, per unit costs continued to rise as institutions were slow to adapt and were not willing to retrench faculty. Furthermore, this could have been partially attributed to initial institutional buffering to their core instructional function as identified by Zammuto (1984). However, by the third year after the policy change, these institutions had begun to reduce their per unit costs after controlling for inflation. By this time, several adjustments had been made in the budgetary formula which necessitated the need to curtail costs.

The implication from this finding was that institutions could eventually respond in a manner that reduced their per unit costs. As the period of revenue decline deepened, institutions were more compelled to improve efficiency and also had more time to plan for such responses. Immediately after the change in policy, most institutions were poorly equipped to manage decline and often chose responses that were counterproductive. Later, institutions were more apt to realize that the decline was not temporary and implemented responses to modify and/or adapt to this condition.

The necessary time to reduce instructional costs per student unit differed according to educational sector which reflected a different process of financial decision making in response to the same condition.

The community colleges were heavily dependent on state revenues and should have been more vulnerable to a revenue decline since they had fewer sources of support. Nonetheless, they maintained their stability along with the senior-level institutions. However, most community colleges continued to experience enrollment increases which meant that part of the decline in revenues was masked by additional achieved economies from scale that were respent. Furthermore, these institutions were smaller which meant that more of them were initially buffered by the state. This also delayed their reduction in per unit costs.

The findings from this study indicated that institutions could respond to decline and still maintain their financial stability. However, efficiency-related responses to revenue distress were necessary provided that institutional quality and the achievement of valued objectives did not suffer. Immediately after the policy change, institutions continued adding programs and full-time faculty to attract new students and additional funding, which was a better response to enrollment decline, in order to fulfill unmet needs by becoming more marketing oriented. These were not efficiency-related responses and institutions did not succeed in reducing their per unit costs. If some of Virginia's institutions were to experience both revenue and enrollment distress in the same year, then a combination of responses would be necessary to effectively resist these conditions. During the most recent year, there was a slight reduction in the level of institutional complexity as institutions did not continue to add programs as rapidly with enrollment increases. This response coupled with salary distress succeeded in lowering institutions' per unit costs. However, much of the decrease in per unit costs was absorbed through these responses since institutions were reluctant to eliminate programs or retrench full-time faculty.

An incentive was needed to encourage institutions to reevaluate their programs in order to identify those of utmost priority. Virginia's institutions were not overly receptive to reallocating resources among programs when this was clearly needed to adapt to a prolonged period of revenue distress. Therefore, this reluctance would make it more difficult for these institutions to continue to achieve valued objectives.

The instructional expenditure proportion was a highly significant predictor variable in explaining the behavior of instructional costs per student unit. It represented a derivative of H. R. Bowen's (1980) revenue theory of cost. Larger institutions spent more for instruction since other functional areas were comprised of a large percentage of fixed costs that were spread over a greater student body. Therefore, more resources were devoted per student to instruction with enrollment growth which masked achieved economies from scale.

Despite the significance of the instructional expenditure proportion variable, its behavior differed according to sector. In the community college sector, larger institutions spent a greater proportion for instruction. Rather than achieving economies from scale which could have been used to lower per unit costs, any savings were respent in the instructional area for items such as additional programs. In the senior-level institutions sector, there was a different meaning behind the significance of this variable. Larger institutions with increasing revenues, which were more research oriented, spent a smaller proportion for instruction which agreed with the findings of Zammuto (1984) for public four-year institutions.

The findings in this study supported those of McLaughlin et al. (1980) which suggested that institutional complexity, rather than size, would be significant in explaining the behavior of instructional costs per student unit. In the analysis for all institutions, size was not a significant predictor in the stepwise regression equation after controlling for the entrance of other independent variables such as the instructional expenditure proportion. However, institutional complexity was significant and reflected the threshold level for institutions. It actually portrayed that smaller institutions had higher complexity levels and higher per unit costs due to the necessity of having to offer a minimum number of programs regardless of enrollment.

The level of institutional complexity was higher in the community college sector since more of these institutions were smaller and below a threshold level of enrollment. Beyond a threshold enrollment level, institutional complexity was linear to enrollment. When McLaughlin et al. (1980) alluded to institutional complexity, they did not accentuate the high levels that existed in smaller institutions. The implications from this finding suggested that instructional per unit costs could have been lowered if enrollments were added to those institutions with high complexity levels. However, the feasibility of this proposal would be questionable since many of the high complexity institutions were located in rural areas.

Even though the level of institutional complexity was linear to scale beyond the threshold level, this variable did not reflect the nature of newly added programs. If these additional programs were more expensive than those in the basic core curriculum, this would have been reflected in the number of programs variable, which was also significant, as it related to per unit costs. The findings from the analysis of all institutions indicated that new additions were more expensive to offer since there was a positive correlation between the number of programs offered and per unit costs. However, this relationship was overshadowed by the threshold level of programs necessary to operate when other significant variables were controlled. Furthermore, part of the increased cost of newly added programs was eclipsed by respent economies achieved from scale.

Size was a significant predictor variable only when controlling for the level of educational and general revenues although there was an indication of multicollinearity between these two variables. However, this relationship did suggest economies of scale even if it was eclipsed by other variables such as institutional complexity. When institutions could spend any newly acquired revenues and savings from scale for other items including the addition of new programs in the instructional area, improved faculty salaries, and increased expenditures on the instructional function required to support graduate students as hypothesized by H. R. Bowen (1980), size was not a significant predictor because it was masked which supported the findings of McLaughlin et al. (1980) and Brinkman (1981). Nonetheless, this finding suggested that if revenues did not vary so greatly between institutions and did not mask savings from scale, additional economies could have been achieved.

The two educational sectors had different patterns as far as the significance of their predictor variables. Despite this fact, both sectors were able to respond to revenue distress effectively enough to maintain their current level of financial stability. However, some of the different patterns between sectors were not specifically recognized in this state's budgetary formula. One example was the level of institutional complexity which was extremely high in smaller community colleges. However, the recent establishment of a funding floor for fixed costs in small institutions with limited flexibility was an attempt to compensate for this omission.

The significance of the interaction variables suggested that the senior-level institutions responded differently to revenue distress. This sector was spending a smaller proportion for instruction, which was the most significant predictor variable, in its attempt to curtail expenditures. The interaction of time and the nonlinear trend for size was significant which indicated that the threshold level had changed. According to Maynard (1971), the staffing ratio influenced the threshold level and was increased in response to revenue distress which was partly achieved by increasing size more than the continued addition of faculty. Even though the staffing ratio was not significantly correlated with time, it significantly interacted with time to explain the change in the threshold level. Therefore, there was an additional range where economies of scale were achieved for this sector even though most of these institutions were beyond this new threshold level.

Since an institution's threshold level was affected by the staffing ratio, an increase in the staffing ratio should have extended the range of achieved economies provided that institutional complexity remained constant. If institutions responded to revenue distress by cutting personnel and programs, then an institution's threshold level would have changed. However, if institutional complexity remained constant with enrollment increases and there was little change in the staffing ratio, then an institution's threshold level would not have changed nor would there have been any greater achieved economies. The findings from this study for the community college sector indicated that neither the level of institutional complexity nor the staffing ratio significantly changed. Therefore, there was no notable difference in these institutions' threshold level. This supported Maynard's (1971) theoretical expectation that if no changes occurred in the staffing ratio, then the threshold level would not have been altered. This was also supported by the lack of a significant interaction between time and the nonlinear trend of size with per unit costs which indicated that the shape of this relationship did not change.

McLaughlin et al. (1980) suggested that the number of programs and institutional complexity were influenced by the number of employed faculty. If there was revenue distress and institutions responded by terminating faculty, then the number of programs and institutional complexity should have been reduced. However, Virginia's colleges and universities did not respond in this manner but employed other efficiency-related responses such as salary distress. Consequently, institutional complexity remained constant. Therefore, it was not unexpected to find that instructional costs per student unit did not appreciably decrease after the change in policy. Actually, a constant institutional complexity level worked against achieved economies and the response of salary distress. The findings from this study suggested that institutional complexity needed to be controlled, despite political pressure to maintain programs and the time to phase out those targeted for elimination, if institutions needed to rapidly reduce their per unit costs in order to preserve their financial stability. This would have required a reallocation of resources among programs versus across-the-board budgetary cuts which penalized those that were most efficient.

The findings from this study supported H. R. Bowen's (1980) law of higher education costs which suggested that no relationship existed between the level of per unit costs and current institutional financial stability since institutions spent whatever resources were available. Furthermore, these two variables were not significantly related in either sector which precluded the suggestion of any interaction effect. His theory also suggested that there would be no difference in current institutional financial stability levels even if institutions had to curtail per unit costs in response to revenue distress since all but the most impoverished ones were in the same relative financial position. This was attributed to a lack of sufficient resources to adequately support all institutional missions to the point where there would be signs of munificence. The findings from this study supported his theory since the level of current financial stability for Virginia's colleges and universities remained stable after the change in budgetary policy. These institutions were also able to maintain their stability between years after the policy change. Thus, the statement by SCHEV

(1979d) that Virginia's higher educational system was basically healthy was supported by these findings.

Although both sectors faced partially different environments, had different patterns of variables that contributed to the significance of instructional costs per student unit, had different levels of resources, had different degrees of flexibility to respond to distress, and did not choose the same responses to revenue distress, there was no significant difference in the level of current financial stability between these sectors. The implications from this finding also supported H. R. Bowen's (1980) revenue theory that institutions' financial problems did not vary since they spent all available revenues as indicated by the significance of the instructional expenditure proportion variable and the lack of significance for the size variable. This was a more compelling argument than the nature of the environment or institutional responses to decline on the character of institutional financial stability. This supposition also explained the predominate location of these institutions' ranking in the stable financial stability category. However, these findings did not reflect all dimensions of an institution's condition since financial stability continued to be an elusive concept. Even though institutions in this state maintained their stability, they may have mortgaged their futures and their ability to achieve valued objectives which would not be disclosed in the short-run.

Institutions have been criticized for being slow adapters to revenue distress conditions. The findings from this study supported this accusation since these institutions did not immediately curtail their costs. However, they successfully avoided a deterioration in financial stability by employing efficiency-related responses. Nonetheless, reliance on salary distress as a response, which was not a significant predictor variable, had its upper limits and reduced institutional flexibility to respond to any further distress. If institutions also chose ineffective responses, then there may have been a deterioration in financial stability as an end result from revenue distress. Even if institutional financial stability did not change, an institution's attempt to achieve valued objectives may have been obstructed. Since there were no changes in current institutional financial stability levels after the policy change, this indicated that these institutions were able to adapt to decline even though they did not employ all the responses that have been prescribed under these conditions which may have been attributed to limited budgetary discretion in public institutions and to fixed costs (Zammuto, 1984). Furthermore, they may have relied too extensively on short-range responses such as across-the-board budgetary cuts among programs without consideration for long-range implications.

The AED (1979) implied that unless institutions could rapidly adjust their per unit costs, when there was revenue distress, financial instability would inevitably occur. However, this view did not consider that institutions may have been able to adapt to distress through multifaceted responses. They could have added enrollments with the expectation that the difference between the marginal versus the average cost allocation in the budgetary formula would be used to offset revenue distress. Institutions could have also searched for other revenue sources to supplement any reduction in appropriations from the state's necessity to economize. These responses would have assisted institutions in maintaining their stability even though expenditures were not immediately reduced. The findings in this study indicated that these institutions were able to maintain stability even when it took several years to implement efficiency responses that reduced per unit costs.

One documented cause of revenue decline was less diversity in the composition of revenues. The findings from this study supported this assertion since those institutions with greater diversity of revenues were not in the weak or declining categories during any of the six years included in this study. In contrast, the institution with the least diversity of revenues was in both the weak and declining categories at least once. If this state had not elected to buffer smaller institutions from the effects of the policy change, this finding implied that more institutions would have been in the weak and/or declining categories.

One discouraging finding was that few institutions were rated in the strong or resilient categories. Furthermore, once an institution obtained this status it did not remain there for any prolonged period of time. Since providing a quality educational system was one of this state's objectives, it was questionable to what extent this was accomplished when no institution, including the flagship university, consistently remained in the strong financial stability category. However, individual institutions have fulfilled their missions even when undernourished.

An implication from this finding was that the use of formulas brought standardization to the budgetary process. While admittedly an improvement over the pork-barrel allocation methods used in earlier years, formulas could have led to an impairment of quality in certain institutions if provisions were not included to recognize excellence and to reward performance. However, the use of formulas, with their provisions for equity and for a minimum amount of funding, also meant that institutions were not allowed to deteriorate to the point of supporting only a marginal operation. Despite this fact, policy makers needed to assess institutions' performance, which reflected their responses to revenue distress, in order to determine if valued objectives were being fulfilled and to evaluate strategic adjustments in budgetary formulas after their implementation before developing other budgetary policy adaptations.

Implications for Future Research

Assessing the impact of a change in state budgetary policy, which triggers revenue distress and institutional responses, is necessary before implementing additional policy changes such as short-range across-the-board budgetary cutbacks. As the effects from institutional responses to state budgetary cutbacks are empirically documented, there may be an indication that certain valued state objectives are not being accomplished. The need to consider the long-range effects from a short-range policy change becomes exigent when state revenues fail to adequately support higher education. Even though prescriptive responses to decline have been frequently suggested, more empirical evidence is needed to confirm the nature and results of institutional responses. Further research should identify and document the stages that institutions experience under declining conditions in order to ascertain the best time to implement the most effective responses.

Studying the economic behavior of higher educational institutions during a period of declining resources is also needed in other sectors. Since different predictors of instructional costs per student unit emerged in the two sectors included in this study, the same may be true in other sectors. To successfully manage a reduction in per unit costs, these predictors should be identified especially if they are not specifically recognized in a state's budgetary formula which may also not be sensitive to sector pattern differences. Furthermore, the distribution of actual costs may or may not closely resemble state appropriations by functional area which should be excogitated in future resource allocation decisions.

Comparable studies should be conducted in other states experiencing budgetary shortfalls to determine if their institutions are effectively responding to revenue decline in a similar manner with or without state buffering. In states that provide for marginal cost funding, different responses may be employed by their institutions than in those states that do not recognize this budgetary element. Comparative analysis among the states would generate a larger sample which would provide more empirical evidence to support or refute prescriptive responses to revenue and/or enrollment distress. For those states suffering budgetary cutbacks sooner than others, updated studies would yield more data for comparative purposes by increasing the number of observations and would disclose any deviations in institutional responses as the period of decline lengthened.

Additional research is needed to examine the relationship between marginal and average costs after a change in budgetary policy especially when there is a shift in the threshold level. Without a change in policy, both of these costs are similar beyond the threshold level. When the threshold level changes, the relationship between these two variables may differ and suggest new areas where economies of scale may be achieved. Furthermore, if institutions respond to revenue or enrollment distress by cutting part-time faculty, per unit marginal cost savings will be less than the reduction in average cost funding. Thus, marginal cost changes during growth periods may differ from those during declining periods.

If smaller institutions experience enrollment distress in addition to revenue distress, more state buffering may be necessary. Further research is needed to identify those institutions that require state buffering as well as to determine what types would be most effective. This is necessary when certain costs are sticky during declining conditions while institutions also lack flexibility to effectively respond.

Additional research is needed to determine if the variables selected as significant predictors of instructional costs per student unit are influential in other states' educational systems. In addition, other variables not included in this analysis also may be significant in the prediction of the criterion variable. The mix of programs, the mix of students by program area, and the previous year's instructional costs per student unit as a lagged variable are predictors not employed in this study that may prove significant to the future prediction and explanation of the unusual behavior of this dependent variable. In addition, an analysis of influential variables based on yearly data should be conducted to determine if their relationships change as institutions respond to decline. Depending upon the response, the ranking, slopes, and intercepts of predictor variables may change. Furthermore, dummy variables could be included for each year's observations in order to identify changes that occur across years before and/or after the policy change. Also, interactions between each year involved in the study and the independent variables could be included to determine to what extent the relationships between independent variables and the criterion variable remain unchanged across several years before and/or after a budgetary policy change. Institutions need to identify those variables that are most influential on per unit costs as they make necessary adjustments to curtail expenditures in response to declining conditions.

Further research by sector is needed to trace the allocation of resources, as they are employed to achieve valued objectives, during a distressed period resulting from state budgetary cutbacks. Since the instructional expenditure proportion variable is highly influential in explaining the variance in instructional costs per student unit for both educational sectors, per unit costs do not decrease quickly unless it is reduced. However, any decrease in the instructional expenditure proportion means that institutions are reallocating resources away from their core area of instruction. If this response reduces instructional quality, then a valued objective is not fulfilled.

Continued research is needed to assess institutional financial stability after delayed responses to decline are implemented. Later responses to distressed conditions may differ from earlier ones and may or may not affect financial stability. An ongoing assessment of institutional financial stability in this state should be conducted so that institutions as well as policy makers can monitor changes and plan appropriately to achieve the most effective use of resources. In addition, an assessment of intangible factors, such as deferred maintenance, should be conducted periodically to determine to what extent financial stability is being maintained by an erosion of physical capital. If institutions mortgage their futures to preserve their current position, this will require additional outlays at a time when institutions are less flexible to meet substantial commitments. Future policy must address this contingency.

A longitudinal financial data file should be established for future research on the financial stability of Virginia's colleges and universities. With the HEGIS financial changes, only six years' data are available for comparative purposes as of this study. This data series needs to be extended to evaluate long-range implications from revenue distress for this state's institutions and to aid in the development of normative data for indicators, including the age of an institution as a possibility, calculated by sector. The availability of longitudinal data can be used to assess the degree that institutions are flexible in responding to changes in their environments while achieving valued objectives.

Further research is needed to determine if incentives are necessary in budgetary formulas to encourage institutions to effectively respond to decline. If institutions become more competitive and attract additional students, this will not achieve necessary state economies. Further competition among institutions may only succeed in lowering quality. Incentives that promote excellent performance should be considered as a substitute for those that encourage institutions to seek additional students and funding unless access were to suffer. Furthermore, incentives should encourage a reallocation of resources, if needed, rather than across-the-board cutbacks which lead to mediocrity and a reduction in quality. Perhaps, a buffering feature that continues to appropriate funds for noncentral programs during their phaseout period could be included which would be an incentive for institutions to become smaller but better, without being penalized, while trying to manage a reduced scale of operations. However, institutions must not be encouraged to respond in a manner that sacrifices or blocks the achievement of other valued objectives such as diversity or access.

In conclusion, maintaining a stable financial stability in colleges and universities will become more difficult as demands on state budgets exceed resources. In response, states will need to make adjustments such as across-the-board budget cuts which undernourish their educational institutions and create revenue distress conditions. Furthermore, some institutions may also undergo enrollment distress which will compound their problems when budgetary formulas reflect average cost funding. These institutions will not be able to immediately reduce their per unit costs. To date, Virginia's public institutions are displaying resiliency to decline while maintaining their financial stability. This demonstrates that institutions can manage decline without sacrificing valued objectives. However, state economizing may also yield undesirable results that counter a state's effort to achieve valued objectives which need to be identified before planning higher educational policy. Through this process, better planning and budgetary policy changes can emerge to provide the most effective higher educational system within the availability of limited resources.

APPENDICES

APPENDIX A

DEFINITION OF TERMS

Budget Formula. An objective procedure to estimate the future budgetary requirements of a college or university through the manipulation of quantitative data (Miller, 1964) that is preestablished (Gross, 1973/1974).

Efficiency. A measure of outputs to inputs representing the maximum amount of outputs to inputs (H. R. Bowen, 1977). One cost measure of efficiency would be the amount of educational costs per student. The greater the amount spent on teaching, the greater it is (H. R. Bowen, 1980). Efficiency is a means to be effective and is sometimes sacrificed in order to achieve access. Specialist organizations usually have more of it (Zammuto, 1982b).

Enrollment Distress. A situation occurring when the level of enrollment decreases from one year to the next. An institution experiencing enrollment distress must initiate a response such as a reduction in faculty (Gilmartin, 1981) in order to maintain its stability.

Financial Stability. The ability of an institution to respond or adapt (Rubin, 1979) to distress in its environment without jeopardizing its current status of achieving valued objectives (Jenny, 1979b) and/or its survival which is influenced by its flexibility (Collier & Patrick, 1978; Maxwell, 1980) to reallocate resources (Dickmeyer & Hughes, 1979a) as it encounters risk. Financial stability is a composite value based upon a series of financial and nonfinancial ratios that measures distresses, responses, and institutional conditions (Dickmeyer, 1983) that reflect the strength and survival capacity of a college or university. For purposes of this study, the operational definition of current institutional financial stability used is a composite measure of the following indicators: (1) FTE students, (2) full-time faculty, (3) average faculty salary, (4) the staffing ratio, and (5) the instructional expenditure proportion.

Full-Time Equivalent Students. A count of students weighting for the percentage of student load carried. For undergraduate and first-time professional students, a full-time equivalent student is defined as a student with a course load of 15 credit hours per semester or 30 credit hours (45 quarter hours) on an annualized basis. For graduate students, a full-time equivalent student is one with a course load of 12 credit hours per semester or 24 credit hours (36 quarter hours) an an annualized basis.

Institutional Complexity. The number of degree programs offered per 100 full-time equivalent students.

Productivity. A measure of outputs from the instructional process in relation to faculty inputs. One surrogate measure of outputs from the instructional process is FTE enrollments. One measure of productivity would be the number of FTE students generated per faculty member or the staffing ratio. When it is increased, per unit costs decrease.

Revenue Distress. A situation occurring when the level of state funding from one year to the next does not keep up with the level of inflation. In real terms, an institution with revenue distress has less resources to spend than it did in a preceding year although its total amount of revenues may have increased. An institution with revenue distress needs to respond by curtailing expenditures while providing the same level of services (Gilmartin, 1981). Otherwise, institutional financial flexibility decreases.

Salary Distress. A situation occurring when the level of average faculty salaries from one year to the next does not keep up with the level of inflation. In real terms, an institution with salary distress has paid its faculty less than it did in a preceding year although its total amount of salary outlay may have increased. An institution with salary distress may experience this condition in a deliberate response to conditions of financial stringency triggered by revenue distress. A prolonged condition of salary distress is likely to erode the quality of an institution's faculty and its flexibility from less academic resources and a greater amount of fixed commitments.

Staffing Ratio. The number of full-time faculty to full-time equivalent students. This is an institution's actual staffing level which may be specified for the instructional function in a budget formula.

Student-Faculty Ratio. A workload measure specifying a predetermined level of staffing contained in a budget formula.

APPENDIX B

CHANGES IN APPENDIX M

Course Level and Discipline	1974-1976[a]	1976-1978[b]	1978-1979[c]	1979-1980[c]	1980-1981[d]	1981-1982[d]	1982-1984[e]
Foundation	1:15	*	*	*	*	*	*
Lower	1:20	*	*	*	1:21	1:22	*
Upper	1:12	*	1:13	1:14	*	*	*
1st Year-Grad.	1:10	*	*	*	*	*	*
Advanced Grad.	1: 8	*	*	*	*	*	*
1st Prof.-Med.	[f]	[g]	1: 2	*	*	*	*
1st Prof.-Den.	[f]	1: 3.8	*	*	*	*	*
1st Prof.-Law	1:20	*	*	*	*	*	*
Lower-Occ./Tech	1:15	*					
Lower-Bus./Tech			1:16	*	*	*	*
Lower-Hlth./Tech			1:10	*	*	*	*
Lower-Engr./Tech			1:12	*	*	*	*
Lower-Agr.			1:16	*	*	*	*
Upper-Agr.			1:11	*	*	*	*
Grad.-Agr.				1: 7	*	*	*
Lower-Arch.			1:16	*	*	*	*
Upper-Arch.			1:11	*	*	*	*
Grad.-Arch.				1: 7	*	*	*
Lower-Engr.			1:16	*	*	*	*
Upper-Engr.			1:11	*	*	*	*
Grad.-Engr.				1: 7	*	*	*
Lower-F/Arts			1:16	*	*	*	*
Upper-F/Arts			1:11	*	*	*	*
Grad.-F/Arts				1: 7	*	*	*
Lower-F/Lang.			1:16	*	*	*	*
Upper-F/Lang.			1:11	*	*	*	*
Grad.-F/Lang.				1: 7	*	*	*
Lower-G/Hlth.			1:10	*	*	*	*
Upper-G/Hlth.			1: 8	*	*	*	*
Grad.-G/Hlth.			1: 6	*	*	*	*
Grad.-Bio./Sci.				1: 7	*	*	*

[a]Data from Gross, 1973/1974

[b]Data from SCHEV, 1975b

[c]Data from SCHEV, 1977a

[d]Data from SCHEV, 1979b

APPENDIX B (continued)

CHANGES IN APPENDIX M

[e]Data from SCHEV, 1981b

[f]Actual ratio for 1972-1973 academic year

[g]Actual ratio for 1974-1975 academic year

*Represents no change from previous period

APPENDIX C

VIRGINIA PUBLIC COLLEGES AND UNIVERSITIES BY SECTOR

Institution
SENIOR-LEVEL INSTITUTIONS
GMU - George Mason University
ODU - Old Dominion University
UVA - University of Virginia
VCU - Virginia Commonwealth University
VPI - Virginia Polytechnic Institute and State University
W&M - The College of William and Mary
CNC - Christopher Newport College
CVC - Clinch Valley College
JMU - James Madison University
MWC - Mary Washington College
NSU - Norfolk State University
RFU - Radford University
VMI - Virginia Military Institute
VSU - Virginia State University
COMMUNITY COLLEGES
BRCC - Blue Ridge Community College
CVCC - Central Virginia Community College
DLCC - Dabney S. Lancaster Community College
DVCC - Danville Community College
ESCC - Eastern Shore Community College
GMCC - Germanna Community College
JRCC - J. Sargeant Reynolds Community College
JTCC - John Tyler Community College
LFCC - Lord Fairfax Community College
MECC - Mountain Empire Community College
NRCC - New River Community College
NVCC - Northern Virginia Community College
PHCC - Patrick Henry Community College
PDCC - Paul D. Camp Community College
PMCC - Piedmont Community College
RHCC - Rappahannock Community College
SSCC - Southside Virginia Community College
SWCC - Southwest Virginia Community College
TNCC - Thomas Nelson Community College
TWCC - Tidewater Community College
VHCC - Virginia Highlands Community College
VWCC - Virginia Western Community College
WVCC - Wytheville Community College
RBC - Richard Bland College

APPENDIX D

STUDENT UNITS

Institution	Academic Year					
	1976	1977	1978	1979	1980	1981
GMU	8269	8691	9389	10282	12342	13033
ODU	14659	15590	16400	16575	16897	16692
UVA	33495	32862	32325	31037	32596	32774
VCU	21112	21627	22070	22198	22346	22741
VPI	28750	29349	29996	30188	31041	32145
W&M	8991	8593	8877	9114	9196	9493
CNC	2550	2794	2965	3036	3028	3148
CVC	979	1005	1049	1456	1081	1145
JMU	10096	10538	11001	11028	11474	12028
LWC	2849	3049	3329	3647	3711	3743
MWC	2563	2696	2686	2738	2754	2916
NSU	7889	7998	8548	7965	7610	8442
RFU	6380	6376	6909	6940	7221	7365
VMI	1787	1897	1986	1996	1939	1960
VSU	6071	6215	5757	5161	5240	5223
BRCC	1203	1180	1156	1079	1094	1166
CVCC	1985	1832	1892	1832	2002	2006
DLCC	726	657	623	657	701	736
DVCC	1847	1759	1695	1711	1746	1940
ESCC	305	282	249	222	247	268
GMCC	600	555	518	524	613	642
JRCC	4479	4516	4532	4226	4391	4744
JTCC	1871	1834	1863	1832	1773	2182
LFCC	787	757	765	814	839	918
MECC	629	633	642	790	935	1130
NRCC	1693	1480	1456	1458	1564	1677
NVCC	15241	14920	15561	15474	16209	17308
PHCC	668	653	674	602	736	817
PDCC	798	761	819	756	781	720
PMCC	1079	1131	1242	1312	1437	1605
RHCC	610	625	687	683	699	751
SSCC	1101	1029	1057	953	1019	961
SWCC	1304	1242	1339	1443	1646	1747
TNCC	3224	3063	3155	3229	3423	3692
TWCC	7050	7010	7615	8182	8130	8476

APPENDIX D (continued)

STUDENT UNITS

	Academic Year					
Institution	1976	1977	1978	1979	1980	1981
VHCC	998	892	859	911	960	1087
VWCC	3295	2938	2829	2925	3127	3281
WVCC	1160	1049	1095	1245	1288	1290
RBC	764	761	793	771	737	707

APPENDIX E

COMPARISON OF HEPI WITH COMPOSITE INDEX DEVELOPED FOR INSTRUCTIONAL EXPENDITURES PER STUDENT UNIT

Category	Component Subindex[a]	HEPI	Pers. Subindex	Serv. Subindex	Inst. Composite
PERSONNEL COMPENSATION		82.0			84.6
1.0 Professional Salaries	58.0		79.5		
2.0 Nonprofessional Wages and Salaries	15.0		20.5		
3.0 Fringe Benefits	9.0		---		
CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT		18.0			15.4
4.0 Services	7.3			54.9	
5.0 Supplies and Materials	3.5			26.3	
6.0 Equipment	2.5			18.8	
7.0 Books and Periodicals	1.7			---	
8.0 Utilities	3.0			---	
Total	100.0	100.0	100.0	100.0	100.0

[a]Data from Halstead and Hickson, 1978, pp. 5-6

APPENDIX F

INSTRUCTIONAL COSTS PER STUDENT UNIT NET OF INFLATION

Institution	Academic Year 1976	1977	1978	1979	1980	1981
GMU	781.56	817.66	815.23	852.27	723.68	766.86
ODU	813.91	822.06	825.74	855.27	872.87	805.37
UVA	1132.22	1031.34	1073.82	1212.01	1148.06	1155.17
VCU	1840.25	1514.91	1556.65	1592.08	1643.86	1598.75
VPI	975.56	969.26	1084.86	1212.75	1224.54	1224.47
W&M	1011.63	1115.67	1183.23	997.32	991.48	988.63
CNC	847.27	745.48	751.68	685.88	780.35	707.66
CVC	1152.75	764.97	740.55	618.87	799.54	714.35
JMU	764.07	775.50	741.16	796.29	692.61	727.16
LWC	1024.52	978.36	864.91	789.07	736.77	677.36
MWC	840.00	785.72	780.84	805.26	827.45	815.39
NSU	978.79	917.81	887.37	948.43	1052.60	753.45
RFU	705.75	723.46	678.63	715.65	701.70	671.78
VMI	1272.57	1079.83	1038.54	1067.46	1082.56	1019.53
VSU	786.90	783.17	780.34	856.80	886.42	906.60
BRCC	687.43	737.92	692.12	823.10	794.78	820.79
CVCC	839.66	844.02	816.37	878.73	845.29	768.46
DLCC	1216.66	1190.17	1228.23	1364.09	1475.04	1590.98
DVCC	789.89	777.01	733.92	768.73	784.59	745.32
ESCC	1009.90	1108.45	1588.66	2026.51	2061.53	1872.72
GMCC	1056.62	959.98	868.10	863.79	720.77	762.27
JRCC	812.14	971.45	986.49	1036.19	928.16	816.80
JTCC	898.46	848.60	944.04	1052.23	882.13	714.57
LFCC	794.81	869.38	935.04	945.05	826.99	734.94
MECC	1056.73	988.85	1107.82	754.82	777.78	774.40
NRCC	857.89	943.53	976.65	1033.40	964.84	926.22
NVCC	793.85	862.95	825.67	883.78	789.59	757.23
PHCC	785.55	973.23	943.14	1178.63	1094.88	975.36
PDCC	768.07	860.83	819.76	887.97	873.04	1008.20
PMCC	761.33	916.95	803.37	811.86	789.87	769.21
RHCC	1419.23	1181.98	2049.50	1701.50	1458.39	1234.67
SSCC	849.42	942.24	881.70	1004.13	952.09	1073.16
SWCC	1094.50	1144.77	1144.55	891.50	960.86	879.71
TNCC	838.29	811.53	789.06	843.54	781.27	716.07
TWCC	740.27	739.85	720.45	741.15	680.45	681.99

APPENDIX F (continued)

INSTRUCTIONAL COSTS PER STUDENT UNIT NET OF INFLATION

Institution	Academic Year					
	1976	1977	1978	1979	1980	1981
VHCC	949.92	1048.99	1039.11	1082.91	938.89	833.84
VWCC	794.41	831.72	923.26	964.14	864.45	803.26
WVCC	1233.75	1219.52	1282.07	1098.67	1236.55	1131.60
RBC	726.84	752.37	694.13	753.07	837.38	824.28

APPENDIX G

NUMBER OF PROGRAMS

Institution	Academic Year 1976	1977	1978	1979	1980	1981
GMU	46	48	47	49	59	60
ODU	77	80	83	90	101	98
UVA	197	197	195	197	176	176
VCU	116	112	116	121	129	129
VPI	167	173	175	176	181	181
W&M	59	59	59	60	60	60
CNC	16	17	17	20	21	21
CVC	12	12	12	13	14	14
JMU	69	71	69	73	78	78
LWC	28	29	28	28	28	28
MWC	32	32	29	29	36	36
NSU	47	47	50	53	68	65
RFU	57	57	54	55	62	62
VMI	10	10	10	10	10	10
VSU	53	52	50	50	62	61
BRCC	25	25	26	26	26	27
CVCC	43	43	41	40	39	41
DLCC	21	21	21	22	22	22
DVCC	28	28	28	28	28	28
ESCC	11	11	12	12	13	13
GMCC	19	19	19	19	20	20
JRCC	41	43	43	45	48	52
JTCC	30	30	30	26	26	30
LFCC	19	19	18	17	17	17
MECC	17	18	18	19	19	19
NRCC	39	39	40	44	47	48
NVCC	73	75	78	78	83	85
PHCC	14	14	14	16	18	21
PDCC	23	23	23	24	25	28
PMCC	25	25	25	26	27	25
RHCC	19	19	20	20	20	20
SSCC	27	27	27	29	29	30
SWCC	26	26	26	27	28	28
TNCC	36	36	37	42	46	47
TWCC	42	43	50	52	64	71

APPENDIX G (continued)

NUMBER OF PROGRAMS

	Academic Year					
Institution	1976	1977	1978	1979	1980	1981
VHCC	20	23	23	26	25	25
VWCC	38	39	41	42	46	49
WVCC	29	29	29	31	34	39
RBC	4	4	4	4	3	3

APPENDIX H

INSTITUTIONAL COMPLEXITY

Institution	Academic Year 1976	1977	1978	1979	1980	1981
GMU	0.7465	0.7193	0.6610	0.6234	0.6514	0.6293
ODU	0.7043	0.6690	0.6538	0.7111	0.7794	0.7632
UVA	1.0099	1.0152	1.0124	1.0518	0.8977	0.8950
VCU	0.8037	0.7552	0.7700	0.8030	0.8490	0.8330
VPI	0.8297	0.8337	0.8300	0.8242	0.8258	0.8000
W&M	0.9609	0.9941	0.9614	0.9537	0.9545	0.9315
CNC	0.7390	0.7158	0.6735	0.7837	0.8197	0.7916
CVC	1.4563	1.4354	1.3905	1.0943	1.5801	1.5766
JMU	0.8871	0.8806	0.8322	0.8731	0.8960	0.8598
LWC	1.1981	1.1619	1.0268	0.9615	0.9434	0.9380
MWC	1.4808	1.3675	1.2758	1.2821	1.5591	1.4706
NSU	0.7240	0.7159	0.7115	0.7580	1.0556	0.9058
RFU	1.1887	1.1513	1.0143	1.0321	1.1291	1.1075
VMI	0.6770	0.6357	0.6184	0.6215	0.6333	0.6277
VSU	1.1330	1.0680	1.0862	1.2174	1.4595	1.4229
BRCC	2.0781	2.1186	2.2491	2.4096	2.3766	2.3156
CVCC	2.1662	2.3472	2.1670	2.1834	1.9481	2.0439
DLCC	2.8926	3.1963	3.3708	3.3486	3.1384	2.9891
DVCC	1.5160	1.5918	1.6519	1.6365	1.6037	1.4433
ESCC	3.6066	3.9007	4.8193	5.4054	5.2632	4.8507
GMCC	3.1667	3.4234	3.6680	3.6260	3.2626	3.1153
JRCC	0.9154	0.9522	0.9488	1.0648	1.0931	1.0961
JTCC	1.6034	1.6358	1.6103	1.4192	1.4664	1.3749
LFCC	2.4142	2.5099	2.3529	2.0885	2.0262	1.8519
MECC	2.7027	2.8436	2.8037	2.4051	2.0321	1.6814
NRCC	2.3036	2.6351	2.7473	3.0178	3.0051	2.8623
NVCC	0.4790	0.5027	0.5013	0.5041	0.5121	0.4911
PHCC	2.0958	2.1440	2.0772	2.6578	2.4457	2.5704
PDCC	2.8822	3.0223	2.8083	3.1746	3.2010	3.8889
PMCC	2.3170	2.2104	2.0129	1.9817	1.8789	1.5576
RHCC	3.1148	3.0400	2.9112	2.9283	2.8612	2.6631
SSCC	2.4523	2.6239	2.5544	3.0430	2.8459	3.1217
SWCC	1.9939	2.0934	1.9417	1.8711	1.7011	1.6027
TNCC	1.1166	1.1753	1.1727	1.3007	1.3439	1.2730
TWCC	0.5957	0.6134	0.6566	0.6355	0.7872	0.8377

APPENDIX H (continued)

INSTITUTIONAL COMPLEXITY

	Academic Year					
Institution	1976	1977	1978	1979	1980	1981
VHCC	2.0040	2.5785	2.6775	2.8540	2.6042	2.2999
VWCC	1.1533	1.3274	1.4493	1.4359	1.4711	1.4934
WVCC	2.5000	2.7645	2.6484	2.4900	2.6398	3.0233
RBC	0.5236	0.5256	0.5044	0.5188	0.4071	0.4243

APPENDIX I

COMPOSITE SCORES OF INSTITUTIONAL FINANCIAL STABILITY FOR STATIC INDICATORS

Institution	Academic Year 1976	1977	1978	1979	1980	1981
GMU	.1442	.2256	.3198	.3976	.6837	.6243
ODU	.5372	.7389	.8591	.6484	.6944	.6854
UVA	1.1727	1.1007	.7762	.8158	.8254	.7466
VCU	.7756	.6266	.6327	.5428	.4893	.4922
VPI	.6909	.8059	.6529	.7142	.6035	.5555
W&M	- .0434	- .2311	- .2017	- .1442	- .2018	- .1437
CNC	.1441	.2233	.2832	- .0741	.1427	.1847
CVC	- .4896	-1.0407	- .9950	- .4464	- .8477	- .9107
JMU	.3267	.3247	.3384	.2273	.1755	.2498
LWC	- .5229	- .5803	- .5354	- .3553	- .3608	- .4249
MWC	- .8184	- .6473	- .6771	- .6542	- .6209	- .5911
NSU	- .0869	- .1335	- .0084	- .0526	- .0288	- .0812
RFU	.0352	- .0914	- .0039	- .1166	- .0786	- .0539
VMI	- .8261	- .8378	- .7641	- .7036	- .7642	- .9480
VSU	- .6703	- .5533	- .7451	- .8663	- .7830	- .4519
BRCC	.1518	.4582	.2105	.2476	.2755	.2688
CVCC	.3774	.3032	.3215	.2936	.4420	.2545
DLCC	.0321	.0650	- .1639	- .1077	- .1878	- .1868
DVCC	.2889	.0718	- .0885	- .0887	- .0978	- .0113
ESCC	- .7932	- .8082	- .7725	- .9272	- .5071	- .5020
GMCC	- .4479	- .6370	- .8377	- .8163	- .8059	- .7170
JRCC	- .1187	.8108	.5884	.3709	.3044	.4161
JTCC	- .1113	.0692	.1098	.2085	- .3645	- .0815
LFCC	- .4912	- .5893	- .5019	- .4221	- .5425	- .7171
MECC	- .7405	- .5439	- .4589	- .4217	- .4533	- .2027
NRCC	- .0895	- .1682	- .2730	- .3667	- .4543	- .2079
NVCC	2.5160	2.5069	2.3173	2.4102	2.3816	2.4955
PHCC	- .3528	- .0879	.0899	- .1187	.1041	- .1750
PDCC	- .6935	- .7707	- .6933	- .7874	- .6293	- .7876
PMCC	- .1170	.1002	- .2394	- .1196	- .2032	.0767
RHCC	- .5010	-1.0332	.0981	- .1752	- .0956	- .0968
SSCC	- .3726	- .3122	- .4096	- .4177	- .3931	- .4525
SWCC	- .0923	.0449	.0761	- .0307	.3017	.0383

APPENDIX I (continued)

COMPOSITE SCORES OF INSTITUTIONAL FINANCIAL STABILITY

FOR STATIC INDICATORS

	Academic Year					
Institution	1976	1977	1978	1979	1980	1981
TNCC	.3840	.2686	.3621	.3875	.3383	.4487
TWCC	.8833	1.0108	.9916	1.0984	.9369	1.0237
VHCC	- .4748	- .3398	- .4782	- .3645	- .6165	- .4535
VWCC	.5362	.3128	.4248	.5526	.4250	.3856
WVCC	- .1518	- .3093	- .3314	- .0508	.1308	- .1262
RBC	- .6942	- .4172	- .3404	- .3107	- .3406	- .4938

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Abstract

AN ASSESSMENT OF THE IMPACT OF CHANGES IN THE STUDENT-FACULTY RATIO USED IN THE BUDGET FORMULA FOR VIRGINIA'S COLLEGES AND UNIVERSITIES ON INSTRUCTIONAL COSTS PER STUDENT, INSTITUTIONAL COMPLEXITY, AND FINANCIAL STABILITY

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The College of William and Mary in Virginia, April 1984

Chairperson: Professor Mary Ann D. Sagaria

The purpose of this study was to determine whether a change in the student-faculty ratio used in Virginia's budget formula for its public institutions had any impact on (1) the level of instructional costs per student unit as well as any predictors that explained its variance, (2) the level of institutional complexity, and (3) the level of financial stability. It was designed to determine if two educational sectors differed in their responses to revenue distress conditions.

HEGIS financial and salary data were compiled for all 39 public institutions in the Commonwealth of Virginia. They were analyzed together as well as by two sectors: (1) senior-level institutions and (2) community colleges. Pooled time-series cross-sectional multiple regression analysis was used to examine changes in the dependent variables after the budgetary adjustments. Stepwise multiple regression was chosen to identify significant predictors of instructional costs per student unit. The current and change levels of institutional financial stability by year were assessed from a composite score based upon a series of financial and nonfinancial indicators.

It was found that there was no significant difference in instructional costs per student unit after the budgetary policy change. From the analysis of all institutions, the significant predictors of this dependent variable were: (1) the instructional expenditure proportion, (2) the staffing ratio, (3) the level of institutional complexity, (4) the amount of educational and general revenues, (5) the number of programs, (6) the interaction of time and sector, and (7) the interaction of time and complexity. Different independent variables were selected for each sector. No predictors interacted with time in the other sector while there were four interactions in the senior-level institutions sector. These institutions did not immediately reduce their complexity levels in response to revenue distress. Nonetheless, per unit instructional costs fell when complexity levels declined two years after the policy change. Most of these institutions were assessed to have preserved their stability despite the type of response to revenue distress.

It was concluded that institutions could not immediately reduce their per unit instructional costs after an upward adjustment in the budget formula. Fixed costs and institutional inertia delayed effective responses. Also, the most significant predictor of per unit costs was

the instructional expenditure proportion variable. In order to reduce per unit costs, it was necessary to consider the behavior of this predictor. In addition, Virginia's public institutions were resilient in responding to revenue distress conditions even though there were delays in implementing effective responses. Finally, much of the decrease in per unit costs was achieved through salary distress rather than a reallocation of resources among programs. A continuation of this pattern coupled with the decrease in the instructional expenditure proportion in response to revenue distress could lead to impaired educational quality.

Further study is needed to evaluate the long-range effect on institutional financial stability from a short-range budgetary policy adjustment before developing other policy changes. In addition, a longitudinal data file to evaluate long-range implications from institutions' responses to revenue distress on the achievement of valued objectives is needed.