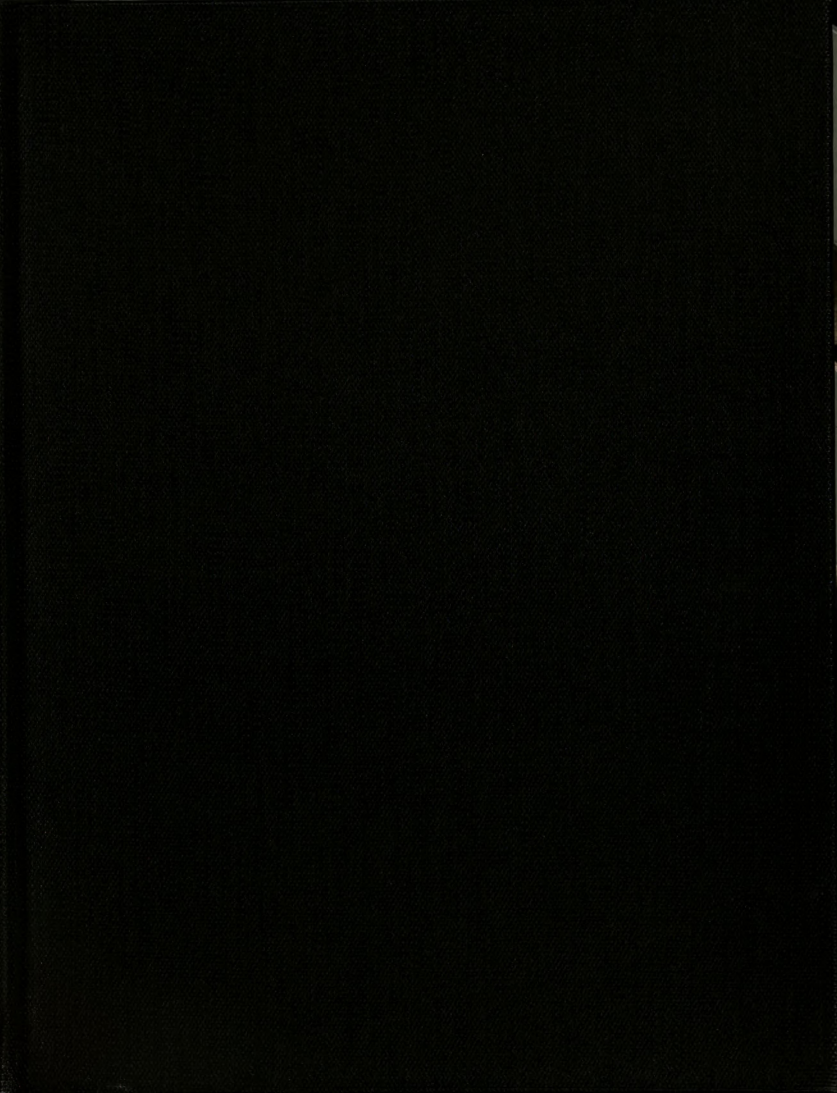






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Susan Work Martin

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A handwritten signature in cursive script, reading "David B. Lasater".

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**MODELING THE LOCAL GOVERNMENT
GENERAL FUND DEFICIT**

By

Susan Work Martin

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the
requirements for the degree of**

DOCTOR OF PHILOSOPHY

Department of Accounting

1988

ABSTRACT

MODELING THE LOCAL GOVERNMENT GENERAL FUND DEFICIT

By

Susan Work Martin

Multiple regression models were estimated to predict the 1981 general fund balances for a set of Michigan local unit of government. Six alternative models are estimated from four years of data (1978, 1979, 1980 and 1981). Three single year models using 1978, 1979, or 1980 data are estimated. Three multiple year models using 1978+1979, 1979+1980 and 1978+1979+1980 are estimated. Thirty matched pairs of local government's (sixty units) audited financial statement data are used to estimate the model. One unit in each pair had a general fund deficit in 1981, the other had a surplus in that year.

Twenty independent variables were used from the following categories: assets, liabilities, budgetary control, tax base, taxing power, and borrowing.

The estimated single year models achieve a R^2 of 96.9%, 94.2%, and 93.2% for 1980, 1979, and 1978, respectively. When their prediction errors are scaled by local unit size, the single year models produce prediction errors of 94.5%, 84.6%, and 96.1% for 1980, 1979, and 1978, respectively. The multiple year models achieve a R^2 of 93.1%, 91.8% and 91.2% for 1979+1980, 1978+1979 and 1978+1979+1980, respectively and size

scaled mean prediction errors of 85.3%, 64.2% and 69.4%, respectively.

Among the independent variables used to estimate the models, the unfunded pension liability and expenditures variance emerge with consistently strong association with the future general fund balance across all six prediction models.

The model estimated with 1978 data (t-3) achieved a prediction error (96.1%) superior to the naive model (93.3%) when predicting the 1982 general fund balance in the hold-out sample with 1979 data. The t-3 model was also the most parsimonious of all six estimated models.

To my daughter, Diana

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CHAPTER 1

INTRODUCTION

1.1 The Research Objective

Fiscal emergencies such as those which occurred in New York, Cleveland, and other cities in the 1970's have drawn attention to the need for early warning systems to predict future difficulties. Many states have evaluated their systems of monitoring local units of government to derive indicators which can be used to predict future financial trouble. Illinois established a Local Government Financial Health Program which utilized thirty-four indicators from a local unit's five most recent audits. New York established a Financial Tracking System to evaluate financial health. Minnesota also established a Financial Health program utilizing indicators to predict financial "stress." Discussion with representatives of each of these States revealed that none of the State monitoring systems were based upon an empirical model or research.

The State of Michigan and many of its local governments suffered serious financial difficulties in the early 1980's. Cities such as Hamtramck, Highland Park and Benton Harbor had to borrow from State funds to meet payrolls through a State Emergency Loan Board because a buyer could not be found for those cities' publicly sold short-term notes.

In 1988, the Michigan legislature enacted a statute (State of Michigan Legislature, Public Act 101 of 1988) which allows the Governor to appoint a manager for a local government if a financial emergency is determined. The "local government fiscal responsibility act" represents a major change in Michigan public policy. One key financial distress criterion in the statute is a projected deficit in the current fiscal year general fund greater than 10% of budgeted revenues. Commonly, an appointed review team makes such projections. Similar legislation was proposed in 1983 (at the time data collection began for this project). Legislators and local government representatives felt the legislation was too far-reaching in allowing a "take-over" of the fiscally irresponsible unit's operations. Passage failed.

Recently, however, court appointment of a receiver for the City of Ecorse (1987) and the "bail-out" (1988) of Wayne County's general fund deficit with state-levied increases in cigarette taxes and a new airport parking facility tax have illustrated the dramatic difficulties encountered to remedy a general fund deficit once it occurs. If an effective "early-warning" system can be established so corrective action can occur before drastic fiscal measures are required, local government taxpayers and the State of Michigan will be benefited. Increased taxes or decreased levels of service may be avoided

through early action to monitor and control revenue collections and costs to keep budgets balanced.

The objective of this dissertation is to estimate a model to predict a general fund deficit with greater accuracy than a naive model. Such a model could assist in development of an "early warning system" for State monitoring of local government units. An early warning of decline of the general fund balance can permit time for development of a satisfactory plan to resolve an impending serious financial problem.

Also, the Government Finance Officers Association markets microcomputer software to compute ratios from financial statement data and offers suggestions to interpret these ratios. However, neither governmental entities or the marketplace have an empirical model to predict governmental financial stress, insolvency, or general fund balance.

1.2 Contributions of this Research

A model which could predict the onset and magnitude of local government financial distress before it occurs could assist state and local government officials as well as prospective purchasers of government short and long-term obligations in evaluating financial position. Moody's Investors Services, Inc., in The Appraisal of Municipal Credit Risk (Smith 1979, 118-119) defines a threshold of serious financial difficulty:

A state or local governmental unit on the threshold of financial difficulty can escape it, but time is short and decisive action is necessary. Experience suggests that the causes of the difficulty must be addressed in the budget for the year following that in which severe revenue failure or over-expenditure occurs. Otherwise, the period of difficulty is prolonged and the situation progressively worsens. The threshold point, consequently, is defined as that time at which it reasonably appears that remedial action, even though delayed, will substantially correct the situation within a single budget year. . . .

As a general test, there appears to be ample justification for regarding a unit as being on the threshold of serious financial difficulty when the cumulative cash deficit equals 5% of prior year's revenues and 10% of prior year's property taxes. Correction at or above these ratios is clearly feasible, but for the great majority of units the difficulties are sufficient to arouse skepticism.

However, if corrective action is not taken the problem may quickly accelerate and become unmanageable.

Governmental units find it very difficult to address both a current short-fall as well as an accumulated deficit. Expenditures are often relatively fixed such as salaries under union contracts. Revenues may be constrained by a ceiling on taxing power. Therefore, large increases in revenues or reductions in expenditures may not be possible to obtain in a single budget year.

The contribution of this research will be a model to predict the general fund balance in advance so that preventive actions to ensure a surplus can be easily taken. This research will contribute knowledge about whether financial variables can be used to estimate a

model that will predict the general fund balance with greater accuracy than a naive model. A gap exists in prior governmental and municipal research in this area as previous work has not attempted to estimate a predictive function for the general fund balance.

The empirical question is to determine whether a predictive model can be developed from financial variables which can predict a general fund deficit prior to its occurrence. The basis for the choice of the dependent variable, the general fund deficit/balance, as the key proxy for financial difficulty/position is discussed more fully in Chapter 2.

1.3 Organization of this Dissertation

The dissertation is organized as follows. Chapter 2 contains the theory for selection of the general fund deficit as the dependent variable and best proxy for future financial difficulty. That chapter also includes a review of relevant prior research. Chapter 3 outlines the research question, how the data was collected, and the independent financial variables both individually and by type. Chapter 4 outlines the research methodology. Chapter 5 reviews the results of the research and contains a discussion of the findings. Chapter 6 concludes the dissertation with the implications of the findings and limitations of the study.

CHAPTER 2

SIGNIFICANT PRIOR RESEARCH

2.1 Introduction

This chapter contains a review of prior research related to the proposed research. Literature which has predicted future financial outcomes from past financial data are reviewed as well as related municipal research.

The accounting literature has established that past financial statement data can be used to predict future financial condition. In governmental units, there are operating revenues and expenditures that recur each financial operating cycle. For example, a high proportion of revenues are property taxes and a high proportion of expenditures are salaries and wages; both remain relatively static. Across governmental units, among financial variables regularities may exist that may also be predictive of future outcomes such as a general fund deficit. Such regularities have been discovered in corporate bankruptcy prediction and municipal bond rating studies. These studies used past financial data to predict future financial outcomes. If corporate financial data can be used to predict bankruptcy and municipal financial data can be used to predict bond ratings, then it is reasonable to presume that municipal financial data can be used to predict the general fund balance.

2.2 The General Fund

2.2.1 The Importance of the General Fund

The general fund is the most important operating fund in a governmental unit. The government's basic operating activity includes provision of services and collection of revenues which are reflected and recorded in the general fund. The Government Finance Officers Association Governmental Accounting, Auditing and Financial Reporting "blue book" (Government Finance Officers Association 1988, 23) is a primary handbook for municipal finance officers on governmental accounting and reporting standards. It notes the importance of the general fund:

The general fund of a government unit serves as the primary reporting vehicle for current government operations. The general fund, by definition, accounts for all current financial resources not required by law or administrative action to be accounted for in another fund. Accordingly, the general fund conceivably could be used to account for all government activities and normally should be used to account for all general government functions.

The Governmental Accounting Standards Board (GASB) also affirms the importance of the fund balance as representing the net financial resources available for future periods. A deficit fund balance represents a net liability which must be satisfied from future periods' resources. In the "Proposed Statement of the Governmental Accounting Standards Board: Measurement

Focus and Basis of Accounting-Governmental Funds"

(Governmental Accounting Standards Board 1987, 72) the concept of interperiod equity is explained.

As noted in paragraph 59 of Concept Statements 1, the intent of balanced budget and debt limitation laws is to require financing and spending practices that enable governmental entities to avoid financial difficulty and to "live within their means." The general objective of these laws is that the current generation of citizens should not be able to shift the burden of paying for current-year services to future-year taxpayers.

Accordingly, a deficit fund balance would represent a decline in interperiod equity. This deficit would indicate that current citizens are "living beyond their means" and shifting the burden of paying for current services to taxpayers in future periods.

Additionally, the importance of the fund balance is emphasized by the GASB in the "Measurement Focus and Basis of Accounting-Governmental Funds" Proposed Statement (Governmental Accounting Standards Board 1987,72).

The fund balance of a governmental fund measured using the flow of financial resources measurement focus (GAAP fund balance) is the net financial resources available for future periods. The Board believes this important piece of information contributes to the overall picture of an entity's financial position.

The American Institute of Certified Public Accountants (1986, 13) Audit and Accounting Guide for

Audits of State and Local Governmental Units defines the general fund as follows:

The general fund accounts for all activities except those required to be accounted for in another fund. Revenues in this fund are derived from taxes, fees, and other sources that usually are not designated for any specific purposes (for example, licenses, permits, or charges for incidental services). The revenues are used for general ongoing government services such as administration, maintenance, and police and fire protection.

The definitions and statements of the AICPA, GASB, and GFOA all concur on the importance of the general fund in its role to account for the bulk of the operating activity of the governmental unit. The GASB's proposed statement focuses on the importance of measurement of fund balance within the governmental funds and its impact on interperiod equity.

The predicted general fund balance can be important knowledge to aid managers in developing plans to prevent financial distress in a governmental unit. It is a key criterion of financial position which is recognized as a critical variable by Moody's - - a deficit general fund balance indicates serious financial difficulty. The general fund balance is the amount of "equity" or monies left over after paying the operating expenditures of the period. If a deficit exists in the general fund after paying operating expenditures, serious short-term effects will generally immediately occur. For example, cutback of services, layoff of personnel, delays in payments to vendors and employees, and inability to borrow, will all

be possible. A municipal finance officer may realize that a general fund deficit will occur at the end of the fiscal period. However, avenues (such as borrowing) which previously existed to remedy a predicted deficit may no longer be available. Revenue correction measures are often unable to be invoked immediately without a vote of taxpayers or elected representatives and considerable debate; particularly if the revenues and taxes are being raised to pay for past obligations rather than provide increased future services.

Rubin (1980) discussed the possibility of restructuring political incentives to cause improvement in financial reporting and budgetary practices. Rubin discussed the great lengths to which politicians will go to "hide" deficits through manipulation of accounting techniques. Of course, a worrisome aspect of Rubin's discussion of the manipulative techniques to obscure deficits is that it may be difficult for a researcher to detect the general fund deficit in all cases where it exists if it is "hidden" through such techniques.

Robert Anthony (1985) discussed "Games government accountants play" to conceal deficits.

. . . this is not the objective of accounting in the typical government organization. In most municipalities, the actual objective is to report a small surplus. A deficit is obviously bad; it indicates that the city did not live within its means. . . .

A nonbusiness organization maintains its capital through operations if it breaks even - that is, if its revenues at least equal its expenses. (Anthony, 1985, 161).

Why would politicians go to such efforts unless the general fund deficit is a recognized indicator of financial distress and a reflection of improper management of resources? Presumably, the consumer of government services, the taxpayer, recognizes a general fund deficit as evidence of mismanagement when reported by the media. A general fund deficit is also a recognized indicator of fiscal distress by other users of financial statements: management (bureaucrats and legislators), and other users such as credit rating agencies (e.g., Moody's).

The general fund accounts for virtually all of the units' primary operations. As the health of the general fund goes, so goes the governmental unit.

2.2.2 The Bond Rating

A general fund deficit generally precedes a downgrading in bond rating. However, a factor which confounds the use of bond ratings as a proxy for predicted financial position is the dramatic increase in municipalities' purchase of bond insurance. Standard and Poor's will issue a AAA rating to units which qualify for and purchase bond insurance through the American Municipal Bond Assurance Corporation (AMBAC) or the Municipal Bond Insurance Association (MBIA). Standard & Poor's Credit Overview - Municipal Ratings (Standard &

Poor's 1983, 95) notes the growth and impact of AMBAC and MBIA insurance.

One way to gain market access is by raising the rating on a bond or note through the use of insurance. Thus the insurance vehicle has gained increasing acceptance by both issuers and investors. The two major insurers in the municipal bond and note field are American Municipal Bond Assurance Corp. (AMBAC) and Municipal Bond Insurance Association (MBIA). . . .

The largest insurer of new issue municipal bonds and notes is MBIA. Total new municipal bond debt service insured during the fiscal year ended Nov. 30, 1982 rose 118% to \$7.2 billion, up from \$3.3 billion the prior year. Excluding notes, cumulative debt service insured by MBIA from its inception in 1973 through fiscal year-end 1982 stood at nearly \$20.6 billion, with almost \$8.8 billion in par value.

As of Nov. 30, 1982, over 71% of the \$8.8 billion carried uninsured ratings of at least 'BBB', compared to 76% a year earlier, with more than 53% rating 'A' or higher and almost 29% not rated. MBIA's insurance guarantee raises the rating of any issue covered to 'AAA'. Of the 1,697 issues insured totaling almost \$10.5 billion par value in bonds and notes, MBIA has sustained no defaults or losses.

Therefore, the rating cannot be meaningfully interpreted for those units which purchase insurance. In effect, the rating can be bought for a fee. The popularity of such insurance indicates that the municipal manager may have realized it is too late to take corrective action to improve the unit's financial position¹.

¹ An interesting research question would be to examine those municipalities who do purchase bond insurance to determine if there are commonalities in their financial condition or if the general fund is in a deficit position at that point. This will not be attempted within the scope of this proposal.

The municipal bond rating was not utilized in this research as a proxy for future financial difficulty/position due to the prevalence of insurance and limited number of units seeking ratings. The municipal bond rating is simply not generalizable to the entire population of municipalities or governmental units as not all governmental units market bonds on an annual basis and not all are rated. Even units which request bond ratings are unlikely to do so annually. Thus, the rating does not serve well as a indicator of future decline in financial position in time to take preventive action. An early warning system could not be established for all units utilizing the rating as a key indicator. By contrast, every governmental unit has some form of financial records which can determine a general fund balance at the end of a fiscal period, even if not audited. The general fund balance was readily available, measurable and meaningful on an annual basis.

2.3 Empirical Tests to Develop Predictive Models

Accounting research has been conducted to develop predictive models of corporate bankruptcy, municipal bond ratings and municipal fiscal stress. Examples of each type of research ^{are} ~~was~~ presented in this section to  illustrate that empirical models using past financial data have successfully predicted future financial position.

2.3.1 Models to Predict Corporate Bankruptcy

Altman (1968) performed a landmark study utilizing financial ratios to predict corporate bankruptcy with a linear discriminant function. His discriminant function contained five independent variables which were based upon their popularity in the literature and potential relevance².

Groups of firms were labeled bankrupt and non-bankrupt. Bankrupt firms were defined as those which had filed a bankruptcy petition under Chapter X during 1946-1965. The non-bankrupt group was selected to eliminate the very large and very small firms. The study group had firms with a mean asset range between \$1 million and \$25.9 million in the reporting period prior to bankruptcy. Altman established a discriminant function supporting his alternative hypothesis that the a priori groups were significantly different.

The predictive accuracy of the multiple discrimination model to classify firms as bankrupt or non-bankrupt was: 95%, 72%, 48%, 29% and 36% (Altman

² The final discrimination function is as follows:

$$Z = .012X_1 + .014X_2 + .033X_3 + .006X_4 + .999X_5$$

where

X_1 = Working capital/Total assets

X_2 = Retained earnings/Total assets

X_3 = Earnings before interest and taxes/Total assets

X_4 = Market value equity/Book value of total debt

X_5 = Sales/Total assets

Z = Overall Index

(Altman 1968, 594).

1968, 604). These percentages correspond in order to the data contained in financial statements one year prior to bankruptcy, two years, three years, four years, and five years prior. In effect, the predictive accuracy of the models decreased in direct correspondence to the distance in time prior to bankruptcy. Altman also tested the model on two secondary samples (years 1958-1961) of 25 bankrupt firms and 25 non-bankrupt firms with a predictive accuracy of 96% for one period prior to bankruptcy.

Moyer (1977) retested the Altman model on a sample of firms ranging in size from \$15 million in assets to \$1 billion for 1965 through 1975. This retest was conducted to evaluate the Altman discriminant models' predictive accuracy in subsequent years. Moyer utilized the stepwise classification (WILKS method) and found that the predictive power of the model was not significantly impaired by eliminating two of the variables in Altman's model³. He did find reduced predictive accuracy of 75% rather than the 95% reported by Altman based on a financial statement one year prior to declaration of bankruptcy. This may indicate that the discriminant

³ "Using a stepwise MDA approach it was found that somewhat better 'explanatory' power could be obtained from the model if the market value of equity/book value of debt and sales/total assets variable are eliminated from the model. This contrasts sharply with Altman's finding that the sales to total assets variable is the second most important variable in the model in terms of its contribution to the model's discriminating ability." (Moyer 1977, 16).

function was sensitive to the time span of the data or possibly the size of the firms in the sample. Moyer compared Altman's model to Beaver's (1968) univariate test of each of fourteen accounting ratios to classify firms as failed or not. Moyer found the Altman multivariate model was clearly superior as it made considerably fewer Type II errors (classifying non-failing firms as failing) than did alternative models.

Altman (1973) again utilized a discriminant function to predict railroad bankruptcy. Based on a paired sample of bankrupt and non-bankrupt firms, the function utilized independent variables which had values significantly different from the industry averages. That function accurately predicted 97.7% of those firms which would be bankrupt with data within one to two years prior to bankruptcy. Altman noted, however, that there was an upward bias in his model and that the observations used to construct the model were the ones classified by it. This caution should be considered in design of research to develop predictive models. If the sample was designed with a hold-out sub-sample to test the final model, the amount of such upward bias in the predictive accuracy could be determined.

Various studies have been performed utilizing ratios to determine if they are useful in predicting corporate bankruptcy. Ohlson (1980) used a logistic model with nine ratios on a sample of 105 failed firms and 2,000

non-failed firms. Firm size (measured by total assets/GNP price-level index) was the most significant variable. Ohlson reported prediction error rates of 17.4% for nonbankrupt firms and 12.4% for bankrupt firms one year prior to bankruptcy.

Dambolena & Khoury (1980) utilized discriminant analysis. Like Altman (1968), a paired sample of bankrupt and non-bankrupt firms was utilized and a discriminant model was tested. The independent variables utilized included profitability, activity and turnover, liquidity, and indebtedness measures. The methodology included the use of the WILKS stepwise method. In the four years prior to failure, 91.3% of the sample was correctly classified in year one, 84.8% in year two, 82.6% in year three and 89.1% in year four. The contribution of this research was summarized as follows:

The strength of the preceding analysis lies not only in the superior predictive power of the model, but in the improvement in the conceptual framework of models for predicting corporate bankruptcy. (Dambolena and Khoury, 1980, 1025).

The research methodologies used to predict corporate bankruptcy have been reviewed and analyzed by a number of researchers. Zavgren (1983) compared prior research for discriminant and conditional probability models. Zavgren noted that little theoretical support for the choice of independent variables has been offered in past studies. She also asserts that macroeconomic variables may also be impacting the results.

Hamer (1984) compared the sets of variables used and the statistical methods in prior research to predict corporate bankruptcy. She concluded that several reasonable sets of variables may be statistically related to corporate financial failure and each of these sets may achieve predictive accuracy of 70 to 80% in each of the three years before failure.

Researchers have also analyzed sample selection in prior corporate bankruptcy prediction research.

Zmijewski (1985) examined potential sample bias for overrepresentation of distressed firms and selection bias by comparing probit estimates. Zmijewski concluded that such bias existed but that it did not appear to affect statistical results or classification rates.

Hennaway and Morris (1983) analyzed the impact of the base year in developing predictive models by constructing two models. One model was constructed from data for each of 5 years prior and the other from 12 months prior to bankruptcy. Both models correctly classified firms 80% of the time.

The most that can be said is that companies in general are more vulnerable in times of economic recession and that firms operating in different industries are more at risk at particular points in the economic cycle. (Hennaway and Morris, 1983, 209).

Hennaway and Morris concluded that industry membership is the most important factor in predicting business failure

and that their results confirm reliability of such models.

2.3.2 Models to Predict Municipal Bond Ratings and Net Interest Cost

Carleton and Lerner (1969) utilized discriminant analysis with financial data as independent variables to contemporaneously classify two random samples of 1967 general obligation bond ratings for 491 municipalities as well as a hold-out sample of 200. Eighty-eight percent of the hold-out sample were correctly classified into the classifications of Ba and Baa (and above) but only 35% were correctly classified across all ratings.

Horton (1970) selected 150 general obligation municipal bonds rated by Moody's and stratified the sampled bonds into investment or non-investment quality. The predictive accuracy to classify the bonds into investment or non-investment quality of the estimated model on the hold-out sample of 50 bonds was only 54%.

Michel (1977) utilized discriminant analysis to predict four groups of Moody's bond ratings (Aaa, Aa, A, Baa) for each of the 50 largest American cities, excluding New York, Washington, D.C., and Honolulu for 1962-1971. Each set of data had a hold-out sample established from a time period which did not overlap each other. The estimated model's predictive accuracy for the hold-out samples was 58.3% and 53.5% using the same

cities and only 38.3% and 35.7% using different cities (Michel 1977, 595).

Osteryount and Blevins (1978) studied Aaa and Aa rated state general obligation bond issues from 1950-1972 and applied stepwise discriminant analysis to select 7 variables. The model correctly classified each of the years from 1950-1972 at 91.57%. Certainly, a limitation of the study could be the focus on the higher grades which may be easier to model and predict than to develop a model which predicts changes in ratings or lower grades.

Raman (1981) utilized financial ratios to develop a model to discriminate between upgraded and downgraded bond ratings. All cities with up/down grading during July 1975-June 1979 were selected resulting in a sample of 30 cities. Discriminant analysis was used to achieve a classification rate ranging from 50.0% to 100%.

Raman (1982) selected cities over 300,000 population over a ten-year period which had an unchanged A rating or were downgraded from an A rating. Five cities were unchanged and seven cities were downgraded from an A rating. Five ratios were selected to estimate a discriminant function to predict a unit's future municipal bond rating. Three variables representing working capital from operations, cash flow from operations and short-term debt achieved an accurate classification rate of 83.3% (Raman 1982, 48). In

particular, short-term debt discriminated between the two groups of cities.

Raman (1982) selected cities (populations 50,000 and above) in four Moody's rating categories that had unchanged ratings over 1975-1979. Ten ratios were selected to estimate a discriminant function to classify the cities' rating by category. The classification accuracy for the four groups ranged between 51.3% and 55.6%. The measures for marketability risk and economic well-being had the greatest discriminating power (Raman 1982, 152).

Wallace (1981) applied both probit and regression analysis to financial data for all general obligation municipal bonds issued in Florida from 1974 to 1976. Her regression model using financial variables explained 86% of the variation in net interest cost for the sample.

Copeland and Ingram (1982) extend Wallace's (1981) research by focusing on state-mandated accounting and auditing practices to determine alternative measures of bond risk and return with a sample of 122 municipalities from throughout the United States.

Our study provides an extension of Wallace's research by (1) examining a more representative sample of United States municipalities, (2) employing alternative measures of bond risk and return, and (3) focusing on state-mandated accounting, auditing, and financial management practices. (Ingram and Copeland, 1982, 766).

In another study, Copeland and Ingram (1982) selected 112 cities with general obligation bond rating

changes (Moody's) during fiscal 1976 along with 56 cities which did not have bond rating changes. All cities selected had populations in excess of 10,000.

Discriminant analysis was used to estimate a classification function with 28 ratios of revenue, expenditure, debt and investment data as independent variables. The overall classification rate was 79%. Reliance on short-term debt was higher for the downrated group for all five years. The results support the assertion that municipal accounting numbers can be found to be contemporaneous measures of the same risk characteristics as those reflected in bond rating changes (Copeland and Ingram 1982, 287).

Copeland and Ingram (1983) selected 62 municipalities for which both bond yields and financial accounting data were available. The usefulness of municipal pension accounting disclosures to assess bond ratings, bond yield premiums, changes in yield premiums, and systematic risk measures were evaluated. The regression models did not establish an association for assessing municipal bond risk. Copeland and Ingram (1983, 160-161) conclude:

Current municipal financial reporting practices do not appear to provide relevant and/or reliable information for assessing municipal bond risk. . . . What would happen if all municipalities did provide timely reports about unfunded pension liabilities? Both the theoretical arguments and corporate securities research findings suggest that municipal bond investors would impound this information into the rates of return they demand in the credit markets. While

we do not know how municipal managers who employ pay-as-you-go practices would react to such credit penalties, some are bound to respond by reducing the unfunded pension liabilities of their communities.

Wilson and Howard (1984) replicate and extend Wallace's (1981) and Copeland and Ingram's (1982) studies using regression and probit analysis to predict municipal bond yield premiums and betas (rather than net interest cost and ratings) for municipalities. Wilson and Howard (1984, 222) conclude:

Our results imply that municipalities having poorer financial operating performance and substandard reporting practices experience, ceteris paribus, lower bond ratings and higher borrowing costs. Additional research is needed, however, to develop a strong theoretical foundation for modeling municipal default risk and to better understand the function of financial and accounting variables in assessing default risk.

Tiller and Mautz (1985) selected a random sample of ten municipalities from each state that had uninsured general obligation bonds outstanding at December 31, 1981. The effect of state accounting and auditing requirements and variability in bond rating were examined using one-way analysis of covariance. The results suggest that municipalities in states with mandated accounting and auditing requirements receive higher ratings than those in other states.

Westcott (1984) analyzed socioeconomic variables and financial accounting ratios with probit analysis to estimate a prediction model for general obligation bond ratings. The predictive accuracy of the model was 65%

for the random sample of 110 cities. Accounting ratios and socioeconomic attributes were not jointly useful in predicting bond ratings (Westcott 1984, 419). Among limitations of the study noted by Westcott was that no reliability tests were conducted on the computer file data used to estimate the model. Also, the time frame of the data may have affected the study's results. However, Westcott notes her negative results are similar to prior studies and suggests it may be due to the subjective nature of the rating process itself (1984, 419).

Apostolou, Reeve, and Giroux (1984) used a two-way analysis of variance on net interest cost for 531 municipal bonds issued by Minnesota municipalities during 1977-1980 and the surplus or deficit. The researchers found no association between the surplus or deficit and change in net interest cost.

Dhaliwal, Sorensen (1985) noted limitations in the Apostolou et al research design. They also urged that the relationship between the cause of the change in the surplus/deficit variable and the effect of this change on net interest cost should be examined. Dhaliwal and Sorensen (1985) recommend that the variables which are the causes of the change in the surplus/deficit be included in a study to more appropriately evaluate the surplus/deficit's association with net interest cost.

The prior research predicting net interest cost and municipal bond ratings provide support for the use of

municipal financial accounting information to predict future financial outcomes. Such information will be used in the current research. Additionally, in one study, socioeconomic data was found to not greatly improve the predictive accuracy of estimated models.

2.3.3 Models to Predict Fiscal Stress

The current research focuses on the development of a parsimonious model for researchers and for state and local policymakers to use as part of a general fund deficit early warning system. A parsimonious model is preferable for obvious economies in data collection and understandability for prospective users. A more important reason for parsimony is that corrective management action may be focused upon the most important variables found to be related to future insolvency of a general fund. A variety of empirical studies and case studies document the search in the municipal reporting environment for fiscal stress proxies.

In 1973, the Advisory Commission on Intergovernmental Relations (ACIR) identified six warning flags based on case studies of thirty cities with serious financial crises.

- . an operating fund revenue-expenditure imbalance in which current expenditures significantly exceeded current revenues in one fiscal period;
- . a consistent pattern of current expenditures exceeding current revenues by small amounts for several years;
- . an excess of current operating liabilities

over current assets (a fund deficit);
 . short-term operating loans outstanding
 at the conclusion of a fiscal year (or in
 some instances the borrowing of cash from
 restricted funds or an increase in unpaid
 bills in lieu of short-term operating
 loans);
 .a high and rising rate of property tax
 delinquency;
 .a sudden substantial decrease in assessed
 values for unexpected reasons.
 (ACIR, 1973, 4).

No empirical techniques were utilized to derive these six warning signs. In 1981, ACIR prepared a bulletin which summarized efforts by states to prevent and control local financial emergencies. Michigan, New Jersey, Illinois, Florida, Ohio and Nevada have statutes which permit state control of local finances if a financial emergency is determined to exist.

Clark (1977) did a detailed review of twenty-six funds flow indicators which may be indicative of "fiscal strain." These "fiscal strain" indicators were factor analyzed to construct composite factors. These factors were then input as variables into a multiple regression model. Clark concluded that problems particular to the Northeast, management problems, and local fiscal characteristics were important causes of "fiscal strain" across a sample of cities from throughout the nation.

Howell and Stamm (1979) performed a factor analysis on data from a sample of 120 medium to large cities from across the nation. They identified 22 financial and economic variables that formed five statistically significant factors related to fiscal stress.

Jones and Gabhart (1979) conducted a factor analysis on 60 Michigan cities' data with over 10,000 population for years 1970-1974. The optimal model for dichotomous classification of cities as cash-rich and cash-poor (75% assets in cash vs. 10 % or less in cash) had a predictive accuracy rate of 75 to 83.5%.

2.4 Summary

The important trait of the studies cited in this chapter is that past financial data has been used in prior accounting research to predict future financial outcomes. For municipalities, net interest cost and bond ratings have been predicted with a high rate of classification accuracy using financial accounting variables. However, no category of financial variable has emerged as a consistent predictor of financial position in empirical research on cash flow or other financial indicators of municipal fiscal stress. Reviews of research into corporate bankruptcy prediction note the lack of theoretical support for the independent variables selected. Similarly, no work has appeared which theoretically develops or empirically tests a model to predict the general fund balance.

Corporate bankruptcy studies provide evidence that past financial data can be used to predict future financial difficulties with a high degree of accuracy. Although federal statutes provide a Chapter for municipal

bankruptcy, the geographic entity and constituency of taxpayers expecting services cannot be "dissolved through bankruptcy."

Therefore, municipal bankruptcy generally does not occur so a parallel study is not appropriate.

Additionally, the general fund variable is a continuous variable, not a dichotomous state like bankruptcy so a discriminant function model would sacrifice meaningful information and is not utilized in this research.

The municipal bond ratings studies indicate that municipal data can be used to predict ratings. A model to predict ratings would not be useful to predict financial distress as few governmental units are rated on an annual basis. For example, only six of the thirty deficit units in the current research sample were rated during the sample period. Only one of the six in the sample which were rated had a change in rating. Clearly, a variable which only exists for 20% (6 of 30) of the governments with a deficit in Michigan could not be a key criterion to predict future financial position.

The definition of stress, distress, financial difficulty, etc. has varied across prior research without a strong theoretical framework for justifying such definitions. The general fund balance used in the current research is a key financial variable which is well understood by both management and taxpayers alike and is readily available and measurable.

The amount of unfunded pension liability has been evaluated by various researchers to determine that it is generally not available in municipal reports. The unfunded pension liability is asserted by these researchers as being a variable of interest to users of municipal reports.

The next chapter will describe the research question, data, and the independent variables.

CHAPTER 3

THE RESEARCH QUESTION, DATA, AND VARIABLES

3.1 Introduction

The prior chapter established the rationale for predicting municipal unit general fund balances. It also contained reviews of bankruptcy, municipal bond rating, and municipal fiscal stress research. A central feature of that research is that predictive models of future financial outcomes have been estimated from past financial data. This chapter outlines the current research question, describes how the data was collected, and discusses the independent variables by category, and lists definitions of each variable.

3.2 The Research Question

The research question is: can a model using prior year financial data predict a government's general fund balance with greater accuracy than a naive model? The naive model used in the current research predicts that the future general fund balance will be in the same amount as the current general fund balance:

$$\text{General Fund Balance}_t = \text{General Fund Balance}_{t-y}$$

where t = index for the target year
 $t-y$ = index for the predictor year, and
 y = 1, 2, or 3 -- the number of
preceding or "lead " years prior
to the target year.

Also, six linear regression models of the target general fund balance will be estimated using various municipal financial data. In all cases of model estimation, 1981 is the year from which the dependent variable general fund balances are sampled. The estimated models will be validated by computing their accuracy in predicting general fund balances measured at fiscal year end 1982.

3.3 The Data

3.3.1 Selection of the Sample

There are over 2,000 local units of government in Michigan. All but the smallest units are required to file an annual audit with the Michigan Department of Treasury. Units with less than 2,000 population file a biennial audit. In addition, property tax data and municipal debt data are on file with the State's Department of Treasury.

All local governmental units in Michigan with a general fund deficit at fiscal year-end in 1981 were selected. These deficit units were matched with a local governmental unit which did not have a general fund deficit. The non-deficit units were selected for matching with deficit units on the basis of two criteria: (1) must be the same type of unit (e.g., county, city, township, village), and (2) must

be generally of comparable size defined as within plus or minus 10% of the same population¹. *full*

Thirteen units with deficits could not be suitably matched with a nondeficit unit and were excluded from the sample²¹. For example, the City of Detroit and County of Wayne had deficits of \$79,490,153 and \$20,760,510, respectively, in 1981. These units could not be matched with a nondeficit unit of comparable size in Michigan. Table 1 summarizes the reasons for excluding a deficit unit from the sample. Four of the matched pairs violate the criteria but were retained in the sample².

² *outside but not inside the criteria,*
¹ Suitable non-deficit matches were found for Benzie County, Lake County, the City of Grosse Pointe Park, and Alpena Township.

¹ ² Ironwood, Houghton, Detroit, Northville, Ecorse, Mineral Hills, Keweenaw, Calhoun, Homer, Wayne, Mason, Coldwater, and Wayne County.

TABLE 1
SAMPLE REDUCTION

Type of Unit	Deficit Unit in 1981*	Final Sample Pairs	<u>Reasons Removed</u>	
			No Match	Other
County	10	6	4	
City	18	13	3	2**
Township	9	6	3	
Village	6	5	1	
	—	—	—	—
Totals	43	30	11	2

*Three different fiscal year-ends were possible in this sample December 31, 1980, March 31, 1981 and June 30, 1981 were defined as "1981" fiscal year-ends.

**One deficit unit had three years of missing audits and the other deficit unit had reported numbers for the general fund balance which appeared to be inaccurate.

The net sample achieved after this process consisted of 30 matched pairs, comprised of 26 cities, 10 villages, 12 townships, and 12 counties. The resultant sample had a mix of different types and sizes of local governmental units. Table 2 lists the governmental units by group and type of unit which were selected for the final sample.

3.3.2 Collection of the Data

Data was collected for a total of five years: four fiscal years ending in 1978, 1979, 1980, 1981 and one additional year, 1982, for a hold-out sample to validate the model. The financial data were collected by reading audited financial statements and manually transcribing the appropriate numbers onto data capture sheets. These capture sheets were subsequently transcribed into the research data base. An example of the original data capture sheet used for 1979, 1980 and 1981 data from the audited financial statements is located in Appendix A.

The State of Michigan has mandated accounting and auditing requirements which include a uniform chart of accounts and uniform standards for audited financial statements. Tiller and Mautz (1985), Copeland and Ingram (1982), and Wilson and Howard (1984) found state mandated accounting and auditing standards were associated with higher bond ratings. The mandated Michigan accounting and auditing standards for local governments improve the reliability of the financial data for this study.

Other financial data were also collected. Total property values (state equalized valuation), local unit taxing power measures, and debt measures were provided by the Property Tax Division and the Municipal Finance Division, Bureau of Local Government Services, Department of Treasury, State of Michigan. The debt variables were computed from manual records of municipal borrowing maintained by the Municipal Finance Division.

Validity checks were done throughout the data collection. The initial check compared each number on the data capture sheet with the original source. Other checks compared certain variables across years within a governmental unit to see if variations in amounts appeared reasonable. Certain variables were compared within categories within years. For example, cash plus savings plus interfund or intergovernmental receivables should not exceed total assets. Additional checks were conducted any time data was transferred from one medium to another or any time data transformation was performed. This careful manual verification prevented researcher-induced error from occurring which could have confounded the results of this study.

TABLE 2

LIST OF GOVERNMENTAL UNITS BY GROUP AND TYPE OF UNIT
SELECTED FOR SAMPLE

Type of Unit	Deficit Unit	Population	Non-Deficit Unit	Population
County	VanBuren	66,672	Lapeer	68,525
	Ionia	50,476	Montcalm	47,512
	Alpena	32,238	Newaygo	34,805
	Manistee	22,948	Oceana	21,835
	Benzie	11,143	Leelanau	13,986*
	Lake	7,748	Kalkaska	10,925*
City	St. Clair			
	Shores	76,277	Kalamazoo	78,532
	Highland			
	Park	27,916	Kentwood	30,358
	Benton Harbor	14,575	Walker	15,097
	Grosse Pointe			
	Park	13,297	Marysville	7,335*
	River Rouge	12,770	Melvindale	12,313
	Three Rivers	6,979	Marshall	7,080
	Huntington			
	Woods	6,935	Flat Rock	6,872
			New	
	Negaunee	5,787	Baltimore	5,445
	Keego Harbor	3,099	Rockford	3,037
	Ionia	2,777	Norway	2,915
	Vassar	2,667	Hartford	2,492
	Reed City	2,212	Zilwaukee	2,206
	West Branch	1,784	Sylvan Lake	1,954
Township	Alpena	32,238	Park	10,340*
	Montrose	6,183	St. Joseph	5,966
	Raisin	5,497	Bath	5,753
	Sherwood	1,756	Brant	1,831
	Manistique	869	Butman	835
	Humboldt	576	Cornell	532
Village	Oxford	2,743	Carleton	2,785
	Sebewaing	2,052	Newberry	2,111
	Dexter	1,522	Shelby	1,624
	Columbiaville	946	Sanford	875
	Clifford	406	Mecosta	421

*Exceeds plus or minus 10% criterion, but was closest unit of

same type with all five years of data available.

3.4 The Independent Variables

A list of potential predictor variables was developed from Moody's and Standard and Poor's rating factors as well as the literature previously reviewed in Chapter 2. Each variable was selected for inclusion in the model when it appeared either as a key factor in rating agency evaluations, as a variable in prior research, or within stress "checklists" prepared by governmental organizations³.

The rating agencies obtain substantial information from units when the units request a new bond issue rating. However, most units do not prepare the bond rating information routinely or on an annual basis. Problems with missing and unavailable data have been noted in prior research such as described in Section 2.4 regarding unfunded pension liability. This will continue to be a troublesome aspect of public sector research until financial reporting improves.

Additional economic data for variables such as income levels, employment mix, retail sales, labor force growth, and building activity was sought. The U.S. Bureau of the Census, Governments Division and other State of Michigan departments were queried. However, economic or demographic

³For example, taxing power is a critical measure of the governmental unit's ability to raise additional revenues. Taxing power is one of Moody's three tests for the threshold of financial difficulty and appears consistently as a factor in prior research. Therefore, certain indices which measure taxing power were evaluated for inclusion in the model.

information which was available was not available on an annual basis for the five year period needed for this study. Thus, the current research was performed using financial statement and other unit-specific financial data. Table 3 lists the variables used in the current research and their description. The variables are discussed by category in the next six subsections.

TABLE 3
VARIABLE NAMES AND DESCRIPTIONS

Type	Variable Name	Description
Dependent:	DEFICIT	General fund balance 1981
Independent:		
Assets	CASH	Cash
	SAV	Savings, investments, and other liquid assets
	DFOF	Due from other funds
	TA	Total assets
	DFOU	Due from other units
Liabilities	AP	Accounts payable
	DOF	Due to other funds
	TL	Total liabilities
	UPL	Unfunded pension liability
	DOU	Due other units
Budgetary Control	REVS	Revenues
	REVAR	Revenues variance
	EXP	Expenditures
	EXPVAR	Expenditures variance
Tax Base	SEV	State equalized valuation
	RSEV	Residential SEV
Taxing Power	RTP	Reserve taxing power
Borrowing	GODPC	General obligation debt per capita
	TAN	Tax anticipation notes per capita
	TDPC	Total debt per capita

3.4.1 Assets

The asset variables reflect available resources to pay current obligations. Municipal managers generally use available liquid assets to pay vendors and employees so asset variables' values may decline as they are used to cover immediate payments for current liabilities due. Definitions of the individual variables are listed below.

- a) Cash (CASH) - cash on hand at fiscal year-end in the general fund.
- b) Savings, investments and other liquid assets (SAV) - current assets other than cash at fiscal year-end in the general fund.
- c) Due from other funds (DFOF) - a receivable of the general fund from other funds of the unit. The amount is due within the next fiscal period.
- d) Total assets (TA) - total assets at fiscal year-end.
- e) Due from other units (DFOU) - a receivable of the general fund from other governmental units. The amount is due within the next fiscal period.

3.4.2 Liabilities

The liability variables reflect current obligations to be paid within the fiscal period, except for unfunded pension liability (UPL). UPL represents an estimate of a long-term total liability for funding of pension obligations. Units in trouble with a deficit may defer

payments to vendors and others to the extent possible. However, many payments must be made to employees, utilities, etc. or cessation of vital service is threatened. Current liabilities such as account payables, therefore, may not increase dramatically due to the need to pay providers of services even though the unit is short of cash.

Unfunded pension liability (UPL) is a substantial long-term liability and funding is often neglected by units in distress. The pension liability payment is more easily deferred than current payments to employees or vendors. This variable may be a key criterion of serious future financial trouble as the unit begins to increase "long-term" liabilities to meet short-term liabilities. All other things equal, a large unfunded pension liability may indicate a currently financially-stressed local government. It is possible that an inability to currently fund its liabilities may be a foreshadowing of future financial stress as well. However, measurement error in the unfunded pension liability may preclude a discoverable relationship between unfunded pension liability and future general fund balances⁴.

Definitions of the liabilities used as independent variables in this study are listed below:

⁴This measurement error stems from the lack of uniformity in municipal pension accounting, and has been documented by other researchers.

a) Accounts payable (AP) - the amount due to vendors within the next fiscal period; i.e. current liabilities to outside parties.

b) Due to other funds (DOF) - the amount the general fund owes to other funds of the unit which is due within the next fiscal period.

c) Total liabilities (TL) - total liabilities at fiscal year-end.

d) Unfunded pension liability (UPL) - amount pensions are estimated to be underfunded at fiscal year-end. The variable's amount was voluntarily disclosed in the financial reports and in some cases was determined by actuarial methods.

e) Due other units (DOU) - the amount the general fund owes to other governmental units which is due within the next fiscal period.

3.4.3 Budgetary Control

The budgetary control variables reflect the actual inflows (revenues) and outflows (expenditures) during the current period. The variance measures reflect a measure of management control of resources. If expenditures consistently exceed the budget amount and/or revenues are consistently less than budgeted, the general fund balance should decline. The revenue variance (REVAR) and expenditure variance (EXPVAR) were computed by comparing actual revenues and expenditures to budgeted revenues and

expenditures in the audited financial reports. A negative value represents an unfavorable variance. A negative revenue variance would mean that actual revenues fell short of (were less than) budgeted revenues. A negative expenditure variance would mean that actual expenditures exceeded (were greater than) budgeted expenditures.

a) Revenues (REVS) - total revenues for the fiscal period just completed in the general fund.

b) Revenues budget variance (REVAR) - amount actual revenues differ from budgeted revenues for the fiscal period just completed.

c) Expenditures (EXP) - total expenditures for the fiscal period just completed in the general fund.

d) Expenditures budget variance (EXPVAR) - amount actual expenditures differ from budgeted expenditures for the fiscal period just completed.

3.4.4 Tax Base

The property tax is ^{levied} ~~assessed~~ against ^{state equalized} valuation (one mill equals \$1 per \$1,000 valuation) and is generally the largest source of revenue for a governmental unit. Although a growth in tax base would appear to imply fiscal health, it is also likely to reflect a dramatic increase in demand for services and expenditures. The variable for residential valuation is a part of the total state equalized valuation. It is also included as a separate independent variable in order to serve as a proxy for local demand for services such

as schools, police, sanitation, etc. The definitions of the variables are listed below.

a) Total state equalized valuation (SEV)- the property tax base ^{taxed property} at fiscal year-end; valuation equals 50% of ^{nonexempt} ~~assessed~~ cash value and ^{each millage point of} ~~property tax is levied at the rate~~ ^{levy consists} of \$1 per \$1,000 of valuation.

b) Total residential valuation (RSEV) - Michigan has seven classes of property valuation; residential reflects the portion of valuation attributed to residential housing.

3.4.5 Taxing Power

The property tax is generally the major source of the local governmental unit's revenue. If actual levied millage is less than total authorized by the local electorate a unit would have a remedy to fund a potential general fund deficit. However, units in serious fiscal stress are often already levying millage at the maximum allowable rate. For example, the City of Highland Park in Michigan has levied the maximum millage for property tax and a city income tax was increased by voters to the maximum rate as well to fund general fund deficits. Similarly, the City of Detroit, Hamtramck, and Benton Harbor all have levied maximum property and income tax rates to fund deficits. A definition of the variable is listed below.

a) Reserve taxing power (RTP) - the difference between the maximum allowable millage permitted by statute and the

actual levied millage; it reflects mills available to be levied within the legal maximum.

3.4.6 Short- and Long-Term Borrowing

The debt variables reflect the amount of short-term and long-term (general obligation debt) debt reported by a local government divided by population. Population scaling allows comparison across units. Units in distress may be likely to accelerate short-term borrowing in years preceding a deficit and then find short-term financing difficult to obtain when a large deficit occurs. Short-term debt has been found to be a significant variable in models predicting future municipal bond ratings (Raman, 1982). Long-term financing may decline in years preceding a deficit as the unit's ability to borrow declines.

a) General obligation debt per capita (GODPC) - the amount of long-term debt the general fund is committed to repay divided by total population.

b) Tax anticipation notes per capita (TAN) - the amount of short-term debt for which property taxes are pledged divided by total population.

c) Total debt per capita (TDPC) - the total short- and long-term debt divided by the total population of the unit.

3.5 Summary

The research question is whether a model constructed from past financial data can predict a future general fund

balance with greater accuracy than a naive model. The research question led to selection of a sample of 30 matched pairs of local governmental units. Data for a variety of financial variables were collected for a five year period of 1978-1982. Six categories of variables were identified for potential inclusion in regression models of future general fund balances. The six categories were: assets, liabilities, budgetary control, tax base, taxing power, and short- and long-term debt.

The next chapter will discuss the empirical specification of the regression models and the design of the tests used to address the research question.

CHAPTER FOUR

METHODOLOGY: A MODEL TO PREDICT THE GENERAL FUND BALANCE

4.1 Introduction

Chapter 2 contained the rationale for choosing the dependent variable, general fund balance. Each of the independent variables, by category, was discussed in Chapter 3. This chapter is an outline of methodology used to identify a model to predict a future general fund balance.

4.2 A Predictive Model of the General Fund Balance

The research question this study addresses is whether a predictive model for a governmental unit's general fund balance, developed from past financial data, has greater predictive accuracy than a naive prediction model. The null hypothesis (H_0) is simply stated:

H_0 = A regression model cannot predict the general fund balance with greater accuracy than a naive model.

The general fund deficits which formed the basis for the matched-pairs sample selection were reported at fiscal year-end 1981. Six regression models were estimated using data for the three years prior to the general fund balance in 1981. Table 4 summarizes lead time, years from which variable values were taken, and the number of observations included in each model's estimation.

TABLE 4
SUMMARY OF SIX LINEAR REGRESSION MODELS
TO BE ESTIMATED

Lead Time	Year of Data used to Estimate Model to Predict General Fund Balance at t=0 or 1981	n
t-1	1980	60
t-2	1979	60
t-3	1978	60
t-1 + t-2	1980 + 1979	120
t-2 + t-3	1979 + 1978	120
t-1 + t-2 + t-3	1980 + 1979 + 1978	180

The dependent variable in each of the models is the general fund balance in 1981 ($t=0$).

Three models were estimated with single years of data at $t-1$ (1980), $t-2$ (1979), and $t-3$ (1978). The single year models can be compared to evaluate predictive accuracy one ($t-1$), two ($t-2$), and three ($t-3$) years prior to the year of the deficit. Also, three models were estimated with combinations of years of data: $t-1 + t-2$ (1980+1979), $t-2 + t-3$ (1979+1978), and finally, all years combined $t-1 + t-2 + t-3$ (1980+1979+1978). The multiple year models can be compared to evaluate if predictive accuracy improves by using additional data from prior years available to estimate the model. The models which were estimated with multiple years of data included each year's value for a variable as an observation for that variable. Hence, two-year combinations of data resulted in 120 observations (60 from, say, $t-1$, and 60 from $t-2$). The dependent variable was always the 1981 amount of the general fund balance.

A hold-out sample of $t+1$ (1982) data was collected to validate the predictive models. The validation was also designed to evaluate the sensitivity of the models to State-specific (Michigan) economic events during 1978, 1979 and 1980 which might have biased the estimated models. Confidence in the intertemporal generalization of the model was strengthened if they achieved a

predictive accuracy greater than the naive model for the hold-out year, 1982.

4.3 Statistical Technique

Because municipal data are often unavailable or difficult to manually obtain, minimization of the number of independent variables was an important objective of the current research in attempting to estimate models usable in a policy setting. Therefore, stepwise selection of the variables was used in a multiple regression model to estimate the 1981 general fund balance. The predictive function was:

$$Y' = A + B_1X_1 + B_2X_2 + . . . B_kX_k$$

where

Y' = estimated 1981 general fund balance

A = intercept constant

B = regression coefficient

X_i = value of the i th independent variable;
 $i = 1, . . . , 20$

R^2 was computed as an estimate of the proportion of the variance of the dependent variable, the 1981 general fund balance, "explained" or accounted for by the independent variables in the equation.

In a stepwise selection of the variables, the first variable considered for entry into the equation is the one with the largest positive or negative correlation coefficient with the dependent variable. In the current

research if no variable remained which satisfies the .05 significance level to enter, then the procedure terminated. After each step, variables already in the equation were considered for removal.

Multiple regression was the appropriate statistical technique because a quantitative, continuous, unbounded variable was being predicted. In contrast to bankruptcy studies where the variable of interest was dichotomous; i.e., bankrupt or non-bankrupt, and discriminant analysis was used, the dependent variable in the current research was continuous and unbounded. It is important to potential users of this model such as finance officers, taxpayers, legislators, etc. to know the amount of the predicted general fund balance in addition to sign (surplus or deficit). A discriminant function would only predict whether the general fund is a surplus or deficit. If discriminant analysis was used, valuable information would be lost that is important to potential users of the model. As discussed in Chapter 2, it is helpful to know two years prior to a deficit whether it is going to be a large or small deficit so that effective management action can be taken to counteract it in time; i.e. budget cuts or revenue enhancement can more easily be made to solve it.

The microcomputer statistical package utilized to conduct the analysis was SPSS-PC+™ V2.0 (Norusis 1988).

4.4 Assumptions of the Model

The multiple regression model requires that certain assumptions about the variables must be met if the coefficients are to be unbiased and efficient (Kenny 1979, 48).

Independence. The assumption of independence means that each observation is sampled independently from the population. This means that the errors will be statistically independent or the covariances of the errors are zero.

In this research, there will be collinearity and interdependence between the variables. For example, the tax base and revenue variables are likely to be collinear. Increases in the tax base are likely to increase tax revenues. Multicollinearity is not a problem for estimation of a predictive model; only for evaluation of causal effects (Kenny 1979, 50-51).

Homoscedasticity. The assumption of homoscedasticity means that the error terms in each regression model had constant variance. A visual inspection of the residuals determined if this assumption was met (Norusis 1988, B-228).

4.5 Summary

This chapter outlined the methodology and statistical technique used to estimate the models for this research. A stepwise regression statistical

technique was used to estimate the predictive function. Chapter 5 presents the results of the statistical analysis, and Chapter 6 presents implications of the results and limitations of the study.

CHAPTER 5

RESULTS

5.1 Introduction

In Chapter 3, twenty financial variables in six categories were proposed to be associated with a general fund balance in a subsequent year. Chapter 4 continued an outline of the methodology used to determine the degree of association between the twenty financial variables in three prior years (1978, 1979, and 1980) with the general fund balance in 1981. The statistical results of the empirical tests conducted on the 1978-81 sample data of sixty local governmental units in Michigan are reported in this chapter.

5.2 Test of Differences of Means by Group

The research design had two groups: deficit and control based upon whether the general fund balance was a deficit or a surplus in 1981. The t-test of differences of means of groups by variable reveals whether the two groups are significantly different. As both groups were drawn from the same population of all local governments in Michigan it is likely that many variables would display no significant difference. However, the research proposed that the independent variables selected would estimate a predictive model of the general fund balance.

Therefore, it was expected that there would be significant differences between the surplus and deficit governments on some variables.

TABLE 5

t-TEST OF DIFFERENCES OF MEANS OF GROUPS BY VARIABLE
ACROSS THREE YEARS (1978, 1979, 1980) OF DATA

Variable Name	Control Group Mean	Deficit Group Mean	F	t
General Fund Balance (1981)	320,963 n=30	-350,508 n=30	1.78	6.35*
CSH	134,376	49,492	37.42**	-1.23
SAV	217,281	161,687	1.25	-.82
DFOF	161,174	155,875	2.03	-.08
TA	663,998	528,359	3.43**	-.58
AP	72,224	103,318	1.15	.94
TL	307,062	471,756	1.45	.96
TDPC	205	189	1.21	-.29
TAN	19	25	3.01**	-.66
GODPC	82	39	2.41**	-1.69
UPL	95,055	1,197,186	358.54**	2.19*
EXP	1,605,734	2,301,643	1.32	1.27
EXPVAR	96,565	-149,767	2.07	4.10*
REVAR	13,817	79,948	2.39**	1.58
REVS	1,723,464	2,089,925	1.07	.68
SEV	50,725,311	51,140,667	1.17	.03
RSEV	35,777,505	39,703,003	1.37	-.71
RTP	.8	.4	4.49**	1.79
DOU	15,238	4,122	16.55**	-.78
DFOU	30,868	36,234	1.51	.17
VARMISS	5.3 n=120	6.5 n=120	1.44	1.41

*significant at .01 if t > 2.33

**significant at .01 if F > 2.07

The t-test of differences in means between the control and deficit group by variable will indicate which variables between the two groups are significantly different. The F statistic tests the hypothesis that the two population variances are equal which is one of the underlying assumptions of the t-test.

Table 5 displays the results of the group differences in the sample. The general fund balance in 1981, the criterion variable, had a group mean of \$320,963 in the control group and -\$350,508 in the deficit group. A comparison of the two groups of predictor variables indicated that two variables were significantly different at the .01 level. The unfunded pension liability (UPL) mean was substantially larger for the deficit group at \$1,197,186 than the control group at \$95,055 and, thus, was likely to be a significant predictor variable in an ordinary least squares estimation of the model to predict the deficit balance in 1981. The expenditures variance (EXPVAR) represented the amount by which actual expenditures exceeded the amount budgeted, and a positive control group mean variance of \$96,565 was significantly different than the negative deficit group mean of -\$149,767. A negative expenditures variance indicated that the government was expending in excess of budget. All other things held constant, this would increase a deficit. It is not surprising that the t-test finds the groups are

significantly different as measured by values for this variable in the sample.

Reserve taxing power (RTP) represented the amount of millage (one mill equals \$1 per \$1,000 of assessed value) which had not been levied but was still available to be levied within legal maximums. Values of the group means for reserve taxing power differed by only .4 of one mill. The control group is characterized by having more untapped revenue capacity than the deficit group, but there was very little unutilized millage in either case.

The Michigan state individual income tax provided the taxpayer with a credit rebate for real property taxes levied through millage on assessed property values. Aware that their constituents are eligible for this rebate, local governments tended to fully utilize the maximum levy for property taxes to generate needed revenues. Thus, local government revenues are "subsidized" by the state credit program. As a result, most governments in Michigan had little RTP left (unlevied millage to utilize), and this variable was likely to drop out of the stepwise regression estimation. This may be a State-specific result. Reserve taxing power (RTP) may be important in deficit prediction models for government units in states which do not have a rebate program like Michigan's.

5.3 Treatment of Missing Values

The data in the original sample had several missing values for several variables. In this particular sample, a mean substitution was not appropriate for missing values. The values of many of the variables had a very wide range due to the large and small size of governmental units selected. Thus, a mean substitution was an unsatisfactory choice for many units to provide a meaningful substitution for a missing value.

An alternative approach was utilized to substitute an average of the two values for the prior year and next year. For example, if values for a given local government existed for 1978 and 1980, they would be averaged to substitute for a missing 1979 value. If that approach was not possible, a value for that unit from the most proximate year available was substituted for the missing value. This method was only utilized within each governmental unit across years. The result of this procedure is displayed in Table 6 which shows the mean, standard error and n for the original sample and for the sample with after substitution.

TABLE 6

**DESCRIPTIVE STATISTICS FOR SAMPLE DATA WITH ORIGINAL VALUES
AND SUBSTITUTION FOR MISSING VALUES**

Variable Name	Original Sample		Substitution Sample	
	Mean S.E.*	n	Mean S.E.*	n
DEFICIT	-14,758.65 50,561.18	240	-14,758.65 50,561.18	240
CSH	80,756.17 30,811.95	208	73,367.46 27,258.40	240
SAV	223,835.59 40,743.30	208	217,655.25 36,789.31	240
DFOF	154,454.79 32,812.44	208	158,818.23 30,101.68	240
TA	612,878.89 112,306.78	208	596,722.51 99,671.00	240
DFOU	38,442.77 13,482.00	240	38,442.77 13,482.00	240
AP	83,115.37 14,338.99	208	84,409.78 14,030.45	240
DOF	206,434.52 50,175.75	208	200,956.06 56,155.45	240
TL	428,086.89 85,501.32	207	425,328.05 77,090.41	240
UPL	740,162.56 279,063.92	177	682,348.97 230,366.24	240
DOU	9,744.38 5,482.67	240	9,744.38 5,482.67	240
REVS	1,926,760.20 250,717.96	209	1,900,312.20 225,540.10	240
REVAR	34,014.53 19,167.46	207	34,152.28 18,191.27	240
EXP	1,987,419.80 266,305.23	209	1,979,805.10 240,430.62	240
EXPVAR	-4,017.87 27,211.68	207	-11,831.47 26,085.32	240
SEV	69,626,830.00 8,061,500.00	240	69,626,830.00 8,061,500.00	240
RSEV	35,777,500.00 5,704,425.00	240	35,777,500.00 5,704,425.00	240
RTP	.67 .14	164	.63 .11	240
GODPC	76.11 12.70	221	70.76 11.76	240
TAN	17.28 3.61	240	17.28 3.61	240
TDPC	220.76 25.38	240	220.76 25.38	240

*Standard error of the mean

This substitution enabled unfunded pension liability to be used in the estimation by increasing n from 177 to 240 and also reserve taxing power n from 164 to 240. The unfunded pension liability was often estimated only periodically rather than annually, so a substitution of this type was appropriate. The unfunded pension liability (UPL) was obtained from reading footnote disclosures which revealed that the value was only periodically estimated based on actuarial or fund management assumptions. The reserve taxing power represented the amount of millage which may be levied but had not yet been utilized. Based upon a visual inspection of the data across units, this number remained relatively static across periods in this sample. Therefore, a substitution of this type was appropriate for unfunded pension liability.

More generally, this type of substitution technique for missing values assumed that the variables move upward or downward in a "trend" fashion and were not erratic across years. This assumption was generally satisfied by governmental unit data. Large categories of expenditures such as employee salaries were fixed, tax levels were relatively fixed, and changes in budgets were generally gradual. Therefore, this approach for substitution of missing values appeared to be a reasonable technique given the nature of the sample data.

5.3.1 Goodness of Fit

The multiple regression model assumes constant variance and normality of the sample data distribution and error. However, the model is robust for violations of these assumptions. A test was performed to evaluate these assumptions and to determine if any transformations of the data were appropriate. Table 7 displays the results of a test of the goodness of fit of the sample distribution by variable against a normal distribution.

TABLE 7

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**KOLMOGOROV-SMIRNOV TEST (Z)* OF GOODNESS OF FIT OF
 DISTRIBUTION OF SAMPLE VALUES AGAINST NORMAL DISTRIBUTION**

Variable Name	Original Sample Data	Sample Data with Substitution for Missing Values
DEFICIT	4.706	4.706
CSH	4.915	5.184
SAV	5.002	5.248
DFOF	5.366	5.681
TA	5.085	5.416
DFOU	6.615	6.615
AP	4.959	5.405
DOF	5.760	6.166
TL	5.236	5.591
UPL	5.647	6.700
DOU	7.038	7.038
REVS	4.301	4.543
REVAR	4.046	4.247
EXP	4.378	4.609
EXPVAR	4.054	4.454
SEV	4.471	4.471
RSEV	5.641	5.641
RTP	5.729	6.932
GODPC	5.106	5.405
TAN	7.042	7.042
TDPC	4.450	4.450

*all Z scores are significant at .01

The Kolmogorov-Smirnov test is a test of goodness of fit (Siegel 1956, 47-52). The Kolmogorov-Smirnov test compared the cumulative sample distribution function to a hypothesized cumulative distribution function (Norusis 1988, B-182). In this case, the sample distribution was compared to a normal distribution. The null (H_0) hypothesis stated that there was no difference between the sample distribution and a normal distribution. If the Z score was statistically significant, then the null is rejected and the values in the sample can not reasonably be thought to have come from a population with a normal distribution.

Two samples were tested with the Kolmogorov-Smirnov (K-S) test. The first sample was the original data and the second sample was the original data with an averaged value or nearest value substituted wherever possible for missing values within cases (governmental units). In both samples, the K-S test was significant for all variables at the .01 level. The variables were not normally distributed.

5.3.2 Checking Assumptions of the Model

It was not surprising that the sample data was nonnormally distributed given the nature of the data in the sample itself with varying types of units (cities, villages, townships, counties), very large and very small units, and the small size of the sample ($n=60$ each year). A logarithmic transformation was conducted on the variables but did not improve the goodness of fit. Therefore, the log

transformed data was not used to estimate the model. The regression models estimated were robust for prediction purposes despite this violation of the assumptions.

Measurement error and specification error in selection of variables are more serious violations and will impair the reliability of the coefficients estimated. The sample data were relatively free of measurement error except to the extent that the substituted value for missing data varied from the "true" value which was unavailable. Therefore, measurement error should not bias the results.

Specification error can result due to inclusion of independent variables which may have a weaker association with the dependent variable than other variables. This is always a possibility in this type of research, particularly since so little work has been done.

A multiple regression model is easily biased by specification error. The relationship between the financial variables selected to the general fund balance is explainable, well understood in the municipal finance community, and well founded in governmental accounting standards (see Section 2.2.1). However, the relationship between financial variables in $t-j$ (where $j = 1, 2, \text{ or } 3$) and the general fund balance in t_0 is not well known. There is substantial specification risk in exploratory studies like this one.

5.4 Results from the Multiple Regression Model

As outlined in Chapter 4, Table 4, six predictive models will be estimated. The discussion of results of those regressions was partitioned into two sections. The first section (5.4.1) contains a review of results from the estimations with each single year of prior data: 1980 ($t-1$), 1979 ($t-2$), and 1978 ($t-3$). The second section (5.4.2) contains a review of results from the estimations with combinations of multiple years of data: 1980 + 1979 ($t-1 + t-2$), 1979 + 1978 ($t-2 + t-3$), and all three prior years 1980 + 1979 + 1978 ($t-1 + t-2 + t-3$).

The data analysis for each of the six models was reported here according to the following format. A correlation matrix was produced based on the data that were used to estimate the model. Then, results of the regression using that data are summarized.

5.4.1 Estimation with Single Years of Data

The correlation coefficients for the dependent variable in 1981 and independent variables in 1980 are displayed in Table 8 .

TABLE 8

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
DEFICIT (1981 GENERAL FUND BALANCE) WITH 1980 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	.53									
SAV	.13	.69								
DFOF	.22	.86	.84							
TA	.33	.89	.89	.98						
DFOU	.45	.92	.73	.93	.94					
AP	-.13	.61	.79	.87	.81	.72				
DOF	.24	.90	.86	.94	.97	.92	.71			
TL	.11	.82	.90	.96	.97	.88	.86	.97		
UPL	-.64	-.02	.37	.13	.14	-.01	.29	.29	.32	
DOU	.43	.92	.74	.95	.95	.98	.77	.92	.89	-.03
REVS	-.08	.63	.85	.79	.82	.65	.72	.82	.89	.50
REVAR	-.39	-.36	-.19	-.14	-.26	-.33	.16	-.35	-.23	-.12
EXP	-.21	.56	.82	.79	.78	.60	.79	.78	.88	.51
EXPVAR	.82	.57	.25	.28	.39	.54	-.10	.40	.23	-.25
SEV	.07	.41	.50	.45	.49	.37	.34	.44	.49	.12
RSEV	.02	.31	.44	.39	.41	.25	.29	.36	.43	.04
RTP	.05	.09	.33	.16	.21	.04	.21	.11	.19	-.01
GODPC	.11	.02	.01	-.05	-.03	-.04	-.10	-.02	-.05	-.08
TAN	-.41	-.02	.11	.30	.14	.13	.62	.06	.19	-.03
TDPC	.08	-.04	-.09	-.11	-.09	-.07	-.12	-.09	-.11	-.11
DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN										

REVS	.63									
REVAR	-.23	-.25								
EXP	.60	.98	-.11							
EXPVAR	.47	.08	-.66	-.08						
SEV	.34	.71	-.26	.69	.10					
RSEV	.24	.65	-.20	.64	-.03	.93				
RTP	.05	.30	.04	.28	.02	.23	.32			
GODPC	-.02	-.08	.00	-.09	.08	-.02	-.01	.02		
TAN	.22	.03	.68	.18	-.55	-.06	-.26	-.05	-.05	
TDPC	-.07	-.18	.01	-.19	.02	-.23	-.20	-.08	.40	-.06

* coefficient significant at .01 if >.32; at .001 if >.39.

The asset category variables (CSH, SAV, DFOF, TA, DFOU) and liability category variables (AP, DOF, TL, UPL, DOU) show very high intercorrelations among each other. Many of the coefficients in the asset and liability categories were above .8 and .9.

Expenditures (EXP) and expenditures variance (EXPVAR) both had significant correlations with many of the other independent variables but not with each other.

The tax base category variables (SEV and RSEV) were significantly correlated with revenues (REV) and also with expenditures (EXP). The tax base should be correlated with revenues but the relationship with expenditures may be spurious simply because the expenditure level is often near the revenue level.

The tax anticipation notes per capita (TAN) or short-term borrowing was significantly correlated with both the revenues variance (REVAR) and expenditures variance (EXPVAR).

Reserve taxing power (RTP), general obligation debt per capita (GODPC), and total debt per capita (TDPC) were not significantly correlated with any other variable. Thus, they were unlikely to appear in the estimated model.

The variables which have significant correlations with the general fund balance in 1981 (DEFICIT) were as follows: CSH (.53), TA (.33), DFOU (.45), UPL (-.64), DOU (.43), REVAR (-.39), EXPVAR (.82), and TAN (-.41). One or more of

the three asset category variables (CSH, TA, DFOU) may drop out of the estimated model due to high intercorrelation with the variables entered. It was likely that UPL and TAN will enter the model as no similar variable was significantly correlated with them. DOU, REVAR and EXPVAR may enter the model or another variable may enter which was significantly correlated with them.

Table 9 presents the results of the regression estimation of the general fund balance in 1981 with 1980 data. As explained in section 5.3, an interpolated or end value was substituted for any missing value. This substitution process only occurred within a governmental unit's data and did not occur across different cases. In other words, the City of Benton Harbor's values were not used to substitute for another governmental unit such as the City of Ionia; they were only used to calculate a substitution for Benton Harbor.

TABLE 9

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1980 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
UPL	-.031 .013	-2.40	.881 .876
SAV	.816 .084	9.66	.905 .900
TAN	-153,201.821 9,090.653	-16.85	.923 .917
CSH	.513 .086	5.98	.929 .923
REVS	-.043 .014	-2.98	.948 .942
DOF	-1.286 .165	-7.78	.953 .946
DOU	7.791 .998	7.80	.969 .964
Constant	33,942.666 25,370.334	1.34	

* all coefficients are significant at .05 except Constant

The t-statistic tests the hypothesis that there is no linear relationship between the dependent variable and the independent variable and that the slope of the regression equation is 0. The statistic was computed by the following equation:

$$t = \text{Coefficient} / \text{Standard Error}$$

The model had a total R^2 of .969 with seven variables in the equation. However, the R^2 only increased by .0016 with the addition of the seventh variable, DOU, indicating that perhaps a more parsimonious model without the seventh variable is available.

Unfunded pension liability (UPL) entered first with a R^2 of .881. The entry of Savings (SAV) increased R^2 by 2.4% to .905. Tax anticipation notes per capita (TAN) entered next to increase R^2 by .6% to .923. Cash (CSH) was the fourth variable which increased R^2 by 1.9% to 92.9%. Revenues (REVS) entered fifth and in combination with UPL, SAV, TAN and CSH explained 94.8% of the variance in DEFICIT. The subsequent variables, Due other funds (DOF) and Due other units (DOU) provided small improvements in the model increasing R^2 to .953 and .969, respectively.

Table 10 presents the correlation coefficients for the dependent variable in 1981 and the independent variables in 1979.

TABLE 10

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
DEFICIT (1981 GENERAL FUND BALANCE) WITH 1979 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	.33									
SAV	-.17	.44								
DFOF	-.16	.49	.67							
TA	-.00	.63	.75	.91						
DFOU	-.29	.03	-.01	.35	.41					
AP	-.05	.58	.67	.88	.91	.26				
DOF	-.28	.61	.83	.79	.86	.23	.76			
TL	-.36	.49	.79	.88	.92	.42	.87	.94		
UPL	-.61	.19	.69	.27	.34	.01	.24	.71	.60	
DOU	.07	.09	-.08	-.05	-.04	-.05	-.03	-.05	-.06	-.05
REVS	-.06	.60	.72	.79	.93	.49	.78	.88	.90	.47
REVAR	.03	.43	.47	.71	.68	.19	.78	.48	.60	-.00
EXP	-.15	.56	.70	.84	.94	.52	.85	.87	.94	.44
EXPVAR	.58	.02	-.02	-.47	-.32	-.59	-.47	-.26	-.47	-.06
SEV	-.27	.08	.27	.29	.41	.79	.28	.30	.45	.24
RSEV	.27	.24	.22	.34	.33	-.08	.25	.25	.21	-.08
RTP	.11	.12	.04	-.02	.02	-.00	-.01	-.06	-.05	-.05
GODPC	.10	.15	-.02	-.06	-.03	-.04	-.10	-.02	-.05	-.04
TAN	.03	.20	.09	.25	.12	-.04	.12	.14	.12	-.04
TDPC	.09	.04	-.10	-.14	-.11	-.04	-.12	-.10	-.13	-.09
DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN										

REVS	-.08									
REVAR	-.08	.50								
EXP	-.09	.98	.60							
EXPVAR	.01	-.25	-.55	-.40						
SEV	-.01	.53	.23	.54	-.44					
RSEV	-.14	.34	.12	.30	.20	-.24				
RTP	-.01	-.00	-.03	-.02	.11	.07	-.09			
GODPC	.26	-.07	-.11	-.08	.07	.09	-.16	.11		
TAN	-.07	.11	.07	.09	-.01	-.12	.47	-.08	-.09	
TDPC	.17	-.16	-.08	-.17	.05	.02	-.30	.04	.46	-.15

* coefficient significant at .01 if >.32; at .001 if >.39.

Only three variables, (CSH, UPL, and EXPVAR) had significant correlations with DEFICIT. These three variables were likely to appear in the estimated model. Again as in 1980, the asset category variables (CSH, SAV, DFOF, TA, and DFOU) and liability category variables (AP, DOF, TL) were significantly intercorrelated.

The budgetary control category variables (REVS, REVAR, EXP, EXPVAR) were significantly correlated with many variables but only EXPVAR was significantly correlated with DEFICIT.

The results of the regression estimation to predict the general fund balance in 1981 with 1979 (t-2) are presented in Table 11.

TABLE 11

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1979 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
UPL	-.166 .001	-17.66	.376 .365
EXPVAR	1.433 .104	13.85	.676 .665
CSH	.771 .166	4.66	.866 .859
REVAR	.804 .190	4.22	.903 .896
DFOF	-1.064 .206	-5.17	.936 .928
TA	.371 .066	5.58	.942 .934
(Constant) N=60	-14,198.150 29,419.605	-.48	

*all coefficients are significant at .05 except Constant

The first variable to enter is unfunded pension liability (UPL) with a contribution of 37.6%. Expenditures variance (EXPVAR) is next which increased the explanatory power of the model by 30% to 67.6%. Cash (CSH) entered next increasing R^2 by 19% to 86.6%. The next three variables to enter the model only contributed a total of a 7.6% increase in the explanatory power. These three variables; revenues variance (REVAR), due from other funds (DFOF), and total assets (TA), contributed 3.7%, 3.3% and 0.6%, respectively.

The last estimation with a single year of data was to predict the general fund balance in 1981 with 1978 (t-3) data. The correlation coefficients between the variables are presented in Table 12.

TABLE 12

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
DEFICIT (1981 GENERAL FUND BALANCE) WITH 1978 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	-.03									
SAV	-.18	.07								
DFOF	-.51	-.10	.55							
TA	-.09	.25	.72	.70						
DFOU	-	-	-	-	-					
AP	-.21	.27	.61	.77	.88	-				
DOF	-.53	.25	.83	.68	.74	-	.66			
TL	-.56	.20	.74	.82	.85	-	.83	.92		
UPL	-.60	.29	.70	.36	.38	-	.30	.86	.69	
DOU	-	-	-	-	-	-	-	-	-	-
REVS	-.10	.26	.65	.55	.92	-	.72	.73	.80	.48
REVAR	-.47	.11	-.04	.49	.38	-	.38	.18	.45	-.01
EXP	-.17	.31	.65	.61	.94	-	.82	.73	.85	.46
EXPVAR	.69	-.08	.20	-.43	-.09	-	-.24	-.13	-.36	-.05
SEV	.08	.02	.05	-.04	-.02	-	.00	.03	-.05	-.05
RSEV	.05	-.20	.40	.42	.59	-	.37	.34	.45	.11
RTP	.11	.16	.02	-.08	.01	-	-.01	-.07	-.06	-.03
GODPC	.02	-.25	-.02	-.01	.00	-	-.01	-.04	.02	.01
TAN	.05	-.03	.17	.10	.05	-	.01	.08	.05	.05
TDPC	-	-	-	-	-	-	-	-	-	-
DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN										
REVS	-									
REVAR	-	.34								
EXP	-	.98	.41							
EXPVAR	-	-.05	-.88	-.15						
SEV	-	-.08	-.04	-.10	.06					
RSEV	-	.70	.26	.65	-.02	-.16				
RTP	-	-.01	-.08	-.01	.09	.11	-.09			
GODPC	-	-.03	-.25	.00	.16	-.09	.16	-.04		
TAN	-	-.02	-.09	-.01	.11	.54	.01	.29	-.08	
TDPC	-	-	-	-	-	-	-	-	-	-

* coefficient significant at .01 if >.32; at .001 if >.39

Six variables were significantly correlated with the general fund balance in 1981 (DEFICIT): DFOF $-.51$, DOF $.53$, TL $-.56$, UPL $-.60$, REVAR $-.47$, EXPVAR $.69$. In the asset and liability categories the interfund receivables and payables (DOF and DFOF) and total assets and liabilities (TA and TL) were significantly correlated with many variables. This was a change from the correlation matrices for 1980 and 1979 data which had all asset and liability variables with many significant correlations. It appears that the aggregated variables for assets and liabilities (TA and TL) as well as interfund borrowings were more important in predicting future difficulty at $t-3$.

Again as in $t-1$ and $t-2$, the budgetary control variables (REVS, REVAR, EXP, EXPVAR) had many significant correlations with other variables. At least one of these variables should enter into the estimated model.

Table 13 presents the results of the regression estimation to predict the general fund balance in 1981 with 1979 data.

TABLE 13

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1978 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
EXPVAR	.426 .069	6.19	.482 .473
TL	-1.575 .083	-18.97	.900 .891
TA	.887 .054	16.38	.932 .924
(Constant) N=60	20,811.799 30,650.425	.68	

*all coefficients are significant at .05 except Constant

This is the most parsimonious model of the six which were estimated with only three variables explaining 93.2% of the variance in the independent variable. Expenditures variance (EXPVAR) entered first and contributes 48.2% to R^2 . Total liabilities (TL) entered next and increases R^2 by 41.8% to 90%. The model achieves R^2 equal to 90% with only two variables. Total assets entered last with a contribution of only 3.2% to total R^2 of 93.2%.

Table 14 summarizes the results of the three models estimated with single years of data.

TABLE 14

REGRESSION MODELS ESTIMATED WITH SINGLE YEARS OF DATA (n=60)

Order of Entry Stepwise Method	1980 Variable Coefficient Contribution to R ²	1979 Variable Coefficient Contribution to R ²	1978 Variable Coefficient Contribution to R ²
1.	UPL -.031 .881	UPL -.166 .376	EXPVAR .426 .482
2.	SAV .816 .024	EXPVAR 1.433 .300	TL -1.575 .418
3.	TAN -153,201.521 .018	CSH .771 .190	TA .887 .032
4.	CSH .513 .006	REVAR .804 .037	
5.	REVS -.043 .019	DFOF -1.064 .033	
6.	DOF -1.286 .005	TA .371 .006	
7.	DOU 7.791 .016		
Constant	33,942.666	-14,198.150	20,811.799
Total R ²	.969	.942	.932

The fit of the model improves with data which is closer in time to the value being estimated, i.e., the 1981 general fund balance. This result parallels that of Altman (1973). However, the improvements are negligible. At t-3 (1978), 93.2% of the variance in the general fund balance in 1981 was explained with the most parsimonious model containing only three variables (EXPVAR, TL, TA).

At t-2, 1979, six variables (UPL, EXPVAR, CSH, REVAR, DFOF, and TA) explained 94.2% of the variance in the general fund balance in 1981. At t-1, 1980, seven variables (UPL, SAV, TAN, CSH, REVS, DOF, DOU) were required to explain 96.9% of the variation in the general fund balance in the subsequent year, 1981.

The three models were quite different structurally as the intercept moves from 33,943 (t-1) to -14,198 (t-2) and to 20,812 (t-3). In addition the number of variables entered through the stepwise regression declined from seven (t-1) to six (t-2) and drops sharply to three (t-3). These clearly are three quite different models.

The model estimated for 1980 provides the best fit to the data, explaining 96.9% of the variation in the general fund balance in 1981. In fact, all three single year models, and notably 1978 (t-3), had a total R^2 exceeding 90%.

5.4.2. Estimation with Multiple Years of Data

This section presents results for three models estimated with combinations of the three years of data prior to the general fund balance in 1981. The first model is estimated with 1980 and 1979. The second model is estimated with 1979 and 1978. The third model is estimated with 1978, 1979 and 1980.

The correlation coefficients for the variables measured at fiscal year-end 1980 and 1979 are presented in Table 15 below.

TABLE 15

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
DEFICIT (1981 GENERAL FUND BALANCE) WITH 1979-1980 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	.42									
SAV	.01	.60								
DFOF	.08	.78	.78							
TA	.20	.83	.85	.96						
DFOU	.13	.70	.46	.74	.77					
AP	-.09	.50	.71	.82	.80	.49				
DOF	.08	.86	.83	.91	.94	.73	.68			
TL	-.05	.76	.86	.94	.96	.73	.80	.96		
UPL	-.63	.02	.50	.17	.20	.00	.26	.38	.40	
DOU	.30	.88	.59	.82	.82	.77	.49	.85	.78	-.02
REVS	-.07	.55	.79	.77	.83	.58	.75	.78	.86	.48
REVAR	-.16	-.13	.11	.19	.10	-.08	.51	-.08	.08	-.06
EXP	-.18	.50	.77	.78	.81	.56	.82	.75	.86	.48
EXPVAR	.71	.43	.15	.04	.17	.11	-.27	.23	.02	-.17
SEV	-.05	.36	.42	.40	.46	.49	.27	.41	.47	.16
RSEV	.18	.04	.11	.15	.14	-.06	.19	.07	.08	-.05
RTP	.09	.07	.16	.06	.11	.01	.07	.03	.06	-.03
GODPC	.10	.05	.00	-.05	-.03	-.03	-.09	-.01	-.05	-.06
TAN	-.00	.04	.05	.14	.06	-.02	.12	.05	.06	-.03
TDPC	.08	-.01	-.09	-.12	-.09	-.05	-.13	-.08	-.11	-.10

DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN

REVS	.45									
REVAR	-.16	.15								
EXP	.42	.98	.26							
EXPVAR	.37	-.06	-.59	-.22						
SEV	.31	.61	-.07	.60	-.06					
RSEV	-.04	.22	.11	.18	.11	-.20				
RTP	.02	.11	-.00	.09	.06	.11	-.20			
GODPC	-.00	-.07	-.06	-.09	.08	.04	-.13	.06		
TAN	-.00	.07	.10	.07	-.04	-.11	.49	-.05	-.08	
TDPC	-.04	-.16	-.04	-.17	.03	-.11	-.22	-.02	.43	-.12

* coefficient significant at .01 if >.21; at .001 if >.31

Four variables were significantly correlated with the general fund balance in 1981 (CSH, UPL, DOU, and EXPVAR). These variables seemed to consistently reappear among the various models which were estimated.

As in the single year models for 1980 and 1979, the asset category (CSH, SAV, DFOF, TA, and DFOU) and liability category (AP, DOF, TL) variables were significantly intercorrelated. This indicated that there may be consistent relationships between these variables irrespective of the time period. The budgetary control variables (REVS, REVAR, EXP, EXPVAR) also had many significant correlations with other variables.

Table 16 presents the results of the regression estimation of the general fund balance in 1981 with the two prior years of data (1980 and 1979).

TABLE 16

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1979-1980 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
EXPVAR	.774 .113	6.82	.506 .502
UPL	-.085 .012	-7.37	.769 .765
REVAR	.297 .160	1.86	.857 .852
DFOF	-1.247 .176	-7.07	.870 .864
TA	.920 .090	10.26	.897 .891
DFOU	-.850 .159	-5.35	.908 .903
SAV	-.326 .131	-2.48	.917 .912
TL	-.525 .123	-4.28	.925 .920
CSH	.263 .088	2.98	.931 .925
(Constant) n=120	-6,987.818 22,483.578	-.31	

*all coefficients are significant at .05 except Constant

Expenditures variance (EXPVAR) entered first with a R^2 of 50.6%. Unfunded pension liability (UPL) entered next and increases R^2 to 76.9%. Revenues variance (REVAR) is the last variable to make a large contribution to R^2 which increased it by 8.8% to 85.7%. These three variables contributed 85.7% of the 93.1% variation explained.

Due from other funds (DFOF), total assets (TA), due from other units (DFOU), savings (SAV), total liabilities (TL) and cash (CSH) contributed small increments of 1.3%, 2.7%, 1.1%, 0.9%, 0.8%, and 0.6% to increase R^2 , respectively.

Table 17 presents the correlation coefficients for the second and third year of data prior (1979 and 1978) to the general fund balance in 1981 being predicted.

TABLE 17

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
DEFICIT (1981 GENERAL FUND BALANCE)
WITH 1978-1979 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	.16									
SAV	-.17	.27								
DFOF	-.31	.26	.61							
TA	-.04	.47	.74	.82						
DFOU	-.20	.03	-.00	.28	.31					
AP	-.13	.45	.64	.84	.90	.21				
DOF	-.40	.46	.83	.75	.81	.18	.72			
TL	-.45	.37	.77	.86	.89	.32	.85	.93		
UPL	-.61	.23	.69	.31	.36	.01	.27	.78	.64	
DOU	.05	.08	-.05	-.03	-.03	-.02	-.01	-.03	-.04	-.04
REVS	-.08	.44	.69	.68	.92	.35	.75	.81	.85	.48
REVAR	-.27	.23	.15	.55	.48	.09	.52	.29	.49	-.00
EXP	-.16	.45	.67	.74	.94	.37	.83	.81	.89	.45
EXPVAR	.64	-.03	.11	-.43	-.19	-.34	-.33	-.18	-.40	-.05
SEV	-.18	.09	.19	.23	.29	.79	.22	.23	.33	.15
RSEV	.16	.03	.30	.36	.44	-.08	.29	.28	.31	.02
RTP	.11	.14	.03	-.04	.02	.00	-.01	-.06	-.06	-.04
GODPC	.06	.12	-.01	-.03	-.02	-.00	-.06	-.01	-.03	-.02
TAN	.04	.02	.12	.11	.06	-.06	.03	.08	.05	.02
TDPC	.06	.06	-.05	-.08	-.07	.02	-.07	-.06	-.07	-.06
DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN										
REVS	-.06									
REVAR	-.04	.39								
EXP	-.06	.98	.47							
EXPVAR	.01	-.13	-.77	-.25						
SEV	.06	.35	.11	.37	-.24					
RSEV	-.12	.51	.21	.46	.07	-.21				
RTP	.01	-.00	-.06	-.02	.10	.05	-.06			
GODPC	.30	-.05	-.07	-.06	.05	.16	-.14	.08		
TAN	-.09	.04	-.05	.02	.08	-.15	.18	.16	-.11	
TDPC	.24	-.10	-.05	-.11	.02	.15	-.25	.03	.51	-.18

* coefficient significant at .01 if >.21; at .001 if >.31.

Six variables were significantly correlated with the general fund balance in 1981 (DFOF, DOF, TL, UPL, REVAR, EXPVAR). Again as in 1980, 1979 and 1980+1979, the asset category and liability category variables had significant intercorrelations. The budgetary control variables also appeared as in other estimations to have many significant correlations with other variables.

Table 18 presented the results of the regression to estimate the general fund balance in 1981 with two years of data for 1978 and 1979.

TABLE 18

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1978-79 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
EXPVAR	1.048 .157	6.69	.409 .404
UPL	-.208 .014	-15.00	.740 .735
CSH	.944 .124	7.63	.845 .841
REVAR	.349 .160	2.18	.890 .887
REVS	.141 .045	3.09	.902 .898
DFOF	-.518 .131	-3.94	.908 .903
SAV	-.514 .146	3.52	.914 .909
EXP	-.097 .047	-2.08	.918 .912
(Constant) n=120	-27,618.676 24,750.121	-1.12	

*all coefficients are significant at .05 except Constant

The first three variables to enter (EXPVAR, UPL, and CSH) contributed 40.9%, 33.1%, and 10.5% for a total R^2 of 84.5%. These variables appeared throughout the single and multiple year models as strongly associated with the general fund balance in 1981. The remaining variables to enter the model (REVAR, REVS, DFOF, SAV, and EXP) contributed small increments of 4.5%, 1.2%, 0.6%, 0.6%, and 0.4%, respectively for a total R^2 of 91.8%.

Table 19 presents the last set of correlation coefficients with all three prior years of data (1980, 1979, and 1978) and the general fund balance in 1981.

TABLE 19

CORRELATION COEFFICIENTS* WITH INTERPOLATED OR NEAREST
VALUES SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT
GENERAL FUND BALANCE (1981)
WITH 1978, 1979, AND 1980 DATA

	DEFICIT	CSH	SAV	DFOF	TA	DFOU	AP	DOF	TL	UPL
CSH	.33									
SAV	-.05	.52								
DFOF	-.05	.70	.73							
TA	.13	.77	.81	.92						
DFOU	.10	.68	.40	.69	.70					
AP	-.13	.45	.69	.80	.81	.42				
DOF	-.03	.82	.81	.88	.91	.69	.65			
TL	-.16	.70	.83	.93	.94	.68	.80	.95		
UPL	-.62	.06	.55	.21	.24	.00	.27	.44	.45	
DOU	.25	.86	.51	.76	.75	.77	.42	.81	.72	-.02
REVS	-.08	.48	.75	.70	.83	.47	.74	.74	.83	.48
REVAR	-.29	-.07	.04	.25	.17	-.06	.43	-.01	.18	-.04
EXP	-.17	.44	.73	.73	.83	.47	.82	.71	.84	.48
EXPVAR	.70	.31	.17	-.07	.09	.08	-.26	.14	-.07	-.13
SEV	-.04	.35	.36	.37	.40	.49	.23	.38	.43	.13
RSEV	.12	-.02	.18	.18	.24	-.07	.23	.10	.15	.01
RTP	.10	.07	.11	.02	.08	.01	.04	.01	.03	-.03
GODPC	.08	.06	.02	-.03	-.02	-.00	-.08	-.00	-.03	-.04
TAN	.02	-.02	.07	.06	.03	-.05	.04	.02	.02	.01
TDPC	.06	.02	-.05	-.08	-.07	-.01	-.09	-.05	-.07	-.07
DOU REVS REVAR EXP EXPVAR SEV RSEV RTP GODPC TAN										
REVS	.37									
REVAR	.10	.22								
EXP	.35	.98	.31							
EXPVAR	.28	-.06	-.73	-.19						
SEV	.31	.47	-.06	.47	-.04					
RSEV	-.05	.38	.20	.34	.05	-.23				
RTP	.01	.07	-.04	.06	.07	.07	-.04			
GODPC	.02	-.05	-.06	-.06	.06	.12	-.16	.04		
TAN	-.03	.03	-.02	.01	.05	-.17	.25	.16	-.12	
TDPC	-.01	-.12	-.04	-.13	.03	.03	-.25	-.02	.48	-.18

* coefficient significant at .01 if >.17; at .001 if >.23

Six variables (CSH, UPL, DOU, REVAR, EXP, and EXPVAR) were significantly correlated with the general fund balance in 1981. The intercorrelation among the asset category and liability category variables was consistent with the other multiple year models and also the single year models for 1980 and 1979 data. The budgetary control variables had many significant correlations with other variables as seen across all six models estimated.

Table 20 below displays the regression estimates of a model to predict the general fund balance in 1981 using all three prior years of data (1980, 1979, and 1978).

TABLE 20

STEPWISE REGRESSION WITH INTERPOLATED OR NEAREST VALUES
SUBSTITUTED FOR MISSING VALUES WITHIN EACH GOVERNMENT

REGRESSION TO PREDICT GENERAL FUND BALANCE (1981)
WITH 1978-80 DATA

Variable Name	Coefficient Standard Error	t*	R ² Adjusted R ²
EXPVAR	.558 .084	6.62	.492 .489
UPL	-.124 .014	-9.01	.778 .776
REVS	.039 .014	2.68	.838 .835
DFOF	-.557 .149	-3.74	.864 .860
CSH	.309 .102	3.03	.882 .878
SAV	.233 .114	2.05	.890 .885
TL	-.871 .144	-6.04	.894 .889
TA	.502 .082	6.15	.907 .902
DFOU	-.392 .146	-2.68	.909 .905
DOF	.449 .171	2.63	.912 .908
(Constant) N=180	-8,379.179 22,186.106	-.38	

*all coefficients are significant at .05 except Constant

This model used more variables (ten) than any other model and achieved the lowest R^2 of the six models estimated. The first three variables to enter (EXPVAR, UPL, and REVS) contributed 49.2%, 28.6%, and 6.0%, respectively to R^2 of 83.8%. Similar to the other multiple year models, the remaining variables to enter (DFOF, CSH, SAV, TL, TA, DFOU, and DOF) contributed very small increments of 2.6%, 1.8%, 0.8%, 0.4%, 1.3%, 0.2%, and 0.4%, respectively to a total R^2 of 91.2%.

Table 21 summarizes the results of the three models estimated with multiple years of data.

TABLE 21

REGRESSION MODELS ESTIMATED WITH MULTIPLE YEARS OF DATA

Order of Entry Stepwise Method	1979+1980 Variable Coefficient Contribution to R ²	1978+1979 Variable Coefficient Contribution to R ²	1978+1979+1980 Variable Coefficient Contribution to R ²
1.	EXPVAR .774 .506	EXPVAR 1.048 .409	EXPVAR .558 .492
2.	UPL -.085 .263	UPL -.208 .331	UPL -1.124 .286
3.	REVAR .297 .088	CSH .944 .105	REVS .039 .060
4.	DFOF -1.247 .013	REVAR .349 .045	DFOF -.557 .026
5.	TA .920 .027	REVS .141 .012	CSH .309 .018
6.	DFOU -.850 .011	DFOF -.518 .006	SAV .233 .008
7.	SAV -.326 .009	SAV -.514 .006	TL -.871 .004
8.	TL -.525 .008	EXP -.097 .004	TA .502 .013
9.	CSH .263 .006		DFOU -.392 .002
10.			DOF .449 .004
Constant	-6,987.818	-27,618.676	-8,379.179
Total R ²	.931	.918	.912

The multiple year models contrast sharply with the single year models. The multiple year models require many more variables to achieve a lower total R^2 . It appears that the addition of multiple years of data blurs the estimation process. The model for all three years of data used ten variables as contrasted with the 1978 model which only required three.

A few variables contributed significantly to each of the multiple year models. Expenditure variance (EXPVAR) entered first and unfunded pension liability (UPL) entered second in each model. Both variables contributed substantially to R^2 . This could indicate that when multiple years of data are combined only EXPVAR and UPL are strong enough predictors across years to emerge consistently with a significant contribution to explained variance. Beyond these two variables, it appears that the models are not conveying significant patterns across years among the variables.

5.5 Hold-out Sample

One additional year of data was collected for the purpose of serving as a hold-out sample to validate the model. The original sample contained data from 30 matched pairs of local governments; 30 had a general fund deficit in 1981 and 30 had a general fund surplus in 1981. This ratio of surplus to deficit changed dramatically in the hold-out year to 9 surplus and 51 deficit. This may be a sample-

specific result due to the economic climate in 1982 which impacted all governments.

A study prepared for the use of the Joint Economic Committee of Congress (1982, 1-2) on "Trends in the Fiscal Conditions of Cities" indicated:

This year the pressures are evidently more intense. Perhaps the most disturbing finding of the report is that for 1982 cities are projecting virtually no growth in revenues. For cities of all sizes, revenues are expected to increase by an average of only 1.3 percent. At present (mid-1982) rates of inflation, this would mean a reduction of approximately 6 percent in real terms. At the same time, however, current expenditures are projected to grow at an average of 7.8 percent, about equal to the anticipated rate of inflation. As a result, cities are increasingly subject to cash squeezes and current deficits. In fact, forty percent of the respondents in 1981 reported that current outlays, including debt service payments, exceeded current revenues. And, on the basis of their projections for 1982, 60 percent could be in such a condition unless expenditures are reduced or more revenues were raised than projected.

Economic pressures in 1982 may have caused more dramatic shifts than usual in the general fund balance.

The accuracy of the predicted values for the general fund balance in 1982 (hold-out sample) was evaluated by the following function:

$$e = \frac{\text{Actual General Fund Balance} - \text{Predicted Value}}{\text{Total Revenues}_t}$$

where t = year of data used to predict

where Actual General Fund Balance and Predicted Value are 1982

Literally interpreted, this accuracy statistic is the amount of error in the prediction expressed as a percentage of the local unit's revenue during the prediction year. The

denominator, total revenues, was selected in order to scale the accuracy statistic relative to the government's size. The use of total revenues in the prediction year was selected because it related to the other variables at the same point in time used to estimate the predicted value.

An accuracy statistic was computed for each of the six regression models estimated and also for a naive model. The naive model simply estimates that the general fund balance for 1982 will be the same as the current general fund balance. The model's predictive accuracy estimated with the single year of 1978 data was compared with the naive model's predictive accuracy statistic. For example, the naive model predicted the 1982 general fund balance was the same as the 1978 general fund balance.

Table 22 displays the accuracy statistics for the estimated and naive models to predict the general fund balance in 1981 and 1982. The general fund balance in 1981 was the independent variable which was used to estimate the models. The general fund balance in 1982 is taken from the hold-out sample to validate the models. In other words, the 1982 general fund balance was estimated from the models using appropriately lagged data; i.e., $t-1$ was estimated with 1980 and predicted 1982 with 1981 data ($t-1$: 1982-1=1981).

TABLE 22

PERCENTAGE PREDICTION ERRORS* OF ESTIMATED AND NAIVE MODELS

Model	<u>1981</u>		<u>1982</u>	
	Mean	Median	Mean	Median
t-1	-5.6%	-0.2%	5.5%	9.9%
Naive	-4.4%	-2.6%	10.0%	7.3%
t-2	-1.0%	1.3%	15.4%	9.9%
Naive	-10.8%	-3.1%	6.2%	3.5%
t-3	-6.9%	-1.4%	3.9%	2.9%
Naive	-7.1%	-5.3%	6.7%	2.4%
t-1+ t-2	0.1%	0.7%	14.7%	6.3%
Naive	-7.7%	-2.7%	7.6%	4.2%
t-2+ t-3	19.9%	12.7%	35.8%	20.1%
Naive	-5.8%	0.0%	6.5%	3.2%
t-1+ t-2+ t-3	17.2%	10.6%	30.6%	21.4%
Naive	-5.8%	0.0%	7.6%	4.2%

*(Actual General Fund Balance - Models' Predicted
 Fund Balance)/Total Revenues

In prediction of the 1982 general fund balance in the hold-out sample, the accuracy of the estimated models was only superior to the naive model to predict the 1982 general fund balance at t-1 and t-3. The t-1 model had a mean accuracy statistic of 5.5% compared to the naive model at 10.0%. The t-3 model performed extremely well with the highest accuracy at 3.9% compared to the naive model at 6.7%.

The t-2 model performed poorly with a mean accuracy statistic of 15.4% compared to the naive model at 6.2%. The multiple year models performed very poorly with mean accuracy statistics of 14.7%, 35.8% and 30.6% compared to the related naive model (7.6%, 6.5%, and 7.6%).

Median statistics are also displayed in Table 22 which parallel the comparisons above regarding the mean statistic except that no estimated model outperforms the naive when comparing the median statistic. The median statistic is provided to reveal more information about the distribution of the accuracy statistic than can be assessed by looking at the aggregated mean statistic.

Another way to evaluate the predictive accuracy of the estimated models is to compare the sign of their predictions with the sign of the actual general fund balance reported in the target year. Table 23 displays the results of the sign predictions from the estimated and naive models. The sign of interest is that for the 1982 hold-out sample. The table reports in contingency table form the percentage of the

hold-out sample signs as classified by the estimated and naive model. The sign is considered a surplus if the general fund balance in 1982 was equal to or greater than zero. The sign is considered a deficit if the general fund balance in 1982 was less than zero.

TABLE 23

PERCENTAGE OF SIGNS OF 1982 GENERAL FUND BALANCE
CLASSIFIED BY ESTIMATED AND NAIVE MODELS

Year	Model	Surplus	Deficit	Total	x ²
	Actual	15.0%	85.0%	100.0%	
t-1	Estimated: Surplus	11.9%	20.3%	32.2%	
	Deficit	65.0%	2.8%	67.8%	13.11
	Naive: Surplus	13.6%	33.9%	47.5%	
	Deficit	50.8%	1.7%	52.5%	47.33
t-2	Estimated: Surplus	13.6%	33.9%	47.5%	
	Deficit	50.8%	1.7%	52.5%	47.33
	Naive: Surplus	11.8%	10.2%	22.0%	
	Deficit	74.5%	3.5%	78.0%	4.64***
t-3	Estimated: Surplus	13.6%	15.2%	28.8%	
	Deficit	69.5%	1.7%	71.2%	8.39
	Naive: Surplus	10.1%	8.6%	18.6%	
	Deficit	76.0	5.4%	81.4%	.52*
t-1 + t-2	Estimated: Surplus	14.4%	34.8%	49.2%	
	Deficit	50.0%	0.8%	50.8%	104.88
	Naive: Surplus	12.7%	22.0%	34.7%	
	Deficit	63.2%	2.0%	65.3%	71.39
t-2 + t-3	Estimated: Surplus	15.2%	48.4%	63.6%	
	Deficit	36.4%	0.0%	36.4%	212.99
	Naive: Surplus	11.0%	9.3%	20.3%	
	Deficit	75.4%	4.3%	79.7%	2.36**
t-1 + t-2 + t-3	Estimated: Surplus	14.2%	33.3%	47.5%	
	Deficit	51.4%	1.1%	52.5%	96.54
	Naive: Surplus	11.8%	17.6%	29.4%	
	Deficit	67.2%	3.4%	70.6%	27.31

*significant at .20

**significant at .10

***significant at .02

The goodness-of-fit chi-square (χ^2) statistic was used to evaluate the results in the contingency table. The goodness-of-fit test evaluates whether the predicted sign and the actual sign are independent. In other words, how well does the distribution of predicted signs fit the distribution of actual signs? This test does not evaluate whether the two distributions are independent.

Again, the t-3 single year model performed the best with the lowest χ^2 goodness-of-fit statistic of all the estimated models. However, even this estimated model at t-3 did not beat the naive model. The naive models outperformed the estimated models in predicting surplus or deficit with three of the naive models having a significant chi-square (χ^2). The goodness-of-fit χ^2 test indicates whether the predicted signs can be expected based upon the actual signs of the general fund balance. The chi-square provides a method of evaluating whether the model will predict future values correctly by measuring them against the actual values in this 1982 sample data.

The estimated models cannot be expected to produce a classification which can be accepted as a "good fit" with the 1982 sample data; however three naive models do "fit" the sample data. This may be somewhat biased due to the sharp change in deficit/surplus signs from 30/30 in 1981 to 51/9 in 1982. Future research may determine whether this result is unique to this particular sample and time period.

The objective of this research was not to predict sign, but to predict the general fund balance. The results in Table 22 support rejection of the null hypothesis that a regression model cannot predict the general fund balance with greater accuracy than a naive model. Overall, the results indicated future research in this area may be productive.

5.6 Summary of the Results

Tables 14 and 24 summarize the single and multiple year models estimated. Table 24 below displays the six stepwise regression models coefficients by variable category and name across models.

TABLE 24

DISPLAY OF SIX STEPWISE REGRESSION MODELS COEFFICIENTS BY
VARIABLE WITH INTERPOLATED OR NEAREST VALUES SUBSTITUTED FOR
MISSING VALUES WITHIN EACH GOVERNMENT
TO PREDICT GENERAL FUND BALANCE IN 1981

Variable	1980 n = 60	1979 60	1978 60	1979-80 120	1978-79 120	1978-80 180
Assets:						
CSH	.513	.771		.263	.944	.309
SAV	.816			-.326	-.514	.233
DFOF		-1.064		-1.247	-.518	-.557
TA		.371	.887	.920		.502
DFOU				-.850		-.392
Liabilities:						
AP						
DOF	-1.286					.449
TL			-1.575	-.525		-.871
UPL	-.031	-.166		-.085	-.208	-1.124
DOU	7.791					
Budgetary Control:						
REVS	-.043			.141		.039
REVAR		.804		.297	.349	
EXP					-.097	
EXPVAR		1.433	.426	.774	1.048	.558
Tax Base:						
SEV						
RSEV						
Taxing power:						
RTP						
Borrowing:						
GODPC						
TAN	-153.201**					
TDPC						
Constant**						
	33.943	-14.198	20.812	-6.987	-27.618	-8.379

**coefficients are expressed in thousands of dollars

Several of the variables parallel significant variables noted in other municipal research. Raman (1982) and Copeland and Ingram (1982) found short-term debt was related to bond rating changes which parallels the tax anticipation note variable (TAN) in this research. Engstrom (1984), Marks and Raman (1985), and Copeland and Ingram (1983) suggested that unfunded pension liability may be associated with municipalities' future financial credit rating and financial position. This research supports that suggestion as unfunded pension liability (UPL) played a significant role in several of the models estimated.

Accounts payable (AP) did not enter into any of the models. This could be due to the fact that governmental funds have a short-term focus for such liabilities and must pay vendors and employees on a regular basis to avoid cessation of services.

Total liabilities (TL) entered into three models. Total liabilities contribute 41.8% in the 1978 single year model. The variable entered the 1980-1979 model and contributed 0.8% and 0.4% in the three-year model. Total liabilities was a powerful variable three years prior to the general fund balance in the single year model.

Intergovernmental receivables (DFOU) entered into two of the multiple year models with a very small contribution to R^2 in each case of 1.1% and 0.2%. Intergovernmental payables (DOU) entered into only one single-year model which was also the best model at $t-1$. Intergovernmental payables

(DOU) had a very large coefficient (7.791) but only contributed 1.6% to the model and was the last variable entered. It appears that intergovernmental receivables or payables play a negligible role in predicting the general fund balance in 1981 in this sample.

Interfund receivables (DFOF) and payables (DFOF) entered into four and two of the six models, respectively. However, neither variable contributed large amounts to explain the variation in the general fund balance. Interfund receivables (DFOF) increased R^2 by 3.3% in the 1979 single year model. DFOF contributed 1.3%, 0.6%, and 2.6% in the three multiple year models for 1980-1979, 1979-1978, and 1980,1979,and 1980, respectively. Interfund payables (DOF) contributed 0.5% entering sixth in the 1980 model. DOF contributed 0.4% entering tenth in the multiple year model using all three years of data. The results indicated that interfund transactions did not contribute much to explain the variation in general fund balance.

Two asset category variables, savings and total assets (SAV and TA) each entered into four of the six models. Savings entered second and contributed 2.4% in the 1980 model. Savings entered into each of the three multiple year models contributing 0.9%, 0.6% and 0.8% to R^2 . Total assets enters last in each and contributes 0.6% and 3.2% to the 1979 and 1978 models. These asset variables seem to assist in the estimation of the general fund balance. However,

cash is far more powerful and diminished the role for the other asset variables.

Three variables appeared in five of the six models estimated. These variables were cash (CSH), unfunded pension liability (UPL) and expenditure variance (EXPVAR).

Cash contributed 0.6% in the 1980 model and 19.0% in the 1979 model. In the multiple year models, cash contributed 0.6%, 10.5%, and 1.8% for 1980-1979, 1979-1978, and 1980-1978, respectively. It appears that cash was a powerful predictor two years prior to the general fund balance.

Unfunded pension liability (UPL) entered as a significant predictor variable in five of the six models. In the 1980 and 1979 single year models, UPL entered first and contributed 88.1% and 37.6%, respectively to R^2 . In the multiple year models, UPL entered second and contributed 16.3%, 33.1% and 28.6% to the 1980-1979, 1979-1978, and 1980-1978 models, respectively.

Expenditure variance (EXPVAR) was the most powerful of the budgetary control category variables. EXPVAR entered second in the 1979 model and first in the 1978 model contributing 30.0% and 48.2%, respectively to R^2 . EXPVAR entered first in all three of the multiple year models contributing 50.6% in 1980-1979, 40.9% in 1979-1978 and 49.2% in the three year model. The amount by which expenditures exceeded budget was a critical variable to

predict future deterioration in financial position in the general fund balance in this sample.

The other budgetary control variables were not as powerful as expenditure variance. Expenditures only entered the 1979-1978 model last with a contribution of 0.4%; a negligible contribution to R^2 . Revenues variance contributed 3.7% to the 1979 model, 8.8% to the 1980-1979 model, and 4.5% to the 1979-1978 model. Revenues appeared in three models. Revenues entered the 1980 model fifth contributing 1.9%. Revenues contributed 1.2% to the 1979-1978 model and 6.0% to the three year model. It appeared that expenditures and revenues have some explanatory power.

5.7 Summary

This chapter presented the results of the multiple regression estimation to develop a predictive model which could predict the general fund balance in 1981 better than chance alone. The null hypothesis was rejected as the 1978 model is remarkable in its parsimony and power with three variables explaining 93.2% of R^2 and achieving a mean predictive accuracy of 3.9%. The naive model had a lower accuracy than the 1978 model at 6.7%. Therefore, the null hypothesis was rejected as a predictive model did achieve greater accuracy than a naive model. The best model of the

six estimated was the 1978 model which was also the basis for rejecting the null hypothesis:

$$Y' = \$20,812 + .887(\text{Total Assets}) - 1.575(\text{Total Liabilities}) + .426(\text{Expenditures Variance})$$

where Y' = a future general fund balance

Chapter 6 will discuss implications of the results and limitations of the study.

CHAPTER 6

IMPLICATIONS AND LIMITATIONS

6.1 Introduction

The previous chapters outlined the research question, sample data, research design and evaluated the results obtained. This chapter will contain discussion of the implications of the results and some limitations of the study.

6.2 Implications of the Results

6.2.1. Implications for Standard-Setting

The explanatory power of the unfunded pension liability variable in this sample lends support to the need for this item to be properly measured and reflected in the body of the financial statements. This research would lend support to the need to set standards for disclosure and reporting of this liability in the financial statements of governmental units.

The explanatory power of the expenditure variance in relation to the general fund balance in this sample lends support to the new concept of interperiod equity espoused by the Governmental Accounting Standards Board in Concepts Statement 1 (previously quoted on page 7). If governments do not "live within their means" (i.e., budgets) then they are shifting the tax burden to future citizens and

taxpayers. The expenditure variance may not only be a key predictor variable for the general fund balance but also a red flag that interperiod equity is declining. The expenditure variance should be carefully measured and regularly reported at public meetings of the municipality.

6.3 Limitations of the Study

The sample was small and Michigan-specific. In 1981 several communities in the northern portion of the lower and upper peninsulas had general fund deficits. This northern representation may bias the results due to a region-specific macroeconomic variable which was not included in the model. The mix of unit types in the sample (county, city, village, township) may bias results and preclude meaningful interpretation. On the other hand, the mix of unit types may facilitate the generalizability of the results. Ideally, type-specific models would be used. Type-specific models would provide more assurance that some structural characteristic, specific to one type and not another, was better exposed to possible inclusion.

The variables could not be transformed to linear, normal distributions. However, regression is relatively robust for this violation.

Another limitation derives from Rubin's (1980) and Anthony's (1985) assertions that politicians may "hide" deficits. If that was true in Michigan during the sample

period, then the sample used in the current research may contain misclassified observations. Such misclassification may affect the coefficient estimates in the regression models and the prediction accuracies reported from those models.

The number of missing values in the sample data is also a limitation of this research. While a substitution method was used which seems appropriate, the results are still limited by the missing data.

The exclusion of socioeconomic variables from the model building may reduce the predictive value of the general fund balance models. Other independent variables such as volume of building permits, percentage of the population which is elderly, number of new businesses, etc., may affect a municipalities' general fund balance. Another limitation of variable selection is the lack of theory to guide the choice of variables used in the current research. No hypotheses are offered about the independent variables.

6.4 Future Research

This research represents a first step toward development of a model to predict a local government's fund balance years ahead of its occurrence. The results support the conclusion that such a predictive model was better than a naive model. However, much work remains to be done to improve conditions in the data which limited this research.

Several additional projects which should be conducted include:

a. Estimate the models by scaling the variables with some indices as was done with the accuracy statistic (divided by total revenues). This may reduce the R^2 but may improve the predictive accuracy of the models.

b. Increase the size of the sample. It's possible that a matched pairs design can be improved upon by including all available units even though the variable of interest (deficit fund balance) may only exist in a few of the units. Data may now be available in a computerized fashion for many more units than was possible at the time this study was conducted and the results should be reevaluated with a larger sample size.

c. Increase the number of years evaluated. It appears that selection of 1982 for a hold-out sample may be biasing the predictive accuracy results due to the dramatic change in deficit/surplus units from 1981 to 1982. Additional years could neutralize the effects associated with any particular year.

d. Select a more recent sample of financial audits and focus on the unfunded pension liability, and budget variances to validate the importance this research would suggest they have in predicting future financial health.

6.5 Summary

The standard-setters should speed requirements to report and disclose variables which may be red flags for future difficulty, such as unfunded pension liability. The research has several limitations, however, it demonstrates that a model of financial data can predict a future general fund balance with greater accuracy than a naive model. This contribution will help fill in a gap in current research on municipal units and may also be of value to State monitoring systems.

APPENDIX A

DATA CAPTURE SHEET

APPENDIX
DATA CAPTURE SHEET

Name of Local Unit:

1981 1980 1979

General Fund:

Fund Balance (deficit)
(unreserved-undesignated)

Accounts Payable

Due to Other Funds

Cash

Savings, investments, and
other liquid assets

Due From Other Funds

Expenditures - Actual

*Expenditures - Actual to budget

Revenues - Actual

*Revenues - Actual to budget

Unfunded Pension Liability

*Actual compared to budget
represents budget variance
(XXXX)=unfavorable variance

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