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Program Evaluation Division

STATE BOARD OF INVESTMENT: INVESTMENT PERFORMANCE

FEBRUARY 24, 1978

STATE OF MINNESOTA
LEGISLATIVE AUDIT COMMISSION
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STATE BOARD OF INVESTMENT: INVESTMENT PERFORMANCE

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FOREWORD

The Program Evaluation Division of the Legislative Audit Commission was established by Chapter 204, Section 91 of the Laws of Minnesota for 1975. The Division is authorized to "determine the degree to which activities and programs entered into or funded by the state are accomplishing their goals and objectives, including an evaluation of goals and objectives, measurement of program results and effectiveness, alternative means of achieving the same results, and efficiency in the allocation of resources." This evaluation, *The Minnesota State Board of Investment: Investment Performance,* is the fifth undertaken by this Division.

The Legislative Audit Commission directed the Division to address three specific issues in this evaluation: the rate of return earned on funds managed by the State Board of Investment, the earning performance of MSBI relative to other fund managers, and the extent of MSBI investments in Minnesota enterprises and their impact on the state's economy.

For each report, a uniform review procedure is followed. After a preliminary draft is completed, it is submitted to the agency evaluated for its verbal and written comments. The written responses of the State Board of Investment are included in Appendix D. In addition, the report is reviewed by an advisory subcommittee of the Legislative Audit Commission prior to its release. We are most grateful for this subcommittee's advice and direction and for Representative Fred C. Norton's able and helpful chairmanship.

We thank Robert E. Blixt, Jr., Executive Secretary of the State Board of Investment, and his staff for their valuable time and assistance on this project.

Scheffel Wright was the project director and chief author of this report. Assisting him were Daniel J. Jacobson, who had primary responsibility for the research on investments in Minnesota enterprises, and Daniel R. Nelson.

February 24, 1978

Bruce Spitz,
Deputy Legislative Auditor
for Program Evaluation

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MINNESOTA STATE BOARD OF INVESTMENT: INVESTMENT PERFORMANCE

EXECUTIVE SUMMARY

This evaluation focused on three main issues:

1) The rate of return earned on funds managed by the Minnesota State Board of Investment (SBI).

2) The relative investment management performance of the State Board of Investment versus other fund managers.

3) The extent of SBI investments in Minnesota companies and the impact of these investments on the Minnesota economy.

The following evaluative conclusions seem warranted: The overall return on the funds studied appears adequate for the periods studied. The relatively low return on stock investments from 1972 to 1976 should not be a cause for concern. Relative to other funds, the Minnesota Adjustable Fixed Benefit Fund (MAFB) performed quite well. Its equity portfolio also ranked well above average as compared to others. Though average, the MAFB bond portfolio's performance from 1972 to 1976 represents a healthy rate of return.

MEASURING THE RATE OF RETURN

There are many ways to calculate rate of return. Different measures are useful for different purposes: for comparing the performance of a fund's management to other fund managers, for understanding the real rate earned by a fund over a specific time interval, and for accounting and reporting purposes. We measured the rate of return on funds managed by SBI by several commonly used formulas and variants on them.

FINDINGS:

- The bond portfolios of the basic retirement funds far outperformed the stocks in the 47-month period studied (from August, 1973 to June, 1977).

- The stock portfolio of the Minnesota Adjustable Fixed Benefit Fund substantially outperformed the bonds from August, 1970 to June, 1977. Since the funds are managed by similar strategies, there is reason to believe that similar results were obtained by the basic retirement funds during this period.

- Including short term securities and income consistently raised the measured performance of both bonds and stocks in the funds. This indicates good investment decisions in allocating funds to the short term portfolio.

- The Public Employees Retirement Fund outperformed both the Teachers and State Employees funds over the period studied.

MEASURING INVESTMENT MANAGEMENT PERFORMANCE

Investment performance is measured by ranking the rate of return of a given fund against a group of comparable funds. Comparisons are generally made not only for a total fund, but also for its component bond and stock portfolios. We report here on three investment performance analyses of the Minnesota Adjustable Fixed Benefit Fund (MAFB), done by:

- Merrill Lynch, Pierce, Fenner and Smith;
- Hamilton, Johnston and Company, formerly the investment performance research division of Wertheim and Company; and
- Standard Valuations, a Minneapolis firm.

The groups of funds to which the MAFB was compared include retirement funds, bank pooled bond and equity funds, insurance company funds and mutual funds.

FINDINGS:

- The performance of the total MAFB fund ranked substantially above average versus virtually all groups of funds to which it was compared.
- The performance of the MAFB equity portfolio also ranked substantially above average.
- The MAFB bond portfolio earned a significantly higher rate of return than the equity portfolio from 1972 to 1976.
- However, this higher rate of return earned by the bond portfolio only represented average performance versus other bond portfolio managers. This average ranking is mitigated somewhat: (1) by the narrower range of returns on bond portfolios – the difference in rate of return between average and above-average performance is substantially less for bonds than for stocks, and (2) by the large holdings of privately-placed bond issues in the MAFB.

SPECIAL ANALYSES AND RELATED ISSUES

Market Sensitivity and Risk. Merrill Lynch's market sensitivity analysis indicates that the MAFB equity portfolio is somewhat riskier than the mutual funds and bank pooled equity funds and somewhat less risky than the retirement fund equity portfolios in the sample.

Cyclical Performance. Hamilton, Johnston and Company rank stock portfolio performance in falling and rising market periods. The MAFB equity portfolio performed below average (37th percentile) during the 1972-1974 bear market and substantially above average (70th percentile) in the bull market of 1974-1976.

Index Funds. The strategy of "indexing" funds has been popular over the past few years in stock fund management. Research indicates that average management performance does not exceed average stock market performance over the long run. The State Board of Investment's stock management follows a modified indexing strategy, which accounts in part for its above average performance recently.

Stocks vs. Bonds. Throughout the recent history of securities markets, from the 1920's until the late 1960's or early 1970's, stocks have on average significantly outperformed bonds. However, for specific periods in the unprecedented economic circumstances of the present decade this has been drastically reversed. Choosing an investment strategy on the basis of historical performance patterns is difficult and tenuously reliable at best. Arguments over stocks versus bonds must be tempered by this knowledge.

INVESTMENTS IN MINNESOTA SECURITIES

Several issues are implicit in this topic: the fiduciary responsibility of fund managers; the degree to which Minnesota companies are currently represented in SBI's portfolios; whether expanded investments in Minnesota companies would stimulate the state's economy; and, if so, whether such expansion would be appropriate.

FIDUCIARY RESPONSIBILITY

Legal standards governing pension funds stress the investment management's obligation to protect the interests of a fund's beneficiaries and participants. Moreover, this obligation is universally accepted within the investment community. Common law principles place the Board in a fiduciary capacity with respect to the beneficiaries of the funds it manages, thereby obligating it to conduct its business solely in the best interests of the funds. Minnesota Statutes further codify this responsibility, and also set forth a prudent person standard for the Board.

HOLDINGS OF MINNESOTA FIRMS' SECURITIES

By three different measures, Minnesota's share of national business activity is approximately 2.0 percent. Minnesota companies' securities account for 9.3 percent of SBI stock investments and for 12.5 percent of bond investments, indicating substantially greater than proportional geographic representation of Minnesota firms.

IMPACT ON MINNESOTA'S ECONOMY

It is unlikely that the Investment Board has a significant impact on the state's economy since its Minnesota investments are generally made in nationally recognized, secure enterprises. These firms would have little difficulty raising capital even if SBI should decide not to purchase their securities.

To exert positive stimulation on the Minnesota economy, the Board would have to invest in smaller, riskier companies which could not raise capital elsewhere. Such an investment program might well be inconsistent with the Board's legal obligations to fund members and beneficiaries. Aside from the general risk factor involved with small companies, there are two additional disadvantages of such investments:

- They would reduce the geographic diversification of the board's portfolios. Geographic diversification helps protect funds from large losses due to local recessions.
- SBI may not be able to sell a Minnesota security at the most opportune time due to political pressure to keep the security.

Furthermore, concentrating investments in Minnesota companies already represented in SBI's portfolios would reduce the diversification among different companies within each sector. Such limited industrial diversification is also potentially harmful.

SUMMARY OF FINDINGS

This evaluation focused on three main issues:

1) The rate of return earned on funds managed by the Minnesota State Board of Investment (SBI).

2) The relative investment performance of the State Board of Investment versus other fund managers.

3) The extent of SBI investments in Minnesota companies and the impact of these investments on the Minnesota economy.

The findings of the study are summarized below. Supporting data and analyses are presented in the text and appendices of this report and in staff papers.

MEASURING THE RATE OF RETURN

The Research Question: What is the rate of return earned on funds managed by the State Board of Investment?

There are many rate of return formulas. Different measures are useful for different purposes: for comparing the performance of a fund's management to other fund managers, for understanding the real rate earned by a fund over a specific time interval, and for accounting and reporting purposes. We measured the rate of return on funds managed by SBI by several commonly used formulas and variants on them. (See Chapter One and Appendix A.) The funds thus analyzed were the Minnesota Adjustable Fixed Benefit Fund (MAFB), which serves most public retirees in Minnesota, and the three largest retirement funds managed by SBI: the Teachers Retirement Association Fund (TRAF), the Public Employees Retirement Fund (PERF), and the State Employees Retirement Fund (SERF). Rates were calculated for the total funds and for their component bond and stock portfolios separately. Those rate formulas which, in our opinion, represent the best measures are presented in Tables S-1 and S-2. The periods analyzed were determined by data availability: sound data were available for the MAFB from August, 1970 to the present, and for the retirement funds from August, 1973 to the present.

The time-weighted rate of return is useful for comparing the performance of different fund managers. This methodology calculates a rate for a series of individual time periods within a longer interval and chains them together, thereby netting out the impact of different cash flows. Since the investment manager has no control over cash flows, it is important to net out their impact so as to avoid potential distortion in measured relative performance. It is called time-weighted because each individual time period is assigned equal weight in calculating the average rate for the total interval. R2 is our preferred time-weighted rate of return for the total funds, and RB4 and RCS4 are the comparable rates for the individual bond and common stock portfolios, respectively, including for each its pro-rated share of short term securities and income therefrom.

The dollar-weighted rate of return is the average annual compound rate of return which a fund must have earned over time interval in order to grow from its beginning market value to its ending market value, taking account of cash flows into and out of the fund. It is called dollar-weighted because it takes account of different amounts of money being in the fund for different lengths of time.

Though not useful for measuring the true rate earned nor for comparing investment management performance, there are simple formulas based on cash income which are popular for reporting purposes. Our preferred formula for this category, R4, measures the rate of return as cash income divided by average book (or original cost) value of the portfolio. RB10 and RCS10 are the comparable rates for

TABLE S-1

SELECTED AVERAGE ANNUAL COMPOUND RATES OF RETURN
TEACHERS RETIREMENT ASSOCIATION FUND,
PUBLIC EMPLOYEES RETIREMENT FUND, AND
STATE EMPLOYEES RETIREMENT FUND

August, 1973, to June, 1977

	TRAF	PERF	SERF
Dollar-weighted R	4.782%	5.941%	5.031%
R2	3.027%	3.581%	3.240%
RB4	6.225	6.364	5.862
RCS4	0.095	0.973	0.796
R4	5.792%	5.873%	5.728%
RB10	7.772	7.786	7.577
RCS10	3.844	3.991	3.907

TABLE S-2

SELECTED AVERAGE ANNUAL COMPOUND RATES OF RETURN
MINNESOTA ADJUSTABLE FIXED BENEFIT FUND

August, 1970 to June, 1977

Dollar-weighted R	8.397%
R2	8.519%
RB4	8.011
RCS4	10.061
R4	5.229%
RB10	7.502
RCS10	3.333

the bond and common stock portfolios, respectively, including for each its pro-rated share of short term securities and income therefrom.

FINDINGS:

- The bond portfolios of the retirement funds far outperformed the stocks in the 47-month period studied (from August, 1973 to June, 1977).
- The stock portfolio of the MAFB substantially outperformed the bonds from August, 1970 to June, 1977. Since the funds are managed by very similar strategies, there is every reason to believe that similar results were obtained by the basic retirement funds during this period.

- Including short term securities and income consistently raised the measured performance of both bonds and stocks in the funds. This indicates good investment decisions in allocating funds to the short term portfolio.

- The Public Employees Retirement Fund outperformed both the Teachers and State Employees funds on all but two rate formulas.

MEASURING INVESTMENT MANAGEMENT PERFORMANCE

The Research Question: How good is the State Board of Investment's fund management when compared to other fund managers?

RATE OF RETURN COMPARISON ANALYSES

Investment performance is measured by ranking the rate of return of a given fund against a group of comparable funds. Comparisons are generally made not only for the total fund, but also for its component bond and stock portfolios. It is frequently useful and instructive to compare the fund's performance to that of different types of funds – e.g., mutual funds, insurance company funds and bank pooled (or commingled) funds, as well as retirement funds. We report here on three investment performance analyses of the Minnesota Adjustable Fixed Benefit Fund (MAFB), done by:

- Merrill Lynch, Pierce, Fenner and Smith;

- Hamilton, Johnston and Company, formerly the investment performance research division of Wertheim and Company; and

- Standard Valuations, a Minneapolis firm.

The rankings reported in these studies are summarized in Exhibit S-1. The most important conclusions are stated below:

FINDINGS:

- The performance of the total MAFB fund ranked substantially above average versus virtually all groups of funds to which it was compared.

- The performance of the MAFB equity portfolio also ranked substantially above average.

- The MAFB bond portfolio earned a significantly higher rate of return than the equity portfolio from 1972 to 1976.

- However, this higher rate of return earned by the bond portfolio only represented average performance versus other bond portfolio managers. This average ranking is mitigated somewhat: (1) by the narrower range of returns on bond portfolios – the difference in rate of return between average and above-average performance is substantially less for bonds than for stocks, and (2) by the large holdings of privately-placed bond issues in the MAFB. (See page II-2 and page II-10 for a fuller discussion.)

EXHIBIT S-1

RANK OF MAFB TOTAL FUND, EQUITY PORTFOLIO AND BOND PORTFOLIO VERSUS OTHER FUNDS AND PORTFOLIOS

	Percentile Rank
I. Hamilton, Johnston and Company	
A. MAFB Equity Portfolio	
vs. 20 Bank Pooled Equity Funds	80
vs. 20 Insurance Co. Equity Funds	85
vs. 20 Investment Company Funds	65
vs. 60 Equity Yardstick Funds	77
B. MAFB Bond Portfolio	
vs. 45 Bond Yardstick Funds	51
II. Merrill Lynch, Pierce, Fenner and Smith	
A. MAFB Equity Portfolio	
vs. 100 Retirement Fund Equity Portfolios	73
vs. 100 Bank Commingled Equity Funds	79
vs. 100 Mutual Funds	65
vs. 300 Equity Funds/Portfolios	82
B. MAFB Bond Portfolio	
vs. 100 Retirement Fund Bond Portfolios	53
vs. 100 Bank Commingled Bond Funds	61
vs. 200 Bond Funds/Portfolios	57
C. MAFB Total Fund	
vs. 100 Retirement Funds	80
vs. 100 Bank Commingled Equity Funds	93
vs. 100 Mutual Funds	79
vs. 300 Funds	84
III. Standard Valuations	
A. MAFB Equity Portfolio	
vs. 7 Bank Pooled Equity Funds Plus S & P 500 Index	75
B. MAFB Bond Portfolio	
vs. Seven Bank Pooled Bond Funds Plus Salomon Brothers Bond Index	0
C. MAFB Total Fund	
vs. 7 Bank Pooled Funds plus Pooled Market Indexes	25
IV. Weighted Average Percentile Rank	
A. MAFB Equity Portfolio	81
B. MAFB Bond Portfolio	54
C. MAFB Total Fund	82

SPECIAL ANALYSES

In addition to the straightforward rate of return comparisons, several special analyses were performed. The most important of these are summarized briefly here. Fuller discussion can be found in Chapter Two of this report and in the staff paper, "Measuring Investment Management Performance."

FINDINGS:

- Market sensitivity and risk: Merrill Lynch's market sensitivity analysis indicates that the MAFB equity portfolio is somewhat riskier than the mutual funds and bank pooled equity funds and somewhat less risky than the retirement fund equity portfolios in the sample.

- Cyclical performance: Hamilton, Johnston and Company ranks stock portfolio performance in falling and rising market periods. The MAFB equity portfolio performed below average (37th percentile) during the 1972-1974 bear market and substantially above average (70th percentile) in the bull market of 1974-1976.

RELATED ISSUES

Two other issues deserve mention here:

- Index funds: The strategy of "indexing" funds has been popular over the past few years in stock fund management. Research indicates that average management performance does not exceed average stock market performance over the long run. The State Board of Investment's stock management follows a modified indexing strategy, which accounts in part for its above average performance.

- Stocks vs. bonds: Throughout the recent history of securities markets, from the 1920's until the late 1960's or early 1970's, stocks have, on average, significantly outperformed bonds. However, for specific periods in the unprecedented economic circumstances of the present decade this has been drastically reversed. Choosing an investment strategy on the basis of historical performance patterns is difficult and tenously reliable at best. Arguments over stocks versus bonds must be tempered by this knowledge.

INVESTMENTS IN MINNESOTA SECURITIES

The Research Question: Can the State Board of Investment stimulate the Minnesota economy by investing in Minnesota companies, without detriment to the funds which it manages and without abrogating its legal responsibilities to fund participants?

Several issues are implicit in this question: the fiduciary responsibility of fund managers; the degree to which Minnesota companies are currently represented in SBI's portfolios; whether expanded investments in Minnesota companies would stimulate the state's economy; and, if so, whether such expansion would be consistent with sound investment management. We measured the extent of current SBI holdings of Minnesota companies' securities and compared their proportional representation in SBI's permanently invested funds to their share of total U.S. business activity. We measured the rate of return on Minnesota stocks in SBI's portfolio. Our staff counsel investigated the fiduciary responsibilities of Minnesota's State Board of Investment. We explored the legal and internal investment management criteria which are employed by the Board in deciding what securities to purchase. Finally, we analyzed possibilities for expanding investments in Minnesota companies with respect to potential stimulation of the economy and consistency with principles of sound investment management.

HOLDINGS AND PERFORMANCE OF MINNESOTA STOCKS

By three different measures, Minnesota's share of national business activity is approximately 2.0 percent. Minnesota companies' securities account for 9.3 percent of SBI stock investments and for 12.5 percent of bond investments, indicating substantially greater than proportional geographic representation of Minnesota firms. Tables S-3 and S-4 summarize these data.

The rate of return earned by Minnesota stocks was slightly above the average for all SBI-held stocks from January, 1971 to June, 1976.

TABLE S-3
SHARE OF SBI'S PORTFOLIO HELD IN MINNESOTA SECURITIES
(In Millions of Dollars)

	Total	Minnesota Securities	Percent in Minnesota
Stocks (5/17/77)	1,055.3	98.1	9.3%
Bonds (5/12/77)	1,099.6	138.0	12.5%
Total	2,154.9	236.1	11.0%

TABLE S-4
MINNESOTA'S SHARE OF NATION'S BUSINESS ACTIVITY
Market Value of Stocks of Companies Listed on New York Stock Exchange, December 31, 1976
(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
858,299	14,340	1.7%

Sales of 500 Largest Industrials, 1976; 50 Largest Transportation, 1975; 50 Largest Retailing, 1975*
(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
1,025,437	20,821	2.0%

Assets of 50 Largest Institutions in Each of the Following Areas: Commercial Banking, Diversified Financial, Utilities, 1975*
(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
1,144,236	22,500	2.0%

*Fortune Magazine

LEGAL AND INVESTMENT MANAGEMENT CRITERIA

Chapter 11 of Minnesota Statutes specifies criteria for legal investments by the Board. SBI also employs further specific criteria for its investment decisions. (These are detailed in pages III-5 through III-8 of this report.) Separate criteria are applied to common stock and bond investments. Of 282 Minnesota companies examined against these criteria, 59 meet the legal criteria for common stock investments. Of these 59, 14 meet the Board's own investment management criteria. SBI holds the stock of 12 of these, plus the stock of five other Minnesota companies which do not satisfy all criteria.

Of 282 Minnesota companies, 14 have issued publicly placed bond obligations that meet the legal requirements for bond investments. A few companies that have only issued privately placed bonds may also qualify, but little data are available on privately placed bond issues. Of the 14 companies known to meet all legal requirements, SBI holds the securities of eight. The Board also has substantial holdings of federally backed securities in Minnesota — Small Business Administration guaranteed loans, New Community Act Debentures, and Government National Mortgage Association (GNMA) mortgage backed securities. As of May, 1977, investments in these securities totaled $54.5 million and accounted for 4.9 percent of all permanently invested bond holdings.

FIDUCIARY RESPONSIBILITY

Legal standards governing pension funds stress the investment management's obligation to protect the interests of a fund's beneficiaries and participants. Moreover, this obligation is universally accepted within the investment community. Common law principles place the Board in a fiduciary capacity with respect to the beneficiaries of the funds it manages, thereby obligating it to conduct its business solely in the best interests of the funds. Minnesota Statutes further codify this responsibility, and also set forth a prudent person standard for the Board, declaring that:

> "Any investments shall be made with the exercise of that degree of judgment and care, under circumstances then prevailing, which men of prudence, discretion, and intelligence exercise in the management of their own affairs . . . considering the probable safety of their capital as well as the probable income to be derived."[1]

IMPACT ON MINNESOTA'S ECONOMY

It is unlikely that the Investment Board has a significant impact on the state's economy since its Minnesota investments are generally made in nationally recognized, secure enterprises. These firms would have little difficulty raising capital even if SBI should decide not to purchase their securities.

To exert positive stimulation on the Minnesota economy, the Board would have to invest in smaller, riskier companies which could not raise capital elsewhere. Such an investment program would most probably be inconsistent with sound investment management practices and thus also inconsistent with the Board's legal obligations. Aside from the general risk factor involved with small companies, there are two additional disadvantages of such investments:

- They would reduce the geographic diversification of the Board's portfolio. Geographic diversification helps protect funds from large losses due to local recessions.
- SBI may not be able to sell a Minnesota security at the most opportune time due to political pressure to keep the security.

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[1] *M.S. Sec. 11.16(1).*

Furthermore, concentrating investments in Minnesota companies already represented in SBI's portfolios would reduce the diversification among different companies within each sector. Such limited industrial diversification can have serious detrimental effects on a portfolio in the event of a sectorally specific recession.

INTRODUCTION

The Legislative Audit Commission directed the Program Evaluation Division of the Legislative Auditor's office to conduct an evaluation of the investment performance of the Minnesota State Board of Investment (SBI). We have studied three specific topics, as directed by the Commission and the advisory subcommittee to the study:

1. The rate of return on funds managed by SBI.

2. SBI's investment management performance relative to other fund managers, including a comparative study of rates of return.

3. The extent of SBI's investments in Minnesota securities and the impact of these investments on the Minnesota economy.

Data for the rate of return calculations in this study came from the State Board of Investment's accounting section and from the Statewide Accounting System. Data for the comparative investment performance summary came from several private investment performance analysis firms. Further information came from numerous sources, including: interviews and meetings with SBI staff, officers and advisors of investment performance research firms, and members of the local investment community; review of SBI's enabling legislation, Minnesota Statutes, Chapter 11, and other legal sources; and review of relevant investment management texts and literature.

Chapter One reports the results of rate of return calculations for the Minnesota Adjustable Fixed Benefit Fund (MAFB) and for the three largest basic retirement funds managed by the Board: the Teachers Retirement Association Fund, the Public Employees Retirement Fund, and the State Employees Retirement Fund. Chapter Two summarizes the investment performance analysis reports of three private research firms. Chapter Three studies the extent of SBI holdings of Minnesota securities, the impact of these investments on the state's economy, and the potential for expanding investments in Minnesota enterprises.

Additional technical material and supporting information are found in the appendices and staff papers accompanying this report. Appendix A provides mathematical statements of the time-weighted rate of return formulas reported in Chapter One. Appendix B lists the funds to which the MAFB is compared in the investment performance analysis research. Staff papers provide fuller and more detailed discussions of the investment performance analysis research and of the issues involved in buying Minnesota securities for public pension and retirement funds.

CHAPTER ONE
MEASURING THE RATE OF RETURN

This chapter summarizes the rate of return calculations performed in our evaluation of the State Board of Investment. We calculated rates using several common formulas and variants on them for each of four major funds whose investments are managed by the Investment Board. These were chosen on the basis of size, and include the Minnesota Adjustable Fixed Benefit Fund (MAFB), the fund which serves most public retirees in Minnesota, and the three largest basic retirement funds: the Teachers Retirement Association Fund (TRAF), the Public Employees Retirement Fund (PERF), and the State Employees Retirement Fund (SERF). Exhibit I-1 shows the values of these funds and their component portfolios as of June, 1977. Time-weighted average rates using five different formulas were calculated for the total funds. The same basic formulas were also used to calculate time-weighted average rates for the bond and stock portfolios separately, both with and without a pro-rated share of short term securities included with each individual portfolio. There are thus ten rates for the bond portfolio of each fund, five with the portfolio's share of short terms and five without, and ten similar rates for stocks. The dollar-weighted, or internal, rate of return, the truest measure of the actual average rate earned by the funds studied, was also calculated for each total fund.

The periods studied were determined by data availability. Reliable and complete data for the Minnesota Adjustable Fixed Benefit Fund were available from July, 1970 to the present. Data for the three basic retirement funds were only available from August, 1973, when they became full participants in the Statewide Accounting System.

The first section herein presents the rates of return calculated by those formulas which we consider most meaningful. Then follows a general discussion of the dollar-weighted rate of return and time-weighted rate of return methodology. The chapter continues with a brief conceptual exposition of the specific formulas, their technical mathematical definitions, and tables presenting the average annual compound rates of return derived from each formula for each fund. A note on the importance of the study period chosen for evaluating the performance of stocks versus bonds concludes the chapter.

EXHIBIT I-1
VALUE OF FUNDS AND PORTFOLIOS STUDIED, JUNE, 1977

	Market Value of Total Fund	Book Value of Total Fund	Market Value of Stock Portfolio	Market Value of Bond Portfolio	Cash Plus Market Value of Short Term Securities
Minnesota Adjustable Fixed Benefit Fund	$ 743,373,314	$ 728,073,002	$361,320,178	$346,287,527	$35,765,609
Teachers Retirement Association Fund	454,600,394	451,431,741	226,383,758	212,471,384	15,745,252
Public Employees Retirement Fund	429,597,025	421,637,415	216,129,465	199,710,375	13,757,185
State Employees Retirement Fund	206,510,391	205,293,020	104,133,709	94,699,963	7,676,719
Totals — Funds Studied	**$1,834,081,124**	**$1,806,435,178**	**$907,967,110**	**$853,169,249**	**$72,944,765**

RATES OF RETURN

Different rate of return measures are useful for different purposes: for measuring and comparing investment management performance, for measuring the true rate earned by a fund over a specified interval, and for reporting purposes. Here we present those rates which, in our opinion, are the best for each purpose. Other rates and calculations are presented, discussed and summarized.

SELECTED RATES OF RETURN

Tables I-1 and I-2 show the rates of return for the four funds using the dollar-weighted R formula and six time-weighted formulas. The dollar-weighted rate of return is the true rate earned on the funds. The next group — R2, RB4 and RCS4 — are probably the best measure of investment management performance in that they: (1) take full account of total income, both cash income and market appreciation or depreciation, (2) net out the influence of cash flows to and from the fund, over which the investment manager has no control, and (3) use for the asset base the beginning market value of the fund or portfolio plus one-half of contributions to the fund or portfolio during the period. This is a very appropriate measure of the funds available to management for investment, and thus on which earnings can be made. The last group, R4, RB10 and RCS10, though not useful for measuring the true return on a fund nor for evaluating investment management performance, are popular formulas for reporting purposes. They measure yield as cash income divided by average original cost (or book value) of the portfolios.

The real, dollar-weighted rate of return for the three basic retirement funds ranged from 4.782 percent for TRAF to 5.941 percent for PERF for the period studied. This difference is mainly attributable to the different cash flows of the funds and also partially attributable to the slightly superior performance of the PERF portfolio. By virtually all measures, PERF outperformed the other two basic retirement funds over the period studied. The bond portfolios of all three funds clearly outperformed the stocks for this period. The total funds and the component bond and stock portfolios showed good cash yield rates on book value of assets, as shown by R4, RB10 and RCS10.

FINDINGS:

- The bond portfolios of the retirement funds far outperformed the stocks from August, 1973 to June, 1977.
- The stock portfolio of the MAFB substantially outperformed the bonds from August, 1970 to June, 1977.
- The Public Employees Retirement Fund outperformed both the TRAF and SERF over the period studied. This is most probably attributable to more advantageous cash flows for PERF, allowing securities to be purchased at more opportune times.

None of the results obtained is unusual or peculiar, considered either against each other or against overall securities market performance.

DOLLAR-WEIGHTED AND TIME-WEIGHTED RATES OF RETURN

Also called the "internal rate of return" in economic and financial jargon, the dollar-weighted rate of return is the average annual compound rate which a fund must have earned in order to grow from its beginning market value to its ending market value, taking account of cash contributions and distributions to and from the fund. It is called "dollar-weighted" because it takes account of different amounts of money being in the fund for different periods of time.

TABLE I-1

SELECTED AVERAGE ANNUAL COMPOUND RATES OF RETURN
TEACHERS RETIREMENT ASSOCIATION FUND,
PUBLIC EMPLOYEES RETIREMENT FUND, AND
STATE EMPLOYEES RETIREMENT FUND

August, 1973 to June, 1977

	TRAF	PERF	SERF
Dollar-weighted R	4.782%	5.941%	5.031%
R2	3.027%	3.581%	3.240%
RB4	6.225	6.364	5.862
RCS4	0.095	0.973	0.796
R4	5.792%	5.873%	5.728%
RB10	7.772	7.786	7.577
RCS10	3.844	3.991	3.907

TABLE I-2

SELECTED AVERAGE ANNUAL COMPOUND RATES OF RETURN
MINNESOTA ADJUSTABLE FIXED BENEFIT FUND

August, 1970 to June, 1977

Dollar-weighted R	8.397%
R2	8.519%
RB4	8.011
RCS4	10.061
R4	5.229%
RB10	7.502
RCS10	3.333

It is very much like the basic interest rate paid on a compound-interest bank account. Given an initial balance or deposit and a stream of further deposits to a savings account, and knowing the interest rate which the account pays, the ending balance can be calculated easily. In calculating the dollar-weighted rate of return, we really work backwards from known beginning and ending balances and a known stream of contributions (deposits) to solve for the interest rate which the beginning balance and the periodic contributions would have to have earned in order to equal the ending balance. Mathematically, this entails solving the following equation (by trial and error) for R:

$$MV1\,(1+R)^{n} + CONT_1\,(1+R)^{n-.5} + CONT_2\,(1+R)^{n-1.5} + \ldots + CONT_i\,(1+R)^{n-i+.5} + \ldots + CONT_n\,(1+R)^{.5} = MV2$$

where:

MV1 = market value of fund at the beginning of the total period;

$CONT_1$, $CONT_2$, $CONT_i$, $CONT_n$ = contributions received at the mid-points of the first, second, i-th and n-th periods;

R = the dollar-weighted rate of return;

n = the number of periods; and

MV2 = market value of fund at the end of the total period.

Time-weighted rates of return are used to measure investment management performance. They net out the impact of contributions, taken into account by the dollar-weighted rate of return, because the contributions flow could unfairly reflect on the investment management. This impact could actually be either positive or negative, but since it is outside the control of the investment manger, any such reflection would give an inaccurate picture of the manager's performance. Put simply, high contributions at opportune buying times will boost the dollar-weighted rate of return, while large contributions at market peaks, when prices are as high as they are likely to be for some time, will dampen the dollar-weighted rate.

Any specific periodic R formula – e.g., R1 through R5 or RCS1 through RCS10 – may be used to compute a time-weighted rate. The time-weighted rate solves for the geometric average of the expression $(1+r_i)$ over a given number of periods, where r_i represents the rate of return for time period i using the specified formula. Technically, this geometric average is found by solving the following expression for R:

$$R = \sqrt[n]{\prod_{i=1}^{n} (1+r_i)} - 1$$

where:

R = the time-weighted average compound rate of return over n periods;

n = the number of periods;

r_i = the rate of return in period i; and

$\prod_{i=1}^{n} (1+r_i)$ = the cumulative product of $(1+r_i)$ over n periods, i.e., the final result of $(1+r_i) \times (1+r_2) \times (1+r_3) \times \ldots \times (1+r_i) \times \ldots \times (1+r_n)$

Time-weighted rates of return are used to measure investment management performance. They have three important characteristics:

1. They net out the impact of contributions, which are generally outside the control of the investment manager, on the measured rate of return. They are therefore very useful for measuring investment management performance, but they do not show the real, dollar-weighted rate earned by the fund given its actual cash flows.

2. Since they are constructed from a series of monthly, bi-monthly, quarterly, or other periodic rates multiplied together to yield cumulative results, they show the value of one dollar invested at the beginning of a period and held until a certain point in time. When presented as an annual rate, as here, they give the average annual compound rate that the dollar would have earned if it were invested at the beginning and held until the end of the study period.

3. Time-weighted rates of return assign equal weights to each monthly, bi-monthly, quarterly or other periodic rate in computing the final average rate. That is, each time period receives equal weight in computing the overall rate of return; hence the name "time-weighted".

COMPLETE TIME-WEIGHTED RATES OF RETURN

We calculated time-weighted rates of return by several variants on the most common formulas. These are discussed here and results presented for the basic retirement funds for 1973-1977 and for the MAFB for 1970-1977.

R1 through R5 measure rates of return for the total funds. R1, R2 and R3 measure rates of return as total income, both cash income and market appreciation or depreciation, divided by different market value asset bases. The base in R1 is beginning market value plus one-half cash income received during the period. The R2 base is beginning market value plus one-half contributions. The base for formula R3 is average assets at market value over the period. R4 and R5 measure the rate of return as total cash income received by the fund as a percentage of average book value and average market value of the fund, respectively. (See Exhibits A-1 through A-4 in Appendix A for mathematical statements of these and following formulas.)

The formulas for the bond and stock portfolios parallel those for the total fund quite closely. There are ten formulas for the bond and ten for the common stock portfolios, because half, the odd numbered formulas, omit the influence of short term securities while the even numbered formulas take account of their influence. (There is obviously never any question as to whether to include short term securities in analyzing the total portfolios.) Where short terms were included, the pro-rated shares attributable to bonds and stocks were determined and those shares were included, rather than the entire short term portfolio.

RB1 and RB2 parallel R1 for the bond portfolios. They measure return as market income, without and with short terms and income therefrom, divided by beginning market value of assets plus one-half of contributions to the bond portfolio (one-quarter of total fund contributions, since the bond portfolio with its share of cash equivalents is one-half of the fund) plus one-half of cash income earned by the bond portfolio during the period. RCS1 and RCS2 provide the same measures for the common stock portfolio.

RB3 and RB4 are the bond-portfolio equivalents of R2. They measure return as market income divided by the beginning market value of assets plus one-half of contributions to the bond portfolios. RCS2 and RCS4 do the same for the common stock portfolios for each fund. RB5 and RB6 are the bond-portfolio analogs to R3. They measure the rate of return as total income divided by average market value of assets for the period. RCS5 and RCS6 are the stock-portfolio counterparts of these rates.

RB7 through RB10 and RCS7 through RCS10 are time-weighted rates using cash income for the income expression in the rate formulas. RB7, RB8, RCS7 and RCS8 measure rate of return as cash income divided by average market value of assets in the respective portfolios. These rates thus parallel the R5 measure for the total funds. RB9, RB10, RCS9 and RCS10 measure return as cash income divided by average book value of assets in the respective portfolios, as R4 does for the total funds.

Tables I-3 and I-4 show annual averages for all rates of return calculated. Exhibits A-1 through A-3 in Appendix A provide mathematical expressions of the formulas. Exhibit A-4 is the key to variable names.

FINDINGS:

- The bond portfolios of the retirement funds far outperformed the stocks from August, 1973 to June, 1977.

TABLE I-3

AVERAGE ANNUAL COMPOUND RATES OF RETURN
TEACHERS RETIREMENT ASSOCIATION FUND,
PUBLIC EMPLOYEES RETIREMENT FUND, AND
STATE EMPLOYEES RETIREMENT FUND
RETURNS ON BOND PORTFOLIO, STOCK PORTFOLIO AND TOTAL FUND[1]

August, 1973 to June, 1977

	TRAF	PERF	SERF
Dollar-weighted R	4.782%	5.941%	5.031%
R1	3.012%	3.566%	3.227%
R2	3.027	3.581	3.240
R3	2.342	2.915	2.400
R4	5.792	5.873	5.728
R5	6.245	6.304	6.244
RB1	4.519%	4.720%	4.169%
RB2	6.198	6.338	5.841
RB3	4.550	4.742	4.178
RB4	6.225	6.364	5.862
RB5	3.469	3.949	3.202
RB6	5.781	5.931	4.890
RB7	8.578%	8.652%	8.480%
RB8	8.599	8.547	8.434
RB9	7.683	7.821	7.530
RB10	7.772	7.786	7.577
RCS1	−0.788%	1.313%	0.793%
RCS2	0.083	0.969	0.790
RCS3	−0.781	1.325	0.806
RCS4	0.095	0.973	0.796
RCS5	−3.087	−0.956	−1.213
RCS6	−0.815	−0.844	−1.106
RCS7	4.019%	4.034%	4.034%
RCS8	4.090	4.213	4.199
RCS9	3.764	3.815	3.753
RCS10	3.844	3.991	3.907

[1] *R1-R5 are rates of return calculated for total fund, RB1-RB10 for bond portfolio and RCS1-RCS10 for stock portfolio.*

TABLE I-4

AVERAGE ANNUAL COMPOUND RATES OF RETURN
MINNESOTA ADJUSTABLE FIXED BENEFIT FUND
RETURNS ON BOND PORTFOLIO, STOCK PORTFOLIO AND TOTAL FUND

August, 1970 to June, 1977

Dollar-weighted R	8.397%[1]
R1	8.506%
R2	8.519
R3	7.905
R4	5.229
R5	5.251
RB1	7.173%
RB2	7.977
RB3	7.214
RB4	8.011
RB5	6.114
RB6	7.660
RB7	6.828%
RB8	6.805
RB9	7.559
RB10	7.502
RCS1	9.428%
RCS2	10.031
RCS3	9.461
RCS4	10.061
RCS5	7.488
RCS6	8.822
RCS7	3.330%
RCS8	3.473
RCS9	3.194
RCS10	3.333

[1] *Dollar-weighted R calculated for the period August, 1970 to December, 1976.*

- Investments in short term securities raised the performance of both the bond and stock portfolios over this period. This indicates good investment management decisions in allocating funds to the short term portfolio, as well as productive investment of that portfolio.

- The Public Employees Retirement Fund outperformed both the TRAF and SERF by all but two measures.

None of these results is unusual or peculiar, considered either against each other or against overall securities market performance.

STOCKS VS. BONDS

The issue whether stocks or bonds are better investment media is frequently raised. Measured performance depends critically on the study period chosen. Over the past fifty years, average stock performance has been significantly higher than average bond performance. In the final analysis, the best investment strategy will depend on the future performance of bonds and stocks. Arguments over the relative merit of different types of securities must proceed in light of this knowledge.

The importance of the period chosen in measuring the performance of bonds vs. stocks is demonstrated dramatically by comparison of the results for the MAFB to those for the three basic retirement funds for the different periods studied. As mentioned previously, data availability constrained us to study the MAFB from July, 1970, to June, 1977 and TRAF, PERF and SERF from August, 1973 to June, 1977, only. The stock portfolio of the MAFB substantially outperformed the bond portfolio, by roughly 2.5 percent annually, during the longer period. Granted, this period coincided with an overall market rise, but that only further serves to illustrate the point being made here. The bond portfolios of the basic retirement funds clearly outstripped their stock portfolios during the shorter period. Both periods included the 1974-1976 recession, but the longer period also included the significant rebound from the 1970 economic slump to the peak in late 1972. The portfolios of the basic funds and the MAFB are very similar. Had data been available for the three retirement funds for the longer period, the results would in all likelihood have been comparable.

CHAPTER TWO
MEASURING INVESTMENT MANAGEMENT PERFORMANCE

This chapter reports on three studies of the State Board of Investment's management of the Minnesota Adjustable Fixed Benefit Fund. The majority of the chapter is devoted to rate of return comparison studies, the most important element of investment management performance analysis. Studies of the MAFB equity portfolio's market sensitivity and its performance through rising and declining stock market periods are also reported. Brief discussions of two related issues — "index" funds and the general question whether stocks or bonds are better investment instruments — conclude the chapter.

RATE OF RETURN COMPARISON ANALYSES

Investment management performance is measured by comparing the rate of return earned by a given fund against the rates earned by comparable funds. The main criteria for comparability are fund size and investment goals. These funds are referred to as comparison funds, the comparison universe, or as "yardstick" funds. This secondary research summarizes investment performance analyses of the Minnesota Adjustable Fixed Benefit Fund done by:

- Merrill Lynch, Pierce, Fenner and Smith;
- Hamilton, Johnston and Company, formerly the investment performance research division of Wertheim and Company; and
- Standard Valuations, a Minneapolis firm.

The MAFB and its component bond and stock portfolios are compared to several categories of funds:

- retirement funds;
- mutual funds (investment company funds);
- bank pooled (commingled) equity funds; and
- insurance company equity funds.

The exhibits in Appendix B list the comparison funds other than retirement funds, for which confidentiality is maintained.

The most common methodology uses the time-weighted rate of return formula R2 discussed on page I-3. (See also Exhibit A-1 in Appendix A.) A rate is calculated for each fund and the results are ranked. Merrill Lynch uses this approach.

Another methodology employs the dollar-weighted rate of return. To surmount the problem of the impact of different cash flows for different funds, the MAFB's actual cash flows are plugged into the comparison funds' portfolios. This methodology thus yields a measure of the true rate which each portfolio would have earned given the MAFB's cash flows. Hamilton, Johnston and Company and Standard Valuations use this technique for their studies.

Exhibit II-1 summarizes the percentile ranks of the MAFB and its portfolios vs. the comparison funds of the three investment performance analysis services. (A percentile rank of 90 indicates that the fund did better than 90 percent of the comparison funds.) Tables II-1 through II-3 show the rankings achieved by the MAFB and its bond and stock portfolios versus Merrill Lynch's comparison universes. Tables II-4 and II-5 show the MAFB portfolios' rankings versus Hamilton and Johnston's yardstick funds. By comparing the actual earnings of the MAFB to the earnings which the median stock and bond yardstick funds would have obtained given the MAFB's cash flows, Hamilton and Johnston conclude that SBI's investment management has earned $22.6 million for the stock portfolio and $2.4 million for the bond portfolio. Tables II-6 through II-8 show the MAFB's rankings against Standard Valuations' comparison funds.

FINDINGS:

- The performance of the total MAFB fund ranked substantially above average versus virtually all groups of funds to which it was compared.
- The performance of the MAFB equity portfolio also ranked substantially above average against all comparison funds.
- The MAFB bond portfolio earned a significantly higher rate of return than the equity portfolio from 1972 to 1976.
- However, this higher rate of return earned by the bond portfolio only represented average performance versus other bond portfolio managers. This average ranking is mitigated somewhat: (1) by the narrower range of rates of return on bond portfolios — the difference between average and above average performance is substantially less for bonds than for stocks, and (2) by the MAFB's large holdings of privately-placed bond issues. (A fuller discussion of these factors follows immediately.)

SPECIAL NOTES ON THE MAFB BOND PORTFOLIO

The MAFB bond portfolio only attained average rankings in these studies. There are two additional factors which these analyses cannot incorporate which indicate that this performance may be better than its average rank indicates.

First, the range of rates of return on bond portfolios is narrower than that for stock portfolios. Thus, the absolute difference in percent rate of return between average and above average rank is less than for stock portfolios. For example, the average annual rate of return from 1972 to 1976 for Merrill Lynch's retirement fund bond portfolios ranged from a low of 2.3 percent to a high of 10.0 percent, with a standard deviation of 1.463 percent, compared to a range of from −9.1 percent to +11.6 percent

EXHIBIT II-1

RANK OF MAFB TOTAL FUND, EQUITY PORTFOLIO AND BOND PORTFOLIO VERSUS OTHER FUNDS AND PORTFOLIOS

	Percentile Rank
I. Hamilton, Johnston and Company	
A. MAFB Equity Portfolio	
vs. 20 Bank Pooled Equity Funds	80
vs. 20 Insurance Co. Equity Funds	85
vs. 20 Investment Company Funds	65
vs. 60 Equity Yardstick Funds	77
B. MAFB Bond Portfolio	
vs. 45 Bond Yardstick Funds	51
II. Merrill Lynch, Pierce, Fenner and Smith	
A. MAFB Equity Portfolio	
vs. 100 Retirement Fund Equity Portfolios	73
vs. 100 Bank Commingled Equity Funds	79
vs. 100 Mutual Funds	65
vs. 300 Equity Funds/Portfolios	82
B. MAFB Bond Portfolio	
vs. 100 Retirement Fund Bond Portfolios	53
vs. 100 Bank Commingled Bond Funds	61
vs. 200 Bond Funds/Portfolios	57
C. MAFB Total Fund	
vs. 100 Retirement Funds	80
vs. 100 Bank Commingled Equity Funds	93
vs. 100 Mutual Funds	79
vs. 300 Funds	84
III. Standard Valuations	
A. MAFB Equity Portfolio	
vs. 7 Bank Pooled Equity Funds Plus S & P 500 Index	75
B. MAFB Bond Portfolio	
vs. Seven Bank Pooled Bond Funds Plus Salomon Brothers Bond Index	0
C. MAFB Total Fund	
vs. 7 Bank Pooled Funds plus Pooled Market Indexes	25
IV. Weighted Average Percentile Rank	
A. MAFB Equity Portfolio	81
B. MAFB Bond Portfolio	54
C. MAFB Total Fund	82

TABLE II-1

PERFORMANCE OF MINNESOTA ADJUSTABLE FIXED BENEFIT FUND (TOTAL FUND) VS. OTHER FUND CATEGORIES, 1972-1976

Year	MAFB Return	Vs. 100 Retirement Funds			Vs. 100 Bank Commingled Equity Funds			Vs. 100 Mutual Funds		
		Mean Return	Median Return	MAFB Percentile Rank	Mean Return	Median Return	MAFB Percentile Rank	Mean Return	Median Return	MAFB Percentile Rank
1972-1976 Cumulative	29.6	18.1	17.3	80	6.0	4.9	93	10.2	9.5	79
1972-1976 Annual Average	5.3	3.4	3.2	80	1.2	1.0	93	2.0	1.8	79
1976	19.1	17.7	17.4	68	17.7	17.3	61	21.7	20.6	41
1975	24.1	22.6	21.6	59	26.7	27.2	36	31.5	31.8	25
1974	−16.0	−17.8	−17.9	61	−25.4	−25.8	91	−25.5	−25.2	89
1973	−10.6	−12.9	−13.2	64	−18.4	−18.4	92	−19.7	−18.1	87
1972	16.9	14.6	14.0	70	17.0	16.8	49	14.2	14.2	68

Source: Merrill Lynch, Pierce, Fenner and Smith, Incorporated, April, 1977.

TABLE II-2
PERFORMANCE OF MAFB EQUITY PORTFOLIO VS. OTHER EQUITY PORTFOLIOS
1972-1976

Year	MAFB Return	S&P 500' Return	Vs. 100 Retirement Fund Equity Portfolios			Vs. 100 Bank Commingled Equity Funds			Vs. 100 Mutual Funds		
			Mean Return	Median Return	MAFB Percentile Rank	Mean Return	Median Return	MAFB Percentile Rank	Mean Return	Median Return	MAFB Percentile Rank
1972-1976 Cumulative	17.7	26.9	7.9	7.3	73	6.0	4.9	79	10.2	9.5	65
1972-1976 Annual Average	3.3	4.9	1.5	1.4	73	1.2	1.0	79	2.0	1.8	65
1976	23.5	23.9	20.9	20.4	72	17.7	17.3	85	21.7	20.6	56
1975	32.3	37.2	33.5	33.6	41	26.7	27.2	76	31.5	31.8	50
1974	−28.0	−26.5	−29.3	−29.9	63	−25.4	−25.8	32	−25.5	−25.2	35
1973	−18.9	−14.7	−20.0	−20.4	56	−18.4	−18.4	46	−19.7	−18.1	47
1972	23.3	19.0	17.6	17.4	85	17.0	16.8	83	14.2	14.2	90

Source: Merrill Lynch, Pierce, Fenner and Smith, Incorporated, April, 1977.

TABLE II-3

PERFORMANCE OF MAFB FIXED INCOME PORTFOLIO VS. OTHER FIXED INCOME PORTFOLIOS, 1972-1976

Year	MAFB Return	Moody's Aa Bonds	Vs. 100 Retirement Fund Fixed Income Portfolios			Vs. 100 Bank Commingled Bond Funds		
			Mean Return	Median Return	MAFB Percentile Rank	Mean Return	Median Return	MAFB Percentile Rank
1972-1976 Cumulative	40.6	41.1	38.9	39.3	53	37.6	38.4	61
1972-1976 Annual Average	7.1	7.1	6.8	6.9	53	6.6	6.7	61
1976	14.8	17.4	15.8	16.1	29	15.8	15.6	37
1975	15.1	10.1	12.1	12.0	88	13.2	12.7	84
1974	−2.8	−1.9	−2.9	−2.8	51	−3.5	−2.4	46
1973	1.0	1.9	2.2	2.6	19	0.6	1.8	36
1972	8.3	9.2	7.9	8.0	58	8.3	7.8	58

Source: Merrill Lynch, Pierce, Fenner and Smith, Incorporated, April, 1977.

TABLE II-4

EQUITY PORTFOLIO: COMPARISON WITH YARDSTICKS
OVER FIVE YEARS FROM DECEMBER 31, 1976
(Amounts in Millions)

Institutions	Annual Rate of Return on Investment (Dollar-weighted)
Minnesota Adjustable Fixed Benefit Fund	5.0%
20 Bank Equity Yardsticks	
High	6.3
Low	−1.9
Median	3.6
Actual fund better than	16 of 20
20 Equity Investment Company Yardsticks	
High	12.9
Low	−4.4
Median	2.5
Actual fund better than	13 of 20
20 Insurance Company Equity Yardsticks	
High	9.0
Low	−3.6
Median	4.0
Actual fund better than	17 of 20
Total – 60 Equity Yardsticks	
High	12.9
Low	−4.4
Median	3.3
Actual fund better than	46 of 60
Market Indices	
S&P 500 Composite Index	6.4
Dow-Jones Industrial Average	8.4
NYSE Composite Index	6.1
Amount at end of period	
Actual Fund	$379.2
Median – 60 Yardsticks	356.6
Difference from median	+22.6

Source: Hamilton, Johnston and Company, Incorporated, April, 1977.

TABLE II-5

FIXED INCOME PORTFOLIO: COMPARISON WITH YARDSTICKS OVER FIVE YEARS FROM DECEMBER 31, 1971 TO DECEMBER 31, 1976

(Bonds Plus Cash Equivalents)
(Amounts in Millions)

Institutions	Annual Rate of Return on Investment (Dollar-weighted)
Minnesota Fixed Benefit Fund	8.0%
Hamilton, Johnston Bond Portfolios Index	7.9
Salomon Brothers Long Term Corporates Index	8.6
45 Bank Fixed Income Yardsticks	
High	9.9
Low	6.3
Median	7.8
Actual fund better than	27 of 45
Amount at end of period	
Actual Fund	$330.8
Median – 45 Yardsticks	328.4
Difference from median	+2.4

Source: Hamilton, Johnston and Company, Incorporated, April, 1977.

TABLE II-6

PERFORMANCE OF MINNESOTA ADJUSTABLE FIXED BENEFIT FUND VS. SELECTED FUNDS, 1970 – 1976

	Annual Dollar-Weighted R, 1970-1976	1970-1976 Rank	Dollar-Weighted R, 1976	1976 Rank
MAFB	10.16%	6 of 8	18.86%	5 of 9
Fund A	12.10	2	19.88	4
Fund B	7.68	8	15.60	9
Fund C	10.39	4	17.05	7
Fund D	N.R.	N.R.	16.91	8
Fund E	10.29	5	20.43	2
Fund F	13.05	1	20.14	3
Fund G	9.75	7	17.55	6
Fund H	11.24	3	20.93	1

N.R. = Not Rated.

Source: Standard Valuations Performance Comparison Study of the Minnesota Adjustable Fixed Benefit Fund, 1977.

TABLE II-7

PERFORMANCE OF MAFB EQUITY PORTFOLIO VS. SELECTED FUNDS, 1970-1976

	Annual Dollar-Weighted R, 1970-1976	1970-1976 Rank	Dollar-Weighted Rank	1976 Rank
MAFB Stocks	9.08%	2 of 8	22.76%	2 of 9
Equity Fund A	7.65	5	N.R.	N.R.
Equity Fund B	3.14	8	13.94	8
Equity Fund C	7.44	6	20.49	4
Equity Fund D	8.74	3	22.42	3
Equity Fund E	6.04	7	12.27	9
Equity Fund F	8.44	4	18.78	6
Equity Fund G	10.34	1	23.06	1
Equity Fund H	N.R.	N.R.	19.46	5
Equity Fund I	N.R.	N.R.	18.41	7

N.R. = Not Rated

Source: Standard Valuations Performance Comparison Study of the Minnesota Adjustable Fixed Benefit Fund, 1977.

TABLE II-8

PERFORMANCE OF MAFB BOND PORTFOLIO VS. SELECTED FUNDS, 1970-1976

	Annual Dollar-Weighted R, 1970-1976	1970-1976 Rank	Dollar-Weighted 1976	1976 Rank
MAFB Bonds	11.47%	8 of 8	15.22%	8 of 9
Bond Fund A	17.01	1	18.69	2
Bond Fund B	13.08	5	17.43	4
Bond Fund C	13.70	2	14.14	9
Bond Fund D	12.68	6	18.66	3
Bond Fund E	13.15	4	15.83	6
Bond Fund F	12.04	7	16.59	5
Bond Fund G	13.37	3	19.25	1
Bond Fund H	N.R.	N.R.	15.71	7

N.R. = Not Rated

Source: Standard Valuations Performance Comparison Study of the Minnesota Adjustable Fixed Benefit Fund, 1977.

and standard deviation of 3.398 percent for Merrill Lynch's retirement fund equity portfolios over the same period. To reiterate the main point, the difference between average and above average bond performance is substantially less than that for stocks.

Secondly, these investment performance analyses cannot adequately reflect differentials resulting from the MAFB bond portfolio's above average size and investment strategies which that large size more or less demands. The MAFB bond portfolio is larger than many to which it is compared. For example, as of November, 1977, MAFB bond holdings exceeded $364,000,000. At the same time, the average size of Hamilton, Johnston and Company's yardstick bond portfolios was $58,000,000. The MAFB pursues a strategy of buying and holding large blocks of fixed income securities. This is a feasible and sensible strategy for a large fund with long term investment objectives and limited staff. Smaller funds can more easily pursue active trading strategies, and can be expected to earn a return slightly higher than that of large funds because they will be able to take advantage of small, profitable trade opportunities not available to larger funds.

Furthermore, given its investment orientation and relative necessity to buy and hold large blocks of securities, it makes good sense for the MAFB to participate in privately-placed bond issues. The Investment Board can purchase large blocks of a private issue at one time via relatively smooth, inexpensive transactions. Private issues have superior call protection and generally offer higher coupon yields than publicly issued bonds of comparable quality. As of February 7, 1978, privately placed bonds comprised 61 percent of the MAFB bond portfolio.

Obviously, this is all to the good. In fact, in the long run, the strategy of buying and holding large blocks of privately placed bonds can do as well as or better than an active trading strategy. Unfortunately, the performance of portfolios heavily weighted with privately-placed bonds will generally fall short of portfolios mainly composed of public issues when measured by standard rate of return comparison methodology. This results because the standard methodology incorporates changes in portfolio market value into the rate of return calculation and is a problem because privately placed issues generally trade at lower market prices in secondary bond markets. Their market value drops soon after they are issued, and this will usually be made up only when the bonds approach maturity. This will lower the rate of return.[1]

It would not be so important if all funds had equal percentages of their assets invested in privately placed bonds or if all funds in the comparison universe were mature (i.e., non-growing) so that gains at bond maturity would offset losses early in the bonds' lives. Unfortunately, this is not the case: the MAFB is a large, rapidly growing fund with substantially greater holdings of privately placed securities than many of the smaller funds and portfolios to which it is compared.

Thus, since the range of bond portfolio returns is narrower than that for stock portfolios, and since the MAFB's large holdings of privately placed bonds tend to cause a slightly lowered rate of return versus portfolios consisting mainly of public issues, the MAFB bond portfolio's average rank should not be construed negatively.

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[1] The long run here means a period on the order of 20 to 40 years. Over such a long period, the impact of large holdings of private issues should tend to net out. However, since most rate of return analyses are done for periods of one to five years, these influences are not netted out and growing portfolios concentrated heavily in private issues suffer a disadvantage in the shorter periods.

SPECIAL ANALYSES

Two special analyses of the MAFB equity portfolio are reported here: Merrill Lynch's market sensitivity analysis and Hamilton, Johnston and Company's study of the portfolio's cyclical performance. Other special studies are also conducted by these two firms; they are reported in the staff paper, "Measuring Investment Management Performance."

MARKET SENSITIVITY AND RISK

Market sensitivity measures a portfolio's sensitivity or responsiveness to stock market fluctuations. Stock market fluctuations are measured as changes in a large stock market index such as the Standard and Poor 400, S & P 500 or the New York Stock Exchange Composite Index. A market sensitivity equal to 1.00 indicates that a one percent change in the stock market – i.e., in the index used – will cause a one percent change in the portfolio's value. A fund completely indexed to the market will obviously fluctuate identically with the market and would thus have a market sensitivity of 1.00. A fund which did not change at all in response to market fluctuations would have a sensitivity of 0. Market sensitivity greater than 1.00 indicates that a portfolio will respond more than proportionally to market fluctuations. For example, a market sensitivity of 1.50 implies that a one percent change in the market will result in a 1.50 percent change in the portfolio's value.

Market sensitivity also measures risk: the lower the market sensitivity, the lower the risk of the portfolio (and the lower the potential for great returns due to general market uptrends). In periods when the stock market outperforms riskless investments (e.g., U.S. Treasury bonds), portfolios with high market sensitivity will outperform those with low market sensitivity. Highly sensitive portfolios will be more adversely affected by market declines.

Table II-9 shows that the MAFB equity portfolio's market sensitivity was 1.03, indicating a very close relationship to the market. This ranked in the thirty-first percentile of one hundred retirement fund equity portfolios, in the seventieth percentile of one hundred bank commingled equity funds and in the sixty-fifth of one hundred mutual funds. This indicates slightly above-average risk versus all 300 comparison funds but somewhat less risk than other retirement funds' equity portfolios.

CYCLICAL PERFORMANCE

Hamilton, Johnston and Company measured the MAFB equity portfolio's performance through the declining ("bear") stock market period from December, 1972 to December, 1974, and also through the rising ("bull") market from December, 1974 to December, 1976. Table II-10 shows that the MAFB portfolio performed below average (37th percentile) during the bear market but substantially above average (70th percentile) during the bull market.

RELATED ISSUES

This chapter concludes with brief discussions of two issues which enjoy a good deal of interest.

INDEX FUNDS

Index funds are based on or patterned after popular stock market indices such as the Standard and Poor 500 Stock Index, the Dow Jones Industrial Average or the New York Stock Exchange Composite Index. Index funds embody the specific investment strategy of buying a share of the total stock market. An index fund simply buys exactly the same stocks in exactly the same proportions as their representation

TABLE II-9

MARKET SENSITIVITY OF MAFB EQUITY PORTFOLIO
VS. OTHER FUND CATEGORIES

	Market Sensitivity		
	Mean	Median	MAFB Percentile Rank
MAFB Equity Portfolio	1.03	–	–
Retirement Fund Equity Portfolios[1]	1.08	1.08	31
Bank Commingled Equity Funds[2]	0.93	0.95	70
Mutual Funds[3]	1.00	0.96	65

[1] *N = 100 retirement funds.*

[2] *N = 100 bank commingled equity funds. See Exhibit II-5.*

[3] *N = 100 mutual funds. See Exhibit II-6.*

Source: Merrill Lynch, Pierce, Fenner and Smith, Incorporated, April, 1977.

in the given index. Market indices have outperformed most managed funds over the past several years, initially creating great interest in index funds. Indeed, SBI manages the MAFB and other retirement fund stock portfolios by a modified indexing strategy, which accounts in part for their good performance in recent years. Recently, however, this excitement has dwindled as many managers again feel they can beat the indices. Research indicates that, in the long run, average managed stock fund performance does not exceed average stock market performance.

STOCKS VS. BONDS

The issue whether stocks or bonds are better investment media is frequently raised. Measured performance depends critically on the study period chosen. Throughout the recent history of the securities markets, from the 1920's until the late 1960's or early 1970's, stocks have significantly outperformed bonds. The rate of return on diversified stock investments through this period has averaged 9 to 11 percent. Many analysts thought that corporate bonds had reached an unsurpassable peak in the late 1960's when their yields rose to 5 percent. However, the unprecedented economic circumstances of the present decade reversed the situation drastically. From 1972 to 1974, bond returns dramatically out-paced those of equity investments. From 1974 to 1976, however, stocks substantially out-paced bonds. The lesson of these examples is that choosing a prospective investment strategy on the basis of historical performance patterns is difficult and tenuously reliable at best. Arguments over stocks versus bonds must be tempered by this knowledge.

TABLE II-10

EQUITY PORTFOLIO: COMPARISON WITH YARDSTICKS
OVER MARKET CYCLES
(Amounts in Millions)

Institutions	Annual Rates of Return on Investment (Dollar-weighted) Bear Market 12/72-12/74	Bull Market 12/74-12/76
Minnesota Adjustable Fixed Benefit Fund	–23.9%	27.2%
20 Bank Equity Yardsticks		
High	–9.4	28.7
Low	–29.6	12.4
Median	–22.7	22.4
Actual fund better than	6 of 20	15 of 20
20 Equity Investment Company Yardsticks		
High	–10.8	35.7
Low	–33.9	13.3
Median	–25.2	24.7
Actual fund better than	11 of 20	12 of 20
20 Insurance Company Equity Yardsticks		
High	–2.5	41.1
Low	–28.3	2.3
Median	–21.3	23.2
Actual fund better than	5 of 20	15 of 20
Total – 60 Yardsticks		
High	–2.5	41.1
Low	–33.9	2.3
Median	–22.6	22.8
Actual fund better than	22 of 60	42 of 60
Market Indices		
S&P 500 Composite Index	–21.2	29.0
Dow-Jones Industrial Average	–19.3	32.0
NYSE Composite Index	–22.5	30.4
Amount at end of period		
Actual Fund	$193.4	$379.2
Median – 60 Yardsticks	199.0	357.5
Difference from median	–5.6	+21.7

Source: Hamilton, Johnston and Company, Incorporated, April, 1977.

CHAPTER THREE
INVESTMENTS IN MINNESOTA SECURITIES

This chapter examines the extent of SBI's holdings in companies based in Minnesota, and the question whether it should increase its holdings in Minnesota companies in order to stimulate Minnesota's economy. The first section discusses the Investment Board's legal obligation to protect the financial interests of its pension plans' beneficiaries and participants. Constrained by this obligation, the issue becomes whether SBI can stimulate Minnesota's economy without hurting the performance of its funds.

The second part examines SBI's current holdings in Minnesota securities. Companies based in Minnesota are well represented in the Investment Board's portfolio. The third section discusses SBI's potential for expanding its holdings in Minnesota securities without jeopardizing the investment funds' performance. It concludes that there are few opportunities for additional investments in Minnesota based companies, particularly among small companies where investments might stimulate Minnesota's economy.

FIDUCIARY RESPONSIBILITY

Legal standards governing pension funds stress the investment manager's obligation to protect the financial interests of a pension plan's beneficiaries and participants. Moreover, this obligation is widely accepted within the investment community. This section addresses the issue whether the State Board of Investment can legally invest in qualifying Minnesota securities serving some public purpose other than that of the investment funds' beneficiaries and participants.

Both common law principles and SBI's enabling legislation indicate that investing in Minnesota companies for a public purpose is appropriate only if it does not harm the performance of the investment funds. Common law places the Board in a fiduciary capacity with respect to the beneficiaries of its funds. It is thus obligated to conduct its business solely in the best interests of the funds.

Furthermore, Minnesota Statutes codify SBI's fiduciary responsibility by stating:

> "the board shall invest funds over which it has supervision in securities authorized by law and may dispose of or convert such securities when in its judgment it is to the best interest of the funds so to do."[1]

The legislation also sets forth a prudent person standard for SBI, declaring that:

> "Any investments shall be made with the exercise of that degree of judgment and care, under circumstances then prevailing, which men of prudence, discretion, and intelligence exercise in the management of their own affairs . . . considering the probable safety of their capital as well as the probable income to be derived."[2]

The phrase "management of their own affairs" raises the presumption that, at best, investing to serve some public benefit can only be a secondary factor in making investment decisions. For example, in 1969 SBI was requested to purchase blocks of federally insured student loans in order to help Minnesota students obtain loans for attending college. Mr. Robert Blixt, Executive Secretary of the Board, in a communication to the Attorney General stated that: "It appears that we would be able to purchase such paper with no detriment to the state funds and with a possible advantage both to Minnesota students and to the lending institutions of Minnesota."

The legality of SBI's investing funds to serve some public purpose, when such investments may not be in the best interest of the funds beneficiaries, has not been tested in court. In view of the investment standards clearly established by the Minnesota Legislature, however, it is the opinion of the Program Evaluation Division's staff counsel that such a course of conduct by the Investment Board would not be upheld.

SBI'S CURRENT HOLDINGS IN MINNESOTA COMPANIES

This section compares Minnesota companies' representation in SBI's portfolio with the state's share of the nation's business activity. Further, it examines the performance of Minnesota stocks in SBI's portfolio and the impact of these investments on the state's economy.

Table III-1 presents the share of SBI's portfolio held in Minnesota companies for both stocks and bonds. Minnesota's 9.3 percent share of stocks and 12.5 percent share of bonds are well above the state's share of the nation's business activity. Part of this substantial representation can be explained by easier availability of information on Minnesota companies. The indexes of the nation's business activity presented in Table III-2 indicate that Minnesota's share of the national total is near two percent. These indexes were selected because they roughly correspond to the universe of companies that would meet SBI's requirements. The first index is based on total market value of stocks of companies listed on the New York Stock Exchange. The latter two indexes are based on Fortune magazine's list of largest firms and institutions for different business categories. The size of a company can be measured either by sales or assets. Sales is the appropriate measure for industrial, transportation, and retailing firms. Assets is the appropriate measure for commercial banks, diversified financial institutions, and utilities.

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[1] *M.S. Sec. 11.13.*

[2] *M.S. Sec. 11.16 (1).*

TABLE III-1

SHARE OF SBI'S PORTFOLIO HELD IN MINNESOTA SECURITIES

(In Millions of Dollars)

	Total	Minnesota Securities	Percent in Minnesota
Stocks (5/17/77)	1,055.3	98.1	9.3%
Bonds (5/12/77)	1,099.6	138.0	12.5%
Total	**2,154.9**	**236.1**	**11.0%**

TABLE III-2

MINNESOTA'S SHARE OF NATION'S BUSINESS ACTIVITY

Market Value of Stocks of Companies Listed on New York Stock Exchange, December 31, 1976

(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
858,299	14,340	1.7%

Sales of 500 Largest Industrials, 1976; 50 Largest Transportation, 1975; 50 Largest Retailing, 1975*

(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
1,025,437	20,821	2.0%

Assets of 50 Largest Institutions in Each of the Following Areas: Commercial Banking, Diversified Financial, Utilities, 1975*

(In Millions of Dollars)

Total	Minnesota Companies	Percent in Minnesota
1,144,236	22,500	2.0%

Fortune Magazine

PERFORMANCE OF MINNESOTA STOCKS

Minnesota stocks in SBI's portfolio have performed slightly better than the entire stock portfolio. Over the 5½ year period, January 1, 1971 through June 30, 1976, the time-weighted annual rate of return for Minnesota stocks in the MAFB fund was 4.46 percent.[3] The entire stock portfolio's comparable rate of return was 4.12 percent. However, this only indicates how Minnesota stocks performed in this period, not how they will perform in the future.

IMPACT ON MINNESOTA'S ECONOMY

It is unlikely that the SBI has a significant impact on Minnesota's economy since the Board's Minnesota investments are generally made in nationally recognized, secure enterprises. These enterprises would have little difficulty raising capital should the Investment Board elect not to purchase their securities. To have an impact on Minnesota's economy, SBI would have to invest in smaller companies in the state.

SBI also participates in federal government programs designed to stimulate small businesses and new communities (Jonathan, Cedar Riverside) in Minnesota and to provide mortgage money for the state. Table III-3 presents SBI's holdings of New Community Act Debentures and Small Business Association guaranteed loans in Minnesota, and GNMA mortgage backed securities purchased from institutions based in Minnesota. These projects and loans clearly stimulate Minnesota's economy. However, since the federal government has guaranteed these loans and bonds, these programs would have little difficulty raising capital should SBI choose not to be involved.

TABLE III-3
SBI'S GOVERNMENT BACKED SECURITIES IN MINNESOTA
(May 12, 1977)

	(In Millions of Dollars)	Percent of Total Bond Portfolio
SBA guaranteed loans	0.9	0.1%
New Community Act Debentures	0.5	0.5%
GNMA mortgage backed securities	48.5	4.4%
Total	**54.4**	**4.9%**

[3] *The rate of return for Minnesota stocks was calculated with the following formula:*

$$R = \frac{MVSTCKS2 - MVSTCKS1 + STKDIV - CONT}{MVSTCKS1 + .5STKDIV + .5\ CONT}$$

The comparable rate of return formula for the entire stock portfolio is RCS1 in Exhibit A-3 of Appendix A.

POTENTIAL FOR EXPANDING SBI'S HOLDINGS IN MINNESOTA SECURITIES

This section shows that substantially expanding SBI's holdings in Minnesota companies may not be desirable. This may also be inconsistent with SBI's legal obligation to protect the best interests of the funds' beneficiaries and participants. The Board can expand its holdings in Minnesota securities either by increasing the number of Minnesota companies in its portfolio or by concentrating its investments in Minnesota companies already represented in its portfolio. However, only the first alternative can realistically affect the state's economy since it would involve investing in smaller companies that may have difficulty raising capital.

Both alternatives have the following disadvantages:

1) They would reduce the geographic diversification of SBI's portfolio. Geographic diversification helps protect SBI from large losses that may result from a local recession. As shown in Table III-1, Minnesota companies' representation in SBI's portfolio is already large.

2) SBI may not be able to sell a Minnesota security at the most opportune time due to political pressure to keep the security.

Furthermore, concentrating investments in Minnesota companies already represented in the Board's portfolios would reduce diversification among different sectors of the economy and among different companies within each sector. The purpose of such diversification is to minimize the risk of large losses due to poor performance by particular economic sectors or individual companies. Thus, this alternative would neither significantly stimulate Minnesota's economy nor conform to accepted investment principles.

A number of legal criteria and investment management criteria limit further SBI investments in Minnesota companies. The next section supports this conclusion for stock investments, the following section for bonds.

STOCK INVESTMENTS

This section identifies legal and investment management criteria for common stock investments and applies them to Minnesota companies to determine SBI's potential for investing in these companies.

Legal Criteria

The enabling legislation of the State Board of Investment specifies that no investment can be made in the common stock of a corporation unless:

1) the corporation has at least $10,000,000 in assets;

2) the corporation has paid cash dividends for each of the past five years;

3) the aggregate earnings available for payment of dividends of the common stock during the last five years has been at least equal to the aggregate of the cash dividends for the same period.

4) A maximum of five percent of the assets in the account may be placed in equity investments, including fixed-income securities convertible into common stock, not conforming with these dividend and earnings standards so long as the corporation maintains the asset value indicated and evidences appropriate growth potential and probable earnings gain.[4]

[4] *M.S. 11.16(13).*

We examined abstracts of the financial records of all publicly held corporations based in Minnesota to determine which corporations met the first two criteria.[5] We were not able to determine compliance with the third criterion, but only in unusual cases would a company qualify under the first two criteria and fail the third. Of 282 Minnesota companies, 59 met the statutory requirements for common stock investments as of 1976.

Investment Criteria

SBI's internal investment management criteria relate to company size, growth and earnings potential, yield, and the quality of the company. The principle reason that SBI does not invest in more Minnesota companies is that most Minnesota companies are too small.

SBI prefers to invest in large corporations for the following reasons:

1) The stock of a large corporation has greater liquidity; that is, more stock can be sold quickly without affecting the market price. Liquidity is important in case SBI recognizes a stock has become a poor risk and desires to sell its entire holding in that stock before the price drops sharply. A stock must be highly liquid for SBI to easily execute the large volume transactions necessitated by its large funds. Currently, SBI has over one billion dollars invested in its stock portfolio of nearly 150 companies, an average investment of about 6.7 million dollars per company. Investments are this large so that the portfolio may contain a manageable number of companies.

2) Large companies are more thoroughly covered by investment research organizations. SBI performs only limited direct investment research, and relies on other research organizations to provide the necessary investment information.

3) Large corporations are typically traded on national exchanges. Very small corporations (those with less than $10 million in assets) have primarily local trading markets, which lack the confidentiality of trading that is found on national exchanges. As a result, SBI's decision to buy or sell a stock may adversely influence its price.

Accordingly, the Legislature and SBI have established the following minimum size criteria for its stock investments.

1) SBI's share of a company's outstanding stock:

   The statutes limit the amount of a company's outstanding stock that may be held by SBI to a maximum of five percent.[6] This makes it easier for SBI to buy or sell a stock without affecting the price of the stock.

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[5] *Bill Dorn Associates, Corporate Fact Book: Directory of Publicly Held Corporations in the 9th Federal Reserve District, 1976, Minneapolis, Minnesota.*

Moody's Investors Service, Inc., Moody's Industrial Manual, Moody's Transportation Manual, Moody's Public Utility Manual, Moody's Bank and Finance Manual, 1976, N.Y., N.Y.

[6] *M.S. Sec. 11.16 (13).*

2) Market capitalization:

A corporation should have a market capitalization of at least 250 million dollars in order for SBI to invest in the corporation. This standard is consistent with the first criterion. To make the average investment of 6.7 million dollars without exceeding the five percent restriction means that SBI can only invest in corporations which have a market capitalization of at least 134 million dollars. Since SBI's portfolio will continue to grow, the size of SBI's investments will also grow, making the $250 million minimum appear reasonable.

3) Trading volume:

A company should have an average trading volume of at least 8,000 shares per day.

These criteria are consistent with those used for a comparable fund managed by Investors Diversified Services (IDS). Both SBI's total fund and the IDS Mutual Fund have about one billion dollars invested in stocks and one billion dollars in bonds. The criteria for both funds are compared in Exhibit III-1.

EXHIBIT III-1
COMPARISON OF CRITERIA USED BY SBI AND IDS

	SBI Funds	IDS Mutual Fund
minimum market capitalization	$250 million	$200 million
maximum share of companies outstanding stock	5%	5%
minimum trading volume	8,000 shares per day = $4.4 million per month at $25 per share	enough to acquire or sell a $6 million holding in a reasonable time without accounting for more than one-half of the amount traded. Using two months as a time standard, the trading volume should be $6 million per month.

The size criteria are not absolute. SBI may choose to invest in a company that does not meet the size standards if the company is very strong on the other criteria. This occurs infrequently, however, as over 97 percent of the companies in SBI's portfolio meet the market capitalization standard.

Applying these size standards to Minnesota companies reveals that there is little opportunity to invest in more Minnesota companies. Out of the 59 Minnesota companies that legally qualify for common stock investments, only 14 meet SBI's market capitalization and trading volume standards. Three more companies meet one of the two standards. Currently, SBI holds stock in twelve of the fourteen companies that meet the size standards. We did not systematically examine the merits of investing in the other two companies, but since size is only one of a number of investment factors, it is not necessarily reasonable for SBI to invest in all fourteen companies. The two companies that are not held by SBI only marginally exceed the size standards and SBI gives higher investment ratings to other companies in their market categories.

While a limited number of companies that do not meet the size standards may be suitable for investments, more investments in such Minnesota companies by SBI do not appear warranted. SBI holds stock in only five companies which do not meet the market capitalization standard. Three of these companies are based in Minnesota — Medtronic, Northwestern National Life, and Minnesota Power and

Light. Although Medtronic has not paid dividends, the Investment Board purchased its stock on the basis of future growth prospects. The statutes allow up to five percent of SBI's assets to be invested in companies that do not meet the dividend or earnings standards specified in the legislation. SBI invested in Northwestern National Life and Minnesota Power and Light because they were rated very high quality, secure companies. It is possible that there are a few Minnesota "growth" stocks, investments in which would provide excellent return and also stimulate the state's economy.

BOND INVESTMENTS

This section identifies legal criteria and investment criteria for bond investments and applies them to Minnesota companies to determine SBI's potential for investing in these companies.

The enabling legislation of SBI specifies that it cannot purchase the bonds of a corporation unless:[7]

1) the corporation has at least ten million dollars in assets;

2) the book value of the corporation's outstanding capital stock equals at least 50 percent of its total funded debt, or the corporation is owned by another corporation which guarantees the debt and meets this requirement (for independent finance corporations the standard is 25 percent instead of 50 percent);

3) the net pretax earnings of the corporation, or of a corporation guaranteeing the debt, equals at least 1.5 times the annual interest charges on the total funded debt for each of the past five years;

4) the corporation's average annual gross operating revenue for the past five years exceeds one million dollars;

5) the bond must be rated among the top third of the quality categories by a nationally recognized rating agency (for Moody's, this means a rating of A or above).

We examined abstracts of the financial records of all publicly held corporations based in Minnesota to determine which corporations meet these criteria.[8] Out of 282 Minnesota companies, 14 have issued publicly placed bond obligations that meet the legal requirements.

The actual number of companies that legally qualify could be higher because we have little data on privately placed bond issues. Out of 77 companies that meet the first four criteria, 56 companies were not rated by Moody's or a similar rating firm in public documents since they had not sold publicly placed bonds. While some of these companies may have sold privately placed bonds, few would likely have been rated A or above by Moody's because most of these companies are too small. Companies that are rated A or above are almost always large in size. The main exceptions are utilities and railroads, which are typically rated highly even when they are small.

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[7] *M.S. Sec. 11.16(12).*

[8] *Op. Cit. Bill Dorn Associates, and Moody's Investors Service Inc.*

Table III-4 gives Moody's ratings and market capitalization for all companies that meet the first four legal requirements for bond investments. The two railroads and four utilities are all rated A or above. All of the other companies that have sold bonds publicly and have market capitalization of over $400 million are rated A or above. The only other A rated company has a market capitalization of $125 million. Since the companies that have not sold bonds publicly are concentrated in the small size category, few would likely be rated A or above by Moody's.

TABLE III-4

MOODY'S RATINGS BY TYPE OF COMPANY AND MARKET CAPITALIZATION FOR COMPANIES MEETING FIRST FOUR LEGAL REQUIREMENTS

		Market Capitalization — All Other Companies		
Moody's Rating	Railroads and Utilities	Over $400 Million	$100 Million — $400 Million	Under $100 Million
A	6	7	1	0
B	0	0	3	3
C	0	0	0	0
No public bond sale	0	2	5	49

SBI has bond investments in eight of the fourteen known legally qualified companies. Reasons for not investing in more of these qualifying companies include the following:

1) Low yield.

2) Bonds are offered infrequently: Pillsbury and Dayton-Hudson have not sold bonds publicly since 1970.

3) A bond sale may be held when SBI does not have funds available for new investments.

4) A bond sale may occur when the market for bonds offers low interest rates. Stock investments and short term investments may be better alternatives.

5) Security of the company.

6) Marketability: The bond sale should be large enough so that SBI can easily sell its portion of the issue in the future. SBI prefers to make investments large enough to keep its portfolio manageable. At the same time, it does not want to acquire too large a proportion of a bond issue because this may make it harder to sell.

7) Diversification: SBI may avoid investing in companies whose business category is already heavily represented in its portfolio.

APPENDIX A
TIME-WEIGHTED RATE OF RETURN FORMULAS

The following exhibits provide detailed mathematical expressions of the time-weighted rate of return formulas reported herein. The reader should recall that the annual average rate is computed by chaining all the periodic rates (r_i) together via the formula below and extracting the proper root. The example below assumes that the periodic rates are calculated quarterly.

$$R = \sqrt[\frac{n}{4}]{\prod_{i=1}^{n} (1+r_i)} - 1$$

where:

R = the time-weighted average compound rate of return over n periods;

n = the number of quarters;

r_i = the rate of return in period i; and

$\prod_{i=1}^{n} (1+r_i)$ = the cumulative product of $(1+r_i)$ over n periods, i.e., the final result of $(1+r_i) \times (1+r_2) \times (1+r_3) \times \ldots \times (1+r_i) \times \ldots \times (1+r_n)$

EXHIBIT A-1
RATE OF RETURN FORMULAS FOR TOTAL FUNDS

$$R1 = \frac{MV2 - MV1 - CONT}{MV1 + .5CONT + .5CASHINC}$$

$$R2 = \frac{MV2 - MV1 - CONT}{MV1 + .5CONT}$$

$$R3 = \frac{MV2 - MV1 - CONT}{.5\,(MV1 + MV2)}$$

$$R4 = \frac{CASHINC}{.5\,(BV1 + BV2)}$$

$$R5 = \frac{CASHINC}{.5\,(MV1 + MV2)}$$

EXHIBIT A-2

RATE OF RETURN FORMULAS FOR COMMON STOCK PORTFOLIOS

$$RB1B = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5BONDINT - MVBNDS1 - (BNDPCNT1 \times CASH1) - .5\,STKDIV - (BNDPCNT2 \times STGAIN) - .5\,CONT}{MVBNDS1 + .25\,CONT + .5\,BONDINT + (BNDPCNT1 \times CASH1)}$$

$$RB2 = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5\,BONDINT + (BNDPCNT2 \times MVSHTMS2) - MVBNDS1 - (BNDPCNT1 \times CASH1) - (BNDPCNT1 \times MVSHTMS1) - .5\,STKDIV - .5CONT}{MVBNDS1 + .25\,CONT + (BNDPCNT1 \times CASH1) + (BNDPCNT1 \times MVSHTMS1) + .5BONDINT + (BNDPCNT2 \times STGAIN)}$$

$$RB3 = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5BONDINT - MVBNDS1 - (BNDPCNT1 \times CASH1) - .5STKDIV - (BNDPCNT2 \times STGAIN) - .5CONT}{MVBNDS1 + .25CONT + (BNDPCNT1 \times CASH1)}$$

$$RB4 = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5BONDINT + (BNDPCNT2 \times MVSHTMS2) - MVBNDS1 - (BNDPCNT1 \times CASH1) - BNDPCNT1 \times MVSHTMS1) - .5STKDIV - .5CONT}{MVBNDS1 + .25CONT + (BNDPCNT1 \times CASH1) + (BNDPCNT1 \times MVSHTMS1)}$$

$$RB5 = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5BONDINT - MVBNDS1 - (BNDPCNT1 \times CASH1) - .5STKDIV - (BNDPCNT2 \times STGAIN) - .5CONT}{.5[MVBNDS1 + MVBNDS2 + (BNDPCNT1 \times CASH1) + (BNDPCNT2 \times CASH2)]}$$

$$RB6 = \frac{MVBNDS2 + (BNDPCNT2 \times CASH2) + .5BONDINT + (BNDPCNT2 \times MVSHTMS2) - MVBNDS1 - (BNDPCNT1 \times CASH1) - (BNDPCNT1 \times MVSHTMS1) - .5STKDIV - .5CONT}{.5[MVBNDS1 + MVBNDS2 + (BNDPCNT2 \times CASH2) + (BNDPCNT1 \times CASH1) + (BNDPCNT2 \times MVSHTMS2) + (BNDPCNT1 \times MVSHTMS1)]}$$

$$RB7 = \frac{BONDINT}{.5[MVBNDS1 + MVBNDS2 + (BNDPCNT1 \times CASH1) + (BNDPCNT2 \times CASH2)]}$$

$$RB8 = \frac{BONDINT + (BNDPCNT2 \times STGAIN)}{.5[MVBNDS1 + MVBNDS2 + (BNDPCNT1 \times CASH1) + (BNDPCNT2 \times CASH2) + (BNDPCNT2 \times MVSHTMS2) + (BNDPCNT1 \times MVSHTMS1)]}$$

$$RB9 = \frac{BONDINT}{.5[BVBNDS1 + BVBNDS2 + (BNDPCNT2 \times CASH2) + (BNDPCNT1 \times CASH1)]}$$

$$RB10 = \frac{BONDINT + (BNDPCNT2 \times STGAIN)}{.5[BVBNDS1 + BVBNDS2 + (BNDPCNT1 \times CASHEQ1) + (BNDPCNT2 \times CASHEQ2)]}$$

Note: For the MAFB calculations, short term securities and short term income were assumed to be divided equally between the bond and stock portfolios. That is to say, BNDPCNT = STKPCNT = .5.

EXHIBIT A-3

RATE OF RETURN FORMULAS FOR COMMON STOCK PORTFOLIOS

$$RCS1 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT2 \times STGAIN) - .5CONT}{MVSTCKS1 + .25CONT + .5STKDIV + (STKPCNT1 \times CASH1)}$$

$$RCS2 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV + (STKPCNT2 \times MVSHTMS2) - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT1 \times MVSHTMS1) - .5CONT}{MVSTCKS2 + .25CONT + .5STKDIV + (STKPCNT1 \times CASH1) + (STKPCNT1 \times MVSHTMS1 + (STKPCNT2 \times STGAIN)}$$

$$RCS3 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT2 \times STGAIN) - .5CONT}{MVSTCKS1 + .25CONT + (STKPCNT1 \times CASH1)}$$

$$RCS4 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV + (STKPCNT2 \times MVSHTMS2) - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT1 \times MVSHTMS1) - .5CONT}{MVSTCKS1 + .25CONT + (STKPCNT1 \times CASH1) + (STKPCNT1 \times MVSHTMS1)}$$

$$RCS5 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT2 \times STGAIN) - .5CONT}{.5[MVSTCKS1 + MVSTCKS2 + (STKPCNT1 \times CASH1) + (STKPCNT2 \times CASH2)}$$

$$RCS6 = \frac{MVSTCKS2 + (STKPCNT2 \times CASH2) + .5STKDIV + (STKPCNT2 \times MVSHTMS2) - MVSTCKS1 - (STKPCNT1 \times CASH1) - .5BONDINT - (STKPCNT1 \times MVSHTMS1) - .5CONT}{.5[MVSTCKS1 + MVSTCKS2 + (STKPCNT1 \times CASH1) + (STKPCNT2 \times CASH2) + (STKPCNT1 \times MVSHTMS1) + (STKPCNT2 \times MVSHTMS2)]}$$

$$RCS7 = \frac{STKDIV}{.5[MVSTCKS1 + MVSTCKS2 + (STKPCNT1 \times CASH1) + (STKPCNT2 \times CASH2)]}$$

$$RCS8 = \frac{STKDIV + (STKPCNT2 \times STGAIN)}{.5[MVSTCKS1 + MVSTCKS2 + (STKPCNT1 \times CASH1) + STKPCNT2 \times CASH2)] + (STKPCNT1 \times MVSHTMS1) + (STKPCNT2 \times MVSHTMS2)]}$$

$$RCS9 = \frac{STKDIV}{.5[BVSTCKS1 + BVSTCKS2 + (STKPCNT1 \times CASH1) + (STKPCNT2 \times CASH2)]}$$

$$RCS10 = \frac{STKDIV + (STKPCNT2 \times STGAIN)}{.5[BVSTCKS1 + BVSTCKS2 + (STKPCNT1 \times CASHEQ1) + STKPCNT2 \times CASHEQ2)]}$$

Note: For the MAFB calculations, short term securities and short term income were assumed to be divided equally between the stock and bond portfolios. That is to say, BNDPCNT = STKPCNT = .5.

EXHIBIT A-4
KEY TO VARIABLE NAMES IN RATE OF RETURN FORMULAS

R1 – R5	– Rate of return formulas for total funds.
RB1 – RB10	– Rate of return formulas for bond portfolios.
RCS1 – RCS10	– Rate of return formulas for common stock portfolios.
MV2	– Market value of the total fund at the end of a given period.
MV1	– Market value of the total fund at the beginning of a given period (at the end of the previous period).
CONT	– Net contributions to the total fund during a given period.
CASHINC	– Total cash income for the fund during the period.
BV2	– Book value of the total fund at the end of a given period.
BV1	– Book value of the total fund at the beginning of the period.
MVBNDS2	– Market value of bonds at the end of a given period.
MVBNDS1	– Market value of bonds at the beginning of the period (at the end of the preceding period).
BVBNDS2	– Book value of bonds at the end of a given period.
BVBNDS1	– Book value of bonds at the end of a given period.
MVSTCKS2	– Market value of common stocks at the end of a given period.
MVSTCKS1	– Market value of common stocks at the beginning of the period.
BVSTCKS2	– Book value of common stocks at the end of a given period.
BVSTCKS1	– Book value of common stocks at the beginning of the period.
MVSHTMS2	– Market value of short term securities at the end of a given period.
MVSHTMS1	– Market value of short term securities at the beginning of the period (at the end of the previous period).
BVSHTMS2	– Book value of short term securities at the end of a given period.
BVSHTMS1	– Book value of short term securities at the beginning of the period.
CASH2	– Cash balance of the fund at the end of a given period.
CASH1	– Cash balance of the fund at the beginning of the period.
CASHEQ2	– Cash equivalents at the end of a given period, defined as the sum of CASH2 plus BVSHTMS2.

CASHEQ1 — Cash equivalents at the beginning of a given period, CASH1 plus BVSHTMS1.

BNDPCNT2 — The percentage of cash and short term securities (i.e., cash equivalents) attributable to the bond portfolio at the end of a given period; technically defined as:

$$\frac{(.5BV2 - BVBNDS2)}{CASHEQ2}$$

BNDPCNT1 — The percentage of cash equivalents attributable to the bond portfolio at the beginning of the period.

STKPCNT2 — The percentage of cash equivalents attributable to the common stock portfolio at the end of a given period; technically defined as:

$$\frac{(.5BV2 - BVSTCKS2)}{CASHEQ2}$$

STKPCNT1 — The percentage of cash equivalents attributable to the common stock portfolio at the beginning of the period.

BONDINT — Bond interest received during a given period.

STKDIV — Dividends on common stocks received during a given period.

STGAIN — Total income (or gain) from short term securities received during a given period.

APPENDIX B

COMPARISON FUNDS USED FOR INVESTMENT PERFORMANCE ANALYSES

EXHIBIT B-1
BANK COMMINGLED EQUITY FUNDS

American Fletcher National Bank and Trust Co. (Indianapolis)
American National Bank and Trust Co. of Chicago
Austin National Bank
Bank of America (San Francisco)
Bank of California (San Francisco)
Bank of Lansing
Bishop Trust Co. Ltd. (Honolulu)
Boston Safe Deposit and Trust Co.
Central National Bank of Cleveland
Central Trust Co. (Cincinnati)
Chemical Bank (New York City)
Citibank (New York City)
Citizens and Southern National Bank (Savannah)
Citizens Fidelity Band and Trust Co. (Louisville)
City National Bank of Connecticut (Bridgeport)
Cleveland Trust Co.
Colorado National Bank of Denver
Commerce Bank of Kansas City
Commercial National Bank of Peoria
Connecticut Bank and Trust Co. (Hartford)
Continental Illinois National Bank and Trust Company of Chicago
Continental Bank (Norristown)
Crocker National Bank (San Francisco)
Detroit Bank and Trust
Equitable Trust Co. (Baltimore)
The Fidelity Bank (Philadelphia)
Fidelity Union Trust Co. (Newark)
Fifth Third Bank (Cincinnati)
First City National Bank of Houston
First Hutchings Sealy National Bank (Galveston)
First International Bank of Houston
First Kentucky Trust Co. (Louisville)
First National Bank and Trust Co. of Fargo
The First National Bank and Trust Co. of Tulsa
First National Bank in Albuquerque
First National Bank in Dallas
First National Bank in St. Petersburg
First National Bank of Aberdeen
First National Bank of Boston
First National Bank of Chicago
First National Bank of Denver
First National Bank of Kansas City
First National Bank of Minneapolis
First National Bank of Neenah
First National Bank of South Carolina (Columbia)
First National Exchange Bank (Roanoke)
First Union National Bank of North Carolina (Charlotte)
Hartford National Bank and Trust Co.
Harvard Trust Co. (Cambridge)
Hawaiian Trust Co. Ltd. (Honolulu)
Heritage Trust Co. (Milwaukee)
Industrial National Bank of Rhode Island (Providence)
Iowa-Des Moines National Bank
Lloyds Bank California (Los Angeles)
The Louisville Trust Co.
Manufacturers Hanover Trust Co. (New York City)
Marine Midland Bank — Western (Buffalo)
Marine Midland Bank — New York City
Marine National Exchange Bank (Milwaukee)
Maryland National Bank (Baltimore)
Mercantile Safe Deposit and Trust Co. (Baltimore)
Mercantile Trust Co. (St. Louis)
Merchant National Bank (Cedar Rapids)
Midlantic National Bank (Newark)
Moline National Bank
National Bank of Detroit
National Bank of Washington (Washington,D.C.)
National City Bank (Cleveland)
The National City Bank of Evansville
National City Bank of Minneapolis
New England Merchants National Bank (Boston)
North Carolina National Bank (Charlotte)
Northern Trust Bank (Chicago)
Northwestern Bank and Union Trust Co. (Helena)
Northwestern National Bank of Minneapolis
Omaha National Bank
Pacific National Bank of Washington (Seattle)
Pittsburgh National Bank
Republic National Bank of Dallas
Rhode Island Hospital Trust National Bank (Providence)
St. Louis Union Trust Co.
Seattle-First National Bank
Security Trust Co. of Rochester
Shawmut Bank of Boston
Southeast First National Bank of Miami
Texas Commerce Bank (Houston)
Third National Bank in Nashville
Title Insurance and Trust Co. (Los Angeles)
Trust Co. Bank (Atlanta)
Union Bank (Los Angeles)
United Bank of Denver
United Jersey Bank (Hackensack)
The United States National Bank of Omaha
United States Trust Co. of New York City
United Virginia Bank (Richmond)
Valley National Bank (Phoenix)
Wachovia Bank and Trust Co. (Winston-Salem)
Wells Fargo Bank (San Francisco)
Winters National Bank and Trust Co. (Dayton)
Worcester County National Bank (Worcester)

EXHIBIT B-2
MUTUAL FUNDS

Aetna Fund
Affiliated Fund
Allstate Enterprises Fund
American Growth Fund
American Investors Fund
American Mutual Fund
Anchor Growth Fund
Axe-Houghton Stock Fund
David L. Babson Investment Fund
Broad Street Investing Corp.
Bullock Fund
C. G. Fund
Centennial Common Stock Fund
Chase Fund of Boston
Chemical Fund
Colonial Fund
Colonial Growth Shares
Composite Fund
Corporate Leaders Trust – Series B
De Vegh Mutual Fund
Delaware Fund
Dividend Shares
Dodge and Cox Stock Fund
Drexel Burnham Fund
Dreyfus Fund
Eaton and HOward Growth Fund
Eaton and Howard Stock Fund
Edie Special Growth Fund
Energy Fund
Enterprise Fund
Explorer Fund
Farm Bureau Mutual Fund
Fidelity Capital Fund
Fidelity Fund
Financial Industrial Fund
First Investors Fund
Founders Mutual Fund
Foursquare Fund
Franklin Custodian-Growth Series
Fundamental Investors
Growth Industry Shares
Guardian Mutual Fund
Hamilton Growth Fund
John Hancock Growth Fund
IDS New Dimensions Fund
Imperial Capital Fund
Investment Company of America
Investment Trust of Boston
Investors Stock Fund
Istel Fund
Ivest Fund
Johnston Mutual Fund
Keystone (K-2) Growth Common
Keystone (S-1) High-Grade Common
Keystone (S-2) Income Common
Keystone (S-3) Growth Common
Keystone (S-4) Lower-Priced Common
Loomis-Sayles Capital Development Fund
Manhattan Fund
Horace Mann Fund
Massachusetts Investors Growth Stock Fund
Massachusetts Investors Trust
Mathers Fund
W.L. Morgan Growth Fund
Mutual Investing Foundation-MIF Fund
Mutual Investing Foundation-MIF Growth Fund
Mutual of Omaha Growth Fund
National Investors Corporation
National Securities-Growth Stock Series
National Securities-Stock Series
New York Venture Fund
Newton Investors Fund
One William Street Fund
Oppenheimer Fund
Over-The-Counter Securities Fund
Pine Street Fund
Pioneer Fund
T. Rowe Price Growth Stock Fund
Bowe Price New Horizons Fund
Putnam Growth Fund
Putnam Investors Fund
Safeco Equity Fund
Scudder, Stevens and Clark Common Stock Fund
Selected American Shares
Sentry Fund
Shareholders' Trust of Boston
Sigma Investment Shares
Smith, Barney Equity Fund
Southwestern Investors
State Farm Growth Fund
State Street Investment Corporation
Steadman Investment Fund
Stein Roe and Farnham Stock Fund
Technology Fund
Travelers Equity Fund
United Accumulative Fund
United Income Fund
Vance, Sanders Common Stock Fund
Washington Mutual Investors Fund
Windsor Fund

EXHIBIT B-3
BANK COMMINGLED BOND FUNDS

American Fletcher National Bank (Indianapolis)
American National Bank and Trust Co. of Chicago
Austin National Bank
Bank of America (San Francisco)
Bank of California (San Francisco)
Bank of Delaware (Wilmington)
Bank of Lansing
Boston Safe Deposit and Trust Co.
Capital National Bank in Austin
Central National Bank of Cleveland
Chemical Bank (New York City)
Citibank (New York City)
Citizens Fidelity Bank and Trust Co. (Louisville)
Cleveland Trust Co.
Colorado National Bank of Denver
Commerce Bank of Kansas City
Commercial National Bank of Peoria
Continental Bank of Morristown
Continental Illinois National Bank and Trust Co. of Chicago
Crocker National Bank (San Francisco)
Detroit Bank and Trust
Equitable Trust Co. (Baltimore)
The Fidelity Bank (Philadelphia)
Fidelity Union Trust Co. (Newark)
Fifth Third Bank (Cincinnati)
First International Bank of Houston
First Kentucky Trust Co. (Louisville)
First National Bank in Albuquerque
First National Bank in Dallas
First National Bank in St. Petersburg
First National Bank of Boston
First National Bank of Chicago
First National Bank of Dayton
First National Bank of Mansfield
First National Bank of Minneapolis
First National Bank of Mobile
First National Bank of Neenah
First National Bank of South Carolina (Columbia)
First National Exchange Bank (Roanoke)
First Pennsylvania Bank (Philadelphia)
First Union National Bank of North Carolina
Hartford National Bank and Trust Co.
Harvard Trust Company (Cambridge)
Hawaiian Trust Co., Ltd. (Honolulu)
Industrial National Bank of Rhode Island (Providence)
Kanawha Valley Bank (Charleston)
Lloyds Bank in California (Los Angeles)
The Louisville Trust Co.
Manufacturers Hanover Trust Co. (New York City)
Manufacturers National Bank of Detroit
Marine Midland Bank – Western (Buffalo)
Marine Midland Bank – New York City
Marine National Exchange Bank (Milwaukee)
Maryland National Bank (Baltimore)
Mercantile National Bank of Dallas
Mercantile Safe Deposit and Trust Co. (Baltimore)
Mercantile Trust Co. (St. Louis)
Merchants National Bank (Cedar Rapids)
Midland National Bank of Milwaukee
Midland National Bank of Minneapolis
Midlantic National Bank (Newark)
Moline National Bank
National Bank of Detroit
National Bank of Washington (Washington, D.C.)
National City Bank (Cleveland)
The National City Bank of Evansville
National City Bank of Minneapolis
New England Merchants National Bank (Boston)
Norfolk County Trust Co.
North Carolina National Bank (Charlotte)
Northern Trust Bank (Chicago)
Northwestern Bank and Union Trust Co. (Helena)
Northwestern National Bank (Minneapolis)
Northwestern National Bank (St. Paul)
Old National Bank (Spokane)
Old Stone Bank (Providence)
Omaha National Bank
Pacific National Bank of Washington (Seattle)
Pittsburgh National Bank
Republic National Bank of Dallas
St. Louis Union Trust Co.
Shawmut Bank of Boston
Southeast First National Bank of Miami
Texas Commerce Bank (Houston)
Title Insurance and Trust Co. (Los Angeles)
Trust Co. Bank (Atlanta)
Union Commerce Bank of Cleveland
Union Planters National Bank (Memphis)
Union Trust Co. (New Haven)
United Bank of Denver
United Jersey Bank (Hackensack)
The United States National Bank of Omaha
United States Trust Co. of New York City
United Virginia Bank (Richmond)
Virginia National Bank (Norfolk)
Wachovia Bank and Trust Co. (Winston-Salem)
Wells Fargo Bank (San Francisco)
Wilmington Trust Co.
Winters National Bank and Trust Co. (Dayton)
Worcester County National Bank

EXHIBIT B-4

BANKS MANAGING HAMILTON, JOHNSTON AND COMPANY BANK EQUITY YARDSTICK FUNDS, MARCH, 1977

American Fletcher National Bank and Trust Co.
American National Bank and Trust Co. of Chicago
American National Bank and Trust Co.
American Securities Investors Trust Co.
Bank of America
Bank of California
Bank of New York
Bank of Virginia
Bankers Trust Company
Central National Bank of Cleveland
Central Trust Co. of Cincinnati
Chase Manhattan National Bank
Chemical Bank (New York City)
Cleveland Trust Co.
Colorado National Bank of Denver
Connecticut Bank and Trust Co.
Continental Illinois National Bank and Trust Co.
Crocker National Bank
Fifth Third Bank (Cincinnati)
First Kentucky Trust Co.
First National Bank of Chicago
First National Bank in Dallas
First National Bank of Denver
First National Bank of Minneapolis
First Pennsylvania Bank
First Wisconsin Trust Co.
Girard Trust Co.
Harris Trust Co.
Hartford National Bank and Trust Co.
Irving Trust Co.
La Salle National Bank
Louisville Trust Co.
Manufacturers Hanover Trust Co.
Marine Midland Bank
Marine National Exchange Bank
Mellon Bank
Midlantic National Bank
Morgan Guaranty Trust Co. of New York
National Bank of Cleveland
National Bank of Detroit
National Shawmut Bank of Boston
New England Merchants National Bank (Boston)
North Carolina National Bank
Northern Trust Co.
Northwestern National Bank of Minnesota
Old Colony Trust (First National Bank of Boston)
Peoples National Bank of Washington
Philadelphia National Bank
Pittsburgh National Bank
Provident National Bank
Rainier National Bank
Republic National Bank of Dallas
Rhode Island Hospital Trust National Bank
Texas Commerce Bank
Trust Company of Georgia
Union Bank of California
Union Commerce Bank
United California Bank
United States Trust Co. of New York City
Wachovia Bank and Trust Co.
Wells Fargo Bank
Winters National Bank and Trust Co.
Wilmington Trust Co.

Total: 63

EXHIBIT B-5

HAMILTON, JOHNSTON AND COMPANY: INVESTMENT COMPANY EQUITY YARDSTICK FUNDS (MUTUAL FUNDS), 1977

I. Growth and Income Funds

Affiliated Fund, Incorporated*
Broad Street Investing Corporation*
Bullock Fund, Ltd.*
Dividend Shares, Incorporated
Eaton and Howard Stock Fund*
Fidelity Fund, Incorporated
Financial Industrial Fund, Incorporated
Fundamental Investors, Incorporated*
Investment Company of America*
Investors Stock Fund, Incorporated
Massachusetts Investors Trust*
One William Street Fund*
State Street Investment Corporation*

II. Long-Term Capital Growth Funds

Anchor Growth Fund, Incorporated*
Dreyfus Fund, Incorporated*
Fidelity Trend Fund, Incorporated*
Johnston Mutual Fund, Incorporated*
Keystone K-2 Growth Common Stock Fund*
National Securities Fund-Growth Stock Series*
Putnam Growth Fund
Salem Fund, Incorporated
Scudder, Stevens and Clark Common Stock Fund, Incorporated*
Stein Roe and Farnham Stock Fund, Incorporated
T. Rove Price Growth Stock Fund, Incorporated*
Value Line Fund, Incorporated

III. Maximum Capital Gains Funds

Chase Fund of Boston*
Mathers Fund, Incorporated
Oppenheimer Fund, Incorporated*
Research Equity Fund, Incorporated*

Total: 29

EXHIBIT B-6

HAMILTON, JOHNSTON AND COMPANY: INSURANCE COMPANY EQUITY YARDSTICK FUNDS APRIL, 1977

Aetna Life Insurance Co.
American Fidelity Insurance Co.
Bankers Life Insurance Co. of Nebraska
BLC Equity Service Corporation
California – Western States Life Insurance Co.
Connecticut General Insurance Corporation
Equitable Life Assurance Co.
Franklin Life Insurance Co.
General American Life Insurance Co.
Guardian Life Insurance Co. of America
John Hancock Mutual Life Insurance Co.
Massachusetts Mutual Life Insurance Co.
Metropolitan Life Insurance Co.
Mutual Benefit Life Insurance Co.
Mutual Life Insurance Co. of New York
National Insurance Agency, Incorporated of South Bend
New England Mutual Life Insurance Co.
Northwestern Mutual Life Insurance Co.
Occidental Life Insurance Co.
Pacific Mutual Life Insurance Co.
Paul Revere Variable Annuity
Phoenix Mutual Life Insurance Co.
Provident Mutual Life Insurance Co. of Philadelphia
Prudential Variable Account
Shenandoah Life Insurance Co.
Sun Life Assurance Co. of Canada
Travelers Insurance Co.
Travelers Insurance Co. "B" Account
Union Central Life Insurance Co.
Variable Annuity Life Insurance Co.
Voyager Life Insurance Co.

Total: 31

EXHIBIT B-7

BANKS MANAGING HAMILTON, JOHNSTON AND COMPANY BANK FIXED INCOME YARDSTICK FUNDS, MARCH, 1977

American Fletcher National Bank and Trust Co.
American National Bank and Trust Co. of Chicago
American National Bank and Trust Co.
American Securities Investors Trust Co.
Bank of America
Bank of California
Bank of New York
Bankers Trust Co.
Central National Bank of Cleveland
Central Trust Co. of Cincinnati
Chase Manhattan National Bank
Chemical Bank (New York City)
Cleveland Trust Co.
Colorado National Bank of Denver
Continental Illinois National Bank and Trust Co.
Crocker National Bank
Equitable Trust Co.
Fifth Third Bank (Cincinnati)
First Kentucky Trust Co.
First National Bank of Chicago
First National Bank in Dallas
First National Bank of Denver
First National Bank of Minneapolis
First Pennsylvania Bank
First Wisconsin Trust Co.
Harris Trust Co.
Irving Trust Co.
La Salle National Bank
Louisville Trust Co.
Manufacturers Hanover Trust Co.
Marine Midland Bank
Marine National Exchange Bank (Milwaukee)
Mellon Bank
Midlantic National Bank
Morgan Guaranty Trust Co. of New York
National Bank of Cleveland
National Bank of Detroit
National Shaw
New England Merchants National Bank
North Carolina National Bank
Northern Trust Co.
Northwestern National Bank of Minnesota
Old Colony Trust (First National Bank of Boston)
Peoples National Bank of Washington
Philadelphia National Bank
Pittsburgh National Bank
Provident National Bank
Rainier National Bank
Republic National Bank of Dallas
Rhode Island Hospital Trust National Bank
Texas Commerce Bank
Trust Co. of Georgia
Union Bank of California
Union Commerce Bank
United California Bank
United States Trust Co. of New York City
Wachovia Bank and Trust Co.
Wells Fargo Bank
Winters National Bank and Trust Co.
Wilmington Trust Co.

Total: 60

EXHIBIT B-8

STANDARD VALUATIONS COMPARISON FUNDS FOR TOTAL MAFB FUND

A. Chemical Bank of New York: Pooled Fund for Employee Benefit Plan, 50% of Equity/50% Fixed Income.

B. Continental Illinois National Bank and Trust Company of Chicago: Pooled Fund for Employee Benefit Plan, 50% Equity/50% Fixed Income.

C. First National Bank of Minneapolis: Pooled Fund for Employee Benefit Plan, 50% Equity/50% Fixed Income.

D. Harris Trust of Chicago: Pooled Fund for Employee Benefit Plan, 50% Equity/50% Fixed Income.

E. Investors Diversified Services: 50% Investors Stock Fund.

F. National Bank of Detroit: Pooled Fund for Employee Benefit Plan, 50% Equity/50% Fixed Income.

G. Northwestern National Bank of Minneapolis: Pooled Fund for Employee Benefit Plan, 50% Equity/50% Fixed Income.

H. Market Indices: 50% Standard and Poor 500/50% Salomon Brothers High Grade Corporate Bond Index.

EXHIBIT B-9

STANDARD VALUATIONS COMPARISON FUNDS FOR MAFB EQUITY PORTFOLIO AND FIXED INCOME PORTFOLIO

I. **Funds and Accounts Compared to MAFB Equity Portfolio**

A. Chemical Bank of New York: Pooled Equity Fund for Employee Benefit Plans.

B. Continental Illinois National Bank and Trust Company of Chicago: Pooled Equity Fund for Employee Benefit Plans.

C. First National Bank of Minneapolis: Pooled Equity Fund No. 20.

D. Investors Diversified Services: Investors Stock Fund.

E. National Bank of Detroit: Pooled Equity Fund for Employee Benefit Plans.

F. Northwestern National Bank of Minneapolis: Pooled Equity Fund for Employee Benefit Plans.

G. Standard and Poor 500 Index.

H. Harris Trust of Chicago: Cyclically Timed Equity Fund.

I. Harris Trust of Chicago: Industrial Dividend Equity Fund.

II. **Funds and Accounts Compared to MAFB Fixed Income (Bonds Only) Portfolio**

A. Chemical Bank of New York: Pooled Fixed Income Fund for Employee Benefit Plans.

B. Continental Illinois National Bank and Trust Company of Chicago: Pooled Fixed Income Fund for Employee Benefit Plans.

C. First National Bank of Minneapolis: Pooled Fixed Income Fund for Employee Benefit Plans.

D. Investors Diversified Services: Selective Mutual Fund.

E. National Bank of Detroit: Pooled Fixed Income Fund for Employee Benefit Plans.

F. Northwstern National Bank of Minneapolis: Pooled Fixed Income Fund for Employee Benefit Plans.

G. Salomon Brothers High Grade Corporate Bond Index.

APPENDIX C
SELECTED REFERENCES

GENERAL

Dietz, Peter O. *Pension Funds: Measuring Investment Performance,* New York: The Free Press, 1966. A basic work which enjoys a very high reputation. Explains many issues in pension fund management, particularly the rate of return, portfolio risk and investment timing. Good treatment of the time-weighted rate of return in Chapter 4.

Fisher, Lawrence and James H. Lorie. "Rates of Return on Investments in Common Stock," *Journal of Business,* Vol. 37, No. 1 (January, 1964), pages 1-21. Summary report on rates of return on investments in all common stocks (aggregated) listed on the New York Stock Exchange for five and ten year periods, 1929 to 1960.

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Lorie, James H. and Mary T. Hamilton. *The Stock Market: Theories and Evidence,* Homewood, Illinois: R.D. Irwin, 1973.

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Hamilton, Johnston and Company, Inc. *Investment Performance Analyses: The Minnesota Adjustable Fixed Benefit Fund, 1972-1976,* Princeton, New Jersey: Hamilton, Johnston and Company, Inc., 1977. Basic report, primarily utilizing dollar-weighted rate of return methodology. Good special analyses, including portfolio turnover and cyclical performance of the equity portfolio. Very helpful methodological discussions.

Merrill Lynch, Pierce, Fenner and Smith, Inc. *Investment Performance Analysis: Comparative Survey, 1972-1976,* New York: Merrill Lynch, Pierce, Fenner and Smith, Inc., 1977. Basic report, primarily using time-weighted rate of return methodology. Good special analyses, including market sensitivity and differential return. Very clear and helpful methodological discussions.

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_____. *Moody's Transportation Manual,* New York: Moody's Investors Service, Inc., 1976.

APPENDIX D
LIST OF STAFF PAPERS

APPENDIX E
WRITTEN RESPONSE OF THE STATE BOARD OF INVESTMENT

ROBERT E. BLIXT
EXECUTIVE SECRETARY

STATE OF MINNESOTA
STATE BOARD OF INVESTMENT

Room 105, MEA Building
55 Sherburne Avenue
Saint Paul 55155

February 24, 1978

Mr. Bruce Spitz
Deputy Legislative Auditor
State of Minnesota
Legislative Audit Commission
Veterans Service Building
St. Paul, Minnesota 55155

Dear Mr. Spitz:

Thank you very much for your Legislative Audit Commission Report concerning the "State Board of Investment; Investment Performance."

Your material is very complete and adequately describes some of the conflicting dates and other qualities of the data which may make exact comparisons difficult.

We are pleased with the performance of the equity portfolio.

You have pointed out the variances in Table S-1 and S-2 on page iv (by listing the different "beginning" dates); obviously, the relative performance of such funds depends entirely upon which starting date is used in such comparisons.

You were most observant in your comments regarding the performance of the Bond Portfolio; especially, since we own so many "private placements" which do not have the market volatility of some bonds - particularly on the upside - and often sell at substantially less than do marketable fixed income securities of comparable maturity dates.

The bond performance is most satisfactory, considering your findings on page II-3 regarding the "private placement" ownership. Such securities provide a yield somewhat higher than the marketable bonds, even though the market action may not be as impressive. This is pointed out very well on page II-14 and the two following pages.

Your analysis seems to justify our use of "private placements" and shows that these instruments may add yield to the account, and do so without subtracting from market performance.

The section regarding Minnesota investments is most interesting. We are concerned about over-concentration of any public fund in "home-state" investments. Nevertheless, your review is very reasonable; it appears that our program is as we have desired.

We are very pleased with your report.

Thank you so much!

Sincerely,

Robert E. Blixt, C.F.A.
Executive Secretary

REB:db

REPORTS OF THE
LEGISLATIVE AUDIT COMMISSION
PROGRAM EVALUATION DIVISION

1. *Regulation and Control of Human Service Facilities,* February 17, 1977.*
2. *Minnesota Housing Finance Agency,* April 19, 1977.
3. *Federal Aids Coordination,* September 2, 1977.
4. *Unemployment Compensation,* February 24, 1978.
5. *State Board of Investment: Investment Performance,* February 24, 1978.
6. *Department of Personnel,* in printing.
7. *Department of Revenue: Assessment/Sales Ratio Studies,* in printing.
8. *Liquor Control,* in printing.

**Out of print.*

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