

RISK-ADJUSTED PERFORMANCE OF SWEDISH BOND FUNDS IN THE YEARS 2000-2003; AN APPLICATION OF THE MODIGLIANI-MEASURE

Daniel Wiberg*

Abstract

This paper compares Swedish long-term bond funds' returns against the OMRX-TBond, which is the major index of long-term bonds issued by the Swedish National Debt Office and other major Swedish bond issuers. The evaluation is made on a total return level as well as on a risk-adjusted basis. To measure risk-adjusted performance a performance measure developed by Modigliani and Modigliani (1997) is used. The main advantage with the Modigliani-measure is that it measures performance in basis points like the original return of any asset. By using the Modigliani-measure the study illustrates the importance of risk-adjustment when comparisons are made between benchmarks, such as an index, and mutual funds or portfolios investing in that particular market. When risk-adjusted, the performance of many of the Swedish mutual funds improved noticeably, most of them however, still underperform the index OMRX-TBond by a few percentage points when risk-adjusted with the M2-model. This result gives support to the idea originally presented by Sharpe (1966) and Jensen (1968), that the majority of mutual funds significantly underperform the market.

Keywords: mutual funds, bonds, portfolio performance, performance measures

*Jönköpings International Business School, Sweden, daniel.wiberg@jibs.hj.se

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1. Introduction

The growing interest for the stock market along with alterations in the Swedish pension-system in the late 1990s had made vast amounts of money available for the institutional investors to manage, amounts which has now diminished substantially. Since the air went out of the IT-bubble in the autumn 2000, most stock markets around the world has continued to decline. During these last years of market decline bond funds have become a popular investment instrument. Bond funds are marketed as, and supposed to provide the investor with stable returns at low risk

It has often been shown for instance by the Swedish Shareholders' Association (Aktiespararna) that a majority of Swedish mutual funds underperform some major Swedish stock market index such as the SIXRX (Findatas Avkastningsindex)¹. When presented in media these studies cause a lot of discussion since the average investor would often have been better off if a monkey managed his accounts⁹; Meaning of curse that a random selected portfolio, the index, performed better. One fundamental idea in modern investment theory is that

investors should be able to choose their investments on the basis of their desired risk tolerance. A lower risk than expected will also produce a lower return than expected. Bond funds are often marketed as investment portfolios with low and close to index performance. And indeed, as shown in this paper the majority of the Swedish long-term bond funds have a risk (standard deviation) lower than the main bond market index OMRX-TBond. However, if the risk of the bond funds has been lower than expected by the unit holders, what is the cost or benefit of this "involuntary" risk reduction.

The question that must be raised is therefore whether or not the Swedish bond funds have produced returns lower than their market index. If so will a risk-adjusted performance measure improve the performance of the Swedish bond funds to a level equivalent to the benchmarks.

To answer these questions the M2-model (Modigliani and Modigliani, 1997) is used, which adjusts the portfolios through leverage to the same level of risk as the benchmark portfolio. By measuring the M2 risk-adjusted performance of Swedish bond funds this paper aims to produce a more revealing evaluation of the Swedish bond funds' performance. The application of the M2-model will basically follow the definitions and notations of the originators.

A simple way of evaluating the performance of a

¹ Formerly Affärsvärdens Avkastningsindex, Findatas Avkastningsindex FDAXA and now SIX-Returnindex SIXRX

⁹ A Blindfolded chimpanzee throwing darts at the *WALL STREET JOURNAL* can do as well as the experts (Malkiel, 1999)

managed portfolio (i.e. a mutual fund) is to take the total returns during a time period and compare it to those of an unmanaged random selected portfolio (the dartboard portfolio)³. The comparison portfolio is referred to as the benchmark. However, this simple evaluation gives the investor very little information, nothing is said about the risk exposure, the managers' skills or if the result is pure chance.

To improve the evaluation, the concept of efficiency might be introduced, where managers are benchmarked against the unmanaged "market" or more specifically, a capitalization-weighted portfolio consisting of the entire market. The benchmarks can then be further revised to more closely reflect the relevant investment sectors under evaluation, that is, different indices relevant for certain security classes. Most of these security classes have their own indices and there are today a very large number of stock indices offered by the various rating agencies and consulting companies. Still, even though the benchmarks have improved over the years, the performance is still focused on total return. Early research, such as Jensen (1968), and Sharpe (1966) as well as more updated Swedish studies by Aktiespararna (the Swedish Shareholders' Association, 1999), has shown that the majority of mutual funds significantly underperform the market.

Thus, for a more valid performance evaluation of a mutual fund one needs a risk-adjusted performance measure. The most common measure of risk-adjusted return used in the industry is the Sharpe ratio, which gives the "reward per unit of risk". The Sharpe ratio can be difficult to interpret and even though experts might find it useful, it is not much help for the average investor who is not intimately familiar with regression analysis and modern theory of finance. A more easily understood and thus more helpful measure of risk-adjusted performance is the Modigliani and Modigliani (1997), M2-measure⁴. With this measure of risk-adjusted performance a more applicable comparison between mutual funds and their benchmarks is made possible.

2. Portfolio Return And Risk

Investors are not interested in the returns of a mutual fund in isolation but in comparison with some alternative investment. To even be considered, a mutual fund should at least give a return similar to or better than some minimum hurdle, such as the return on a completely safe, liquid investment available at that time (Simons, 1998). Such a return is referred to as the "risk-free rate" and is usually a short-term government security, such as a 90-day Treasury bill. However, the risk-free rate is certainly not the only relevant investment for comparison. As mentioned

before most equity and bond funds measure their performance against some benchmark index such as the S&P 500 index, or for Swedish mutual funds, the more relevant SIXRX-index (Findatas Avkastningsindex) or for bond the OMRX-TBond.

But investors are not only interested in the returns; they are also concerned with the risk taken to achieve those returns. Although a number of performance measurements exist, the common feature is that they all measure fund returns relative to risk. However, they differ in how they define and measure risk, and consequently, in how they define risk-adjusted performance

Investors demand and receive higher returns with increased variability, suggesting that variability and risk are related. The basic measure of variability is standard deviation, also known as the volatility. Both the Sharpe-ratio and the Modigliani-measure are based on the standard deviation as a risk measure in their risk-adjusting performance measurements.

Theoretically the standard deviation states that if the fund returns are normally distributed and the historical standard deviation is used as a proxy of the future risk, then with an 68% probability, the fund return will deviate from the mean return by plus or minus one standard deviation. A high standard deviation shows that the fund has a great variation in returns.⁵

More specific to this thesis, the standard deviation measures how the funds historic returns have deviated from the mean return of the fund over a period of 36 months. The standard deviation calculated and reported by Morningstar is based on monthly returns and reported on an annual basis.

2.1. Other Ways Of Measuring Performance

Another way to use the standard deviation, which might be useful for fund managers in particular, is to measure the funds "tracking error" compared to its benchmark. What "tracking error" refers to is the standard deviation of the difference in returns between the fund and the appropriate benchmark index. Such a comparison will reveal how able the fund manager is to track the returns on some benchmark index related to the fund's announced purposes.

Standard deviation is sometimes criticised as being an inadequate measure of risk because investors does not dislike variability per se. Rather, they dislike losses but are quite happy to receive unexpected gains (Simons, 1998). Downside risk may be a better

³ Refers to Malkiel's metaphor of a monkey who threw darts at the Wall Street Journal as a proxy for a randomly selected portfolio, also referred to as the market portfolio (Malkiel, 1999).

⁴ Named after its two originators (Muralidhar, 2000)

⁵ With a probability of 95% the fund returns will not deviate by more than two standard deviations from the historical mean return. Hence if the standard deviation is 20 and the expected return 10%, the actual return will end up between +30% and -10% with a likelihood of 68%.

reflection of investor's attitudes toward risk and therefore a better measure of risk. Never the less, the distinction between downside risk and standard deviation is of little importance because the two measures are highly correlated. Sharpe (1997) found that the two measures had a correlation coefficient of 0,932. It is logical that stocks with larger downside deviations will also have larger standard deviations.

In recent years Value at Risk or VAR has gained a lot of acceptance, especially if the portfolio consists of some derivatives or bonds. Essentially, VAR gives an answer to the question of how much the value of a portfolio can decline with a given probability under a given time period (Simons, 1998). The strength of VAR is that it constructs a measure of risk for the portfolio not from its own past volatility but from the volatilities of risk factors affecting the portfolio as it is constructed today. A measure based on risk factors rather than on the portfolios own volatility is especially important for funds that range far and wide in their choice of investments, use futures and options, and abruptly change their commitments to various asset classes. This description applies to many hedge funds, but perhaps not that good to ordinary bond funds.

It is interesting to note that the dominant use of standard deviation as a measure of risk, indicates a widespread assumption that the returns have a symmetric normal distribution.

3. The Sharpe Measure Of Risk-Adjusted Performance

The M2-model of risk-adjusted performance (RAP(i)) measures performance along the same basic lines as the Sharpe ratio (S_i), and even though RAP(i) and S_i provides very different measures of risk-adjusted performance, their ranking of performance coincides. The portfolio that has the best performance according to the RAP criteria is also the best by the Sharpe measure and vice versa⁶.

The Sharpe ratio (Sharpe, 1966) is today the most commonly used measure of risk-adjusted performance. Basically the Sharpe ratio measures the "reward per unit of risk", thus a high Sharpe ratio means that the fund delivers a lot of return for its level of volatility. The Sharpe ratio is calculated by taking the total return then converting it into excess return by subtracting the risk-free rate, and then divide that result by the dispersion measure, standard deviation or sigma. The Sharpe ratio can thus be expressed as:

$$\text{Sharpe ratio} = S_i = e_i / \sigma_i;$$

Where

e_i = excess return of portfolio i ($e_i = r_i - r_f$)⁷; and

σ_i = standard deviation of portfolio i 's excess return

Any portfolio positioned on the capital market

line has a Sharpe ratio equal to that of the market (Sharpe ratio = 1.0) and, therefore, has a neutral performance. A higher Sharpe ratio would indicate that the fund has outperformed the market, while a lower Sharpe index would indicate underperformance, for any level of risk.

Since both the Sharpe ratio and the M2-measure are based on the CAPM they are also constrained by the standard assumptions of this basic model. Consequently the relevance of these risk-adjusted performance measures for choosing a mutual fund critically depends on the investors ability to do two things: 1) combine an investment in a mutual fund with an investment in the risk-free asset, and 2) leverage the investment by, for example, borrowing money to invest in the mutual fund (Simons, 1998). For the result to hold true, the investor must be able to borrow and lend at the same risk-free rate.

While experts may find the Sharpe measure or even some other performance measure such as the Jensen's alpha or the Treynor ratio helpful in comparing funds, the resulting figures are difficult to interpret. So despite its near universal acceptance among academics and institutional investors, the Sharpe ratio is not well known among the general public and financial advisors. Investigations in the matter have lead to cold-blooded criticism:

"The Sharpe ratio is so esoteric that most mainstream financial dictionaries ignore it, most planners can't adequately explain it, and I am not even going to attempt it here." (Jaffe, 1998)⁸

4. The M2-model

Like most conventional methods, the M2 measures the performance of any managed portfolio against that of a relevant "unmanaged" market-portfolio. However, the M2-measure makes the comparison in performance after adjusting the portfolio to the appropriate level of risk, that is the level of risk in the unmanaged benchmark portfolio. After this proper matching of the portfolios risk to that of the benchmark, the return of this risk-adjusted portfolio i (RAP(i)) is measured in basis points like the original return of any asset. Which of course makes the M2 easy to understand and interpret.

In particular, the RAP(i) can be compared to the return of a market-portfolio over the same period of time (call it r_m). The difference tells us how much, in basis points, portfolio i outperformed the market (if the difference is positive), or underperformed the

⁸ Quoted in Simons (1998); Jaffe, C. A. (1998) "Don't Be Duped by Alphabet Soup." The Boston Globe (March 9), pp.A14, A16. It is this view that the Sharpe ratio may be too difficult for the average investor to understand and interpret, that gave Modigliani and Modigliani the incentive to propose a new more comprehensible measure of risk-adjusted performance, a measure that express a fund's performance relative to the market in percentage terms.

⁶ Both models are based on the Capital Asset Pricing Model and the assumptions underlying the models are therefore the same.

⁷ Where r_i is the return of portfolio i , and r_f is the risk free rate.

market (if the difference is negative), on a risk-adjusted basis. Since the benchmark portfolio is in principle a viable alternative investment to any portfolio i , the differential performance ($RAP(i)-r_M$) can be regarded as a standard to assess whether the managed portfolio is worth keeping or not.

The risk-adjusting of portfolios is accomplished by theoretically leveraging or unlevering the original portfolio. Given any portfolio i , with total return r_i , and a dispersion of σ_i , it is possible to construct a new version of that portfolio having any desired level of risk.

Before going deeper into the techniques and formula's of the M2-model a summation of the definitions and notations used is in order.

$RAP(i)$ = risk-adjusted performance of portfolio i ;

r_f = short-term risk-free interest rate;

r_i = return of portfolio i ;

$r(i)$ = return of risk-equivalent (or matched) portfolio, or the risk-adjusted return of portfolio i ;

e_i = excess return of portfolio i ($e_i = r_i - r_f$);

$e(i)$ = excess return of risk-equivalent portfolio i ($e(i) = r(i) - r_f$);

σ_i = standard deviation of r_i and e_i ;

$\sigma(i)$ = standard deviation of $r(i)$ and $e(i)$;

S_i = the Sharpe ratio = e_i/σ_i ;

r_M = return of the market portfolio;

e_M = excess return of the market portfolio ($e_M = r_M - r_f$); and

σ_M = standard deviation of r_M and e_M .

4.1. Leverage And The Derivation Of Rap, A Measure Of Risk-Adjusted Performance

The M2-model provides us with a risk-adjusted performance measure, called RAP, for any portfolio through one central operation, leverage. Unlevering or leveraging the initial portfolio matches the portfolio to the same level of risk as the benchmark, or more precisely the appropriate index. Unlevering a portfolio means that one sells a portion of the portfolio and uses the proceeds to buy risk free securities (such as short-term government securities). Since the portion of risky securities is decreased and counter-balanced by a proportional increase in risk-free securities, this operation will reduce the risk of the portfolio. Consequently, unlevering the portfolio also lowers the expected return of the portfolio (provided that the original portfolio had a positive excess return). Indeed, if one sells, $d_i\%$ of the portfolio and invests the proceeds in risk-free securities, this will reduce the dispersion (sigma) of the returns of the portfolio by $d_i\%$ (because $d_i\%$ of the returns will have been made constant/risk-free). It also reduces the excess return of the portfolio by the same $d_i\%$. Likewise, leveraging a portfolio means that one increases the investment in the portfolio through borrowing. Intuitively, this will increase the risk and expected return of the portfolio (again, assuming a positive excess return on the original portfolio). If an

additional amount, $d_i\%$ is financed by borrowing and then invested in the portfolio, then both sigma and the excess return of the portfolio will increase by $d_i\%$.

From these operations the M2-measure derives that the risk-adjusted return of portfolio i , or $RAP(i)$, is the return of portfolio i , levered by an amount d_i (d_i positive or negative), where d_i is defined as the leveraging required to make portfolio i risk-equivalent to the desired benchmark portfolio. That is to make the portfolio's sigma, $\sigma(i)$, equal to that of the benchmark portfolio.

Following the notations of Modigliani and Modigliani (1997). The value of d_i can be inferred from the definition:

$$\sigma(i) = (1 + d_i)\sigma_i = \sigma_M \quad (1)$$

which implies:

$$d_i = \sigma_M/\sigma_i - 1 \quad (2)$$

Since borrowing is not free, one must take into account the interest on d_i , which is the amount borrowed (if d_i is positive) or lent (if d_i is negative), we then find that:

$$RAP(i) = r(i) = (1 + d_i)r_i - d_i r_f \quad (3)$$

Substituting Equation (2) into equation (3), we can rewrite RAP as:

$$RAP(i) = (\sigma_M/\sigma_i)r_i - [(\sigma_M/\sigma_i) - 1]r_f = (\sigma_M/\sigma_i)(r_i - r_f) + r_f \quad (4)$$

Using the definition of e_i , RAP can also be written as:

$$RAP(i) = (\sigma_M/\sigma_i) e_i + r_f \quad (5)$$

Where

$$e(i) = (\sigma_M/\sigma_i)e_i \quad (6)$$

Using these equations and substituting them into each other one can compute the $RAP(i)$ either from total returns, using Equation (4), or from excess returns using Equation (5).

5. The Data

The Swedish mutual funds for which risk-adjusted performance is calculated in this thesis are all open-ended mutual funds that are stipulated "Swedish

Long-Term Bond Funds" (clearly stated in the investment policy of each mutual fund). This means that the fund's invest in bonds denominated in SEK. The fund's invests in government bonds or bonds issued by local authorities or agencies, mortgage bonds, corporate bonds of good rating, and bonds issued by supranational institutions. The fund's may further use derivative instruments to reduce risks. The investment framework uphold the OMRX-Tbond as a suitable and proper benchmark index.

The relevant funds have all been classified by Morningstar Sweden and Svensk Fondstatistik AB. Morningstar is also the provider of data for the mutual funds. Furthermore, the funds need return and risk statistics for at least 36 months to be considered in this thesis. This latter criteria reduced the number of relevant funds since much of the expansion in the mutual fund industry has taken place during this three

year period. All and all there were 35 Swedish funds registered by Morningstar, which satisfied the criterion. The fund managers and fund names can all be found in table 1.

The risk-free rate used in the calculation of risk-adjusted performance in the period 2000-05-02 to 2003-04-30, is the average return on a 90-day Treasury Bill during the same period (SSV-3M). The risk free rate is referred to as a fixed income security with short maturity and the compounding of 90-days Treasury Bills is the shortest fixed income security investment strategy available. The 90-days Treasury Bill had an average monthly return of 4.43% during the period 2000-05-02 to 2003-04-30 (Swedish National Debt Office).

The standard deviations of the benchmark index have, like for the funds, been calculated on the basis of monthly returns. The standard deviation of the market, that is, the monthly volatility of returns for the OMRX-Tbond during the period 2000-05-02 to 2003-04-30 (36 months) was 2.8% and the total return of the market for that period was equal to 27.7% (Stockholm Stock Exchange).

6. The Mutual Fund And Market Performance In The Period 2000-2003

The strong market development of the late 1990's continued during the first months of 2000. The year began with a continuing strong growth in high-tech and telecom stocks, the bull market was also supported by the development of the American NASDAQ-market.

By the late spring of 2000 the NASDAQ as well as the Swedish market became more volatile and prices started to decline. The rapid decline continued and during the autumn the telecom and the high-tech sectors plunged. The sharp drop in prices during the latter six months of 2000 leads to a negative total return in the Swedish stock market. The SIXRX-index ended up with a total return of -12%. At the bond market the decreasing demand for loans by the Swedish Government led to smaller volumes outstanding.

However, the total turnover of the Swedish bond market is still very large. During 2000 the primary dealers traded a total of 36 000 billion SEK, which was an 18% drop in turnover from 1999. The overall total return of the OMRX-Tbond was 7.9% and the OMRX-Tbond volatility during the year was 2.9%.

The governments reduced borrowings might be one reason for the considerable growth in corporate bonds which has been seen during the last years. Nonetheless, the decline in market volume continued in 2001 and the turnover dropped another 10% and ended up at 33 000 billion SEK.

The yields on the bond market also declined during the. With political conflicts and uncertainty the stock market year 2001 proved to be rotten, prices

continued to fall and the Swedish market went down by around 35%, following both the U.S. and the European markets.

During 2002 the bond market yields have increased again and the volatility of the index was around 3.2%. The fear of an inflation rate at a too high level also made the central bank raise the interest rate.

However, due to falling stock prices and sluggish market recovery the interest rates have declined once again, a drop that started during the autumn of 2002. The pattern is the same in most western economies, with low interest rates and slow market recovery. At the stock market one can see that cyclic stocks have had positive price developments. However, for the former growth sectors high-tech and IT the structural problems and inferior performance continues.

As the year 2003 progresses the Swedish stock market has started a slow recovery. Interest rates are still at low levels and there seems to be no consensus about Sweden potential membership in EMU. This might affect the riskiness of the Swedish bond market, but it is hard to say to what extent.

7. The Swedish Mutual Funds Risk-Adjusted Performance In The Period 2000-05-02 To 2003-04-02

The application of the RAP measure on Swedish data for the period 2000-05-02 to 2003-04-30 followed the formula

$$RAP(i) = (\sigma_M/\sigma_i)(r_i - r_f) + r_f$$

where, the risk free rate for the whole 36-month period (2000-04-30 to 2003-05-02) was $r_f = 4.43\%$ and the market or benchmark volatility $\sigma_M = 2.8\%$. The statistics and the resulting figures can, for all concerned funds, be found in table 1.

Looking at total return, the average Swedish Long-Term Bond fund underperformed the market (or more exactly the OMRX-Tbond).

When the RAP measure is applied and calculated for the 35 Swedish bond funds a new but similar picture appears. On average, the Risk-adjusted performance of Swedish bond funds was still inferior to the total return performance of the market. The average RAP of the 35 Swedish bond funds was 24.62%. These findings are in accordance with the findings and theory of Modigliani and Modigliani (1997).

The Swedish bond funds are presented in table 1. The table shows that, like the original article by Modigliani and Modigliani (1997), some of the "well performing" funds turn out to be less attractive on a risk-adjusted basis. The reversed is especially true, in the sense that many of the less "well performing" funds, manage a lot better on a risk-adjusted basis.

Table 1. Risk Adjuster Performance analysis of Swedish Long Term Bond funds in the period 2000-05-02 to 2003-04-30.

<i>Fund</i>	<i>Total Return, % 36 month</i>	<i>Standard Deviation, % 36 month</i>	<i>RAP, M2 %</i>	<i>Leverage Factor</i>	<i>Fund minus Benchmark, %</i>	<i>Management Fees</i>
Risk Free Rate,						
SSV-90	4,43					
Benchmark	27,7	2,8				
<i>(OMRX-Tbond, 000502-030430)</i>						
Alfred Berg Obligationsfond	22,2	2,7	22,86	0,04	-5,50	0,5
AMF Pension Rantefond Sverige	24,2	2,7	24,93	0,04	-3,50	0,15
Aragon Avkastningsfond	20,5	2,5	22,43	0,12	-7,20	0,5
Banco Obligationsfond	22,2	2,7	22,86	0,04	-5,50	0,6
Carlson SEK Long Bond A	22,1	2,4	25,05	0,17	-5,60	0,7
Carlson SEK Long Bond B	22,1	2,3	25,94	0,22	-5,60	0,5
Enter Obligationsfond	22,5	2,5	24,67	0,12	-5,20	0,45
Erik Penser Obligationsfond Sverige	19,1	2,1	23,99	0,33	-8,60	0,35
Firstnordic Sverige Obligationer	20,7	2,4	23,41	0,17	-7,00	0,75
Folksam LO Obligation	26,0	2,4	29,60	0,17	-1,70	0,4
Folksam Obligationsfond	22,9	2,1	29,06	0,33	-4,80	0,3
Folksam Tjänstemannafond Obligation	26,8	2,4	30,53	0,17	-0,90	0,4
Handelsbanken Mega Avkastning Acc	19,6	1,9	26,79	0,47	-8,10	0,3
Handelsbanken obligationsfond	21,8	2,5	23,88	0,12	-5,90	0,75
HQ Obligationsfond	21,3	2,3	24,97	0,22	-6,40	0,8
Länsförsäkringar Mega Obligation	21,5	2,2	26,16	0,27	-6,20	0,3
Länsförsäkringar Mega Statsobligation	20,4	2,2	24,76	0,27	-7,30	0,3
Länsförsäkringar Obligationsfond	21,3	2,2	25,90	0,27	-6,40	0,5
Moderne Fonder Sverige Obligation	21,8	3	20,64	-0,07	-5,90	0,3
Nordea Obligationsinvest	22,0	2,6	23,35	0,08	-5,70	0,75
Nordea Obligationsfond	22,2	2,6	23,57	0,08	-5,50	0,75
Nordea Portföljinvest Obligation	22,8	2,7	23,48	0,04	-4,90	0,6
Nordea-1 Swedish Bond Fund Acc	18,3	2,6	19,37	0,08	-9,40	0,5
SEB Lux Bond - SEK Acc	20	2,2	24,25	0,27	-7,70	0,8
SEB Lux Bond Fund - SEK Inc	20,1	2,2	24,37	0,27	-7,60	0,8
SEB Lux Fund - Index Linked Bond	17,0	1,6	26,43	0,75	-10,70	0,7
SEB Obligation Stiftelsefond	20,8	2,2	25,26	0,27	-6,90	0,7
SEB Obligationsfond	20,8	2	27,35	0,40	-6,90	0,7
Skandia Kapitalmarknad	24,3	2,9	23,61	-0,03	-3,40	0,6
Skandia Realräntefond	34,3	4,1	24,83	-0,32	6,60	0,6
SPP Obligationsfond	23,0	2,4	26,10	0,17	-4,70	0,2
SSF Swedish Bond Acc	20,9	2,5	22,88	0,12	-6,80	0,75
SSF Swedish Fixed Income Shares Acc	18,4	2	23,99	0,40	-9,30	0,75
Trevisse Obligationsfond	21,7	2,7	22,34	0,04	-6,00	0,65
Öhman Obligationsfond	21,5	2,7	22,13	0,04	-6,20	0,6
Average	21,9	2,4	24,62	0,17	-5,78	0,55

Almost every fund in table 1 underperform the benchmarks total return of 27,7% when looking at total returns. When adjusting for risk via the M2-measure the risk-adjusted performance is on average still inferior but to less extent. This means that the Swedish long-term bond fund's on average have a lower volatility of returns than the index. However, the lower levels of risk will also produce lower returns than the index. Even when the fund portfolios are adjusted to have the same level of risk as the benchmark index, the returns are lower than the index. The conclusion must therefore be that the Swedish long-term bond fund's underperform their benchmark

index in both total return and risk-adjusted level's. Some examples will now illustrate the analysis and application of the RAP-measure.

For example, Skandia Realräntefond had a total return of 34.3% during the concerned period, well above the benchmark (OMRX-Tbond 27.7%), but the risk adjusted performance of the fund was only 24.83%. That is a risk-adjusted performance 2.89% lower than the benchmark. Another way of putting it would be that the investors in the fund have not been adequately rewarded for the risk they have been exposed to. If the fund would have had the same lower risk level as the benchmark, it would have

underperformed it by almost 3%.

The fund Folksam Obligationsfond is an example of the opposite, which is underperformance in total return (22.9% almost 5% less than the total index return of 27.7%) and a superior performance on a risk-adjusted basis (29.06%). If the fund portfolio manager had been willing to accept higher risk, up to the same level as the OMRX-Tbond index the manager could have leveraged (borrowed at the risk free rate) the fund portfolio by an additional amount of 33% (the leverage factor, 0.33) of the funds' value, to invest in the fund-portfolio. This operation would have increased the risk-level of the fund to the same level as the benchmark and produced a 1.36% superior return (29.06%-27.7%).

Another example of a fund that performs superior to the benchmark on a risk-adjusted basis but not in total returns, is the Folksam LO Obligation which has a total return performance of 26.0% and a RAP of 29.60%, almost 2% better than the benchmarks return of 27.7%.

A Fund that is much improved by the risk-adjustment procedure is also the SEB Obligationsfond it has a total return performance of 20.8% well below the index return of 27.7%, but after adjusting for risk the funds performance is improved to 27.35% just slightly lower than the benchmark. The fund portfolio consequently have a much lower level of risk than the benchmark (2% compared to benchmarks 2.8%). The portfolio manager could therefore have leveraged the fund portfolio with as much as 40%. The risk (standard deviation) of the portfolio would then have been the same as that of the benchmark, 2.8%. What table 1 clearly shows is that the Swedish long-term bond fund's have total returns which on average is around 20% lower than the benchmarks total return. There might of course be various and very different reasons for this underperformance. However, the strongest single factor that affects the average performance of the funds must be the relative low levels of risk in the fund portfolios compare to that of the index. Only one of the 35 Swedish bond fund's have a volatility greater than that of the benchmark (Skandia realräntefond Std. 4.1% compared to index Std. 2.8%). On average the standard deviation of the Swedish long-term bond funds is 2.4% compared to the index which has a standard deviation of 2.8%. How these differences in risk have come about is hard to say. The important fact is that whether or not this difference is justified the Swedish bond fund's continues to underperform the market (average RAP 24.62%, compared to benchmark return of 27.7%) even on risk-adjusted levels.

8. Result Discussion and Related Studies

The common belief that mutual funds generally underperform the market confirms the original version of the so-called efficient market theory: those expenditures on research and trading are wasted in a

market in which securities prices contain all information. This idea is attributed to two studies made in the 1960's by Sharpe (1966) and Jensen (1968), which showed that mutual funds underperformed common market indices. These two studies formed a paradigm (Ippolito, 1993) that has been dominating the impression of mutual fund performance almost until this day.

The inferior performance of Swedish mutual funds' total returns in the period 2000-05-02 to 2003-04-30, can to some extent, be explained by the dominant role of government bonds in the index. Most of the trades in the Swedish long-term bond market takes place in this kind of low risk government bonds. The dominant role of these securities is so significant that fund portfolio managers seems to be reluctant towards holding more risky and less liquid securities such as corporate bonds. The development and performance of the OMRX-Tbond index might therefore not be gained to its full extent by the Swedish bond funds.

Modigliani and Modigliani (1997) demonstrate the application of RAP on a small sample of selected equity mutual fund's, which suits their demonstration of the usefulness of RAP. The application and results of their study is nonetheless similar to the results of this thesis. For instance, the improved performance of funds with lower than benchmark volatility is in accordance with the selected sample in the Modigliani and Modigliani article. Another finding confirming the results in this study is that some of the funds that have volatility in excess of the benchmark have a downward risk-adjusting of their performance.

In spite of this, the period 2000-05-02 to 2003-04-30 have proven to be quite good for the Swedish long-term bond funds, with average total return's (over the risk free-rate, 4,04%) of almost 18%. When risk-adjusted, the performance of many of the Swedish mutual funds improved noticeably, most of them however, still underperform the index OMRX-Tbond by a few percentage points when risk-adjusted with the M2-model. On average the underperformance is around 3%, sufficient enough to support the idea originally proposed by Jensen⁹; *it's difficult to systematically beat the market. But it's not difficult to systematically throw money down a rat hole by generating commissions.* What Jensen means is basically that the funds themselves trade the fund portfolio to the extent that the cost of this trade burdens the result (Ippolito, 1993).

The influence played by administrative fees, is shown by Dahlquist, Engström, and Söderlind (2000) to have a direct and evident effect on the return of the funds, compared to the costless benchmark this cost is quite substantial. This paper might therefore be consistent with another proposition made by Sharpe and Jensen; *that mutual funds essentially waste their*

⁹ M. Jensen, quoted in Forbes, October 8, 1984. See, Ippolito (1993).

expenditures in futile efforts to find and act on new information" (Ippolito, 1993). Still, if these costs are so substantial that the average Swedish bond fund's performance is about 5% lower than the benchmark's, it would be sensible to think of some more cost efficient portfolio strategies i.e. indexing.

If active management of the Swedish mutual funds had a significant negative effect on performance during the concerned period, it would contradict the findings of Dahlquist, Engström, and Söderlind (2000), who find evidence suggesting that actively managed equity funds perform better than more passively managed funds. Indeed, Ippolito (1993) as well proposes that a majority of funds are sufficiently successful to generate an industry average which matches the returns available from indices, after subtracting expenses and adjusting for risk¹⁰. These two studies are however made on equity and not bond funds.

Even though much of the research and studies in mutual fund performance have been done on foreign records, mainly U.S. data. There is little evidence pointing to some specific circumstance in the Swedish financial market, which would make the results particularly unacceptable. Still, one important circumstance in the Swedish bond market is, and will continue to be for some time, the dominant role of government bonds.

8.1. Criticism of the M2-model

As in any theory there are some shortcomings with the M2-model. But hopefully, the qualifications of the model are in excess of the shortcomings. The shortcomings of the M2-measure are also the same as for the CAPM and the Sharpe-ratio, which is as mentioned, the most broadly used theories in security pricing and performance.

The M2-model for risk-adjusted performance is based on historical data, "as any investment prospectus will tell you, is not a necessarily indicative of future performance" (Modigliani and Modigliani, 1997). Nevertheless, historical data is in many ways the best estimates of future performance available. Grinblatt and Titman (1992) have found evidence of performance persistence for mutual funds, so if not perfect, they still remain valuable and appealing information. In addition, most investors probably want some information on how various fund managers performed in the past, and whether they were adequately compensated for the risk to which they were exposed.

As mentioned, the M2-model shares its shortcomings with the Sharpe ratio, that is because the model is also based on the standard deviation as a

measure of risk, and return as a measure of reward. Thus, the M2-measure ranks portfolios in the same manner that the Sharpe ratio does. Some investors might feel that other measures of risk are more appropriate such as "VAR" or "downside-risk".

The risk-free rate is also an important factor for the way in which M2-model works, a factor that may need some analysis. Most investors are probably not allowed to borrow at the risk-free rate, which is essential for the model to hold exactly (through leverage). Although complicated, the model should hold for some variations and differences in interest rates as well.

For this study in particular it is also important to note that there might be an element of survivorship bias. Although important, the impact of this element is supposed to be small or at least not significant for the results and conclusions of this thesis. In fact, survivorship bias would actually overstate the performance of the mutual funds.

Important to note, is also that the M2-measure identifies the "best performing" portfolio for any set of portfolios with the same benchmark. Combinations of those portfolios that might be more optimal are not considered. Hence an even better portfolio might possibly be constructed from the combination of the existing portfolios in the set.

9. Conclusions

Many observers of the Swedish financial market share the view that mutual funds on average underperform the market. The application of Modigliani and Modigliani's Risk-Adjusted performance measure on Swedish long-term bond fund's data for the period 2000-05-02 to 2003-04-30, shows that on a risk-adjusted basis this idea is confirmed. This study does not claim that all Swedish long-term bond fund's significantly underperform their benchmark index OMRX-TBond.

But it does suggest that, on a risk-adjusted basis, the average bond fund has a lower or at least neutral performance relative to the benchmark. Over the period 2000-05-02 to 2003-04-30 the risk-adjusted return is on average 3% lower than the benchmarks. This finding is consistent with the results of Sharpe (1966) and Jensen (1968), who in many ways have created the notion of underperformance in mutual funds.

The risk level of the Swedish long-term bond funds is on average 0.4% lower than their benchmark the OMRX-Tbond. An increase in volatility in the funds might not automatically lead to higher returns. However, if such an increase might occur, it would be consistent in the sense that it makes the Swedish long-term bond funds on average, more comparable to the Swedish market.

This thesis is the first application of the Modigliani and Modigliani measure of risk-adjusted performance on Swedish bond fund data. Not only

¹⁰ It must be stressed however, that this study is based on Bond portfolios and not equity portfolios; to whatever extent this might affect the results.

does this measurement display the importance of risk-adjustment and risk-equivalence when evaluating and assessing portfolios, it also demonstrates the originators idea that a simple and easily understandable measure of risk-adjusted performance might have great implications for the individual

investors choice of portfolio.

Interesting areas for future research on this subject would be the legal regulations concerning leverage; perhaps leverage is tool for portfolio optimization that has received an unreasonable bad reputation.

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