Bondmaster – Computer Software for Bond Management

Zdenko Prohaska, Ph.D. (Full Professor)
Ivan Uroda, B.Sc. (assistant - novice researcher)
University of Rijeka
Faculty of Economics
Ivana Filipovica 4, Rijeka, Croatia
Phone: ++385 51 355 111
Fax: ++385 51 675 750
E-mail: zdenko.prohaska@ri.t-com.hr, ivan.uroda@efri.hr

Abstract - The computer software Bondmaster is an educational PC program for investing in fixed income securities, i.e. in bonds. The main task of the program is to calculate the current yield of bonds, the yield to maturity of coupon bearing bonds, their present value and duration, both for annual and semiannual payments of interests. Special attention is paid to the currency risk in foreign exchange operations, the forecasting of interest rates and prices of bonds and a bond table generator is also included. There are also a lot of utilities built in like a calculator, a calendar and a file viewer with search function. Macros and a mouse support are also provided. The program was designed and programmed in the mid nineties in Microsoft QuickBasic with special functions included by using professional libraries. The algorithm was carefully elaborated so the program operates in text mode and it can be run in window or full screen mode on PC computers with OS from MS DOS to Windows XP Professional.

I. INTRODUCTION

Educational software is essential in finance for the students to understand better the investment process in securities, like bonds and shares. It is also necessary to apply the methods of calculating the prices, rates of return of securities in everyday practice. There are two ways to provide such software. First, it is possible to use a spreadsheet program like Excel and the financial functions built in or, secondly, to develop a standalone computer program to fit such needs.

Generally speaking if only a few calculations are to be done than an Excel spreadsheet is the easiest way to solve the problem, but if some special financial functions are to be used and if there are a lot of calculations needed, i.e. to prepare a complete "yield book" as part of the computer program, then the alternative way, i.e. to develop a standalone application is often recommended. For this purpose the author developed in the mid nineties an educational PC program called "Bondmaster" which is running on PCs and all operating systems from MS DOS to Windows XP Professional.

II. THE STRUCTURE OF THE PROGRAM

The program is divided in three parts (menus) the System menu, the Tools menu and the Bond management menu.

In the System menu, basic system functions are possible like Information about the program, DOS commands, OS shell (exit to DOS or Windows), shortcuts or macros and Quit or end of program [2] [3] [7]. (Fig. 1.)
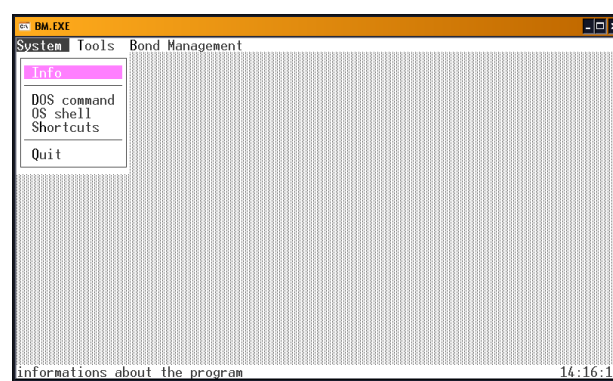

Fig. 1. System menu screenshot

There is a Help function (F1) and activation of pull down menus included (Alt) or (F10). A Microsoft compatible mouse support is also present [5] [6]. (Fig. 2.)
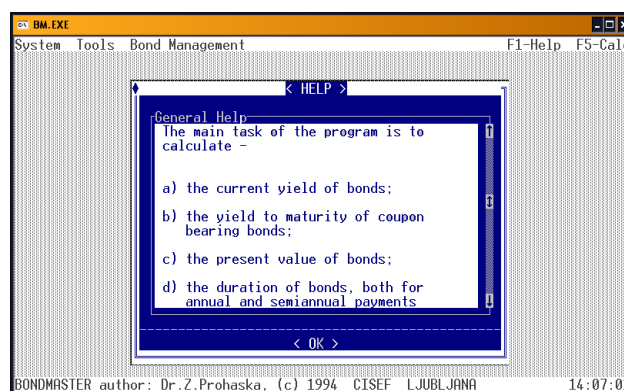

Fig. 2. Help menu screenshot

The second or the Tools menu provides additional helpful functions like line switching (25 or 43/50 lines mode), free RAM, ASCII code and there are a calculator and a complete file viewer with search function built in [8]. The calculator can be activated by pressing (F5). (Fig. 3.)
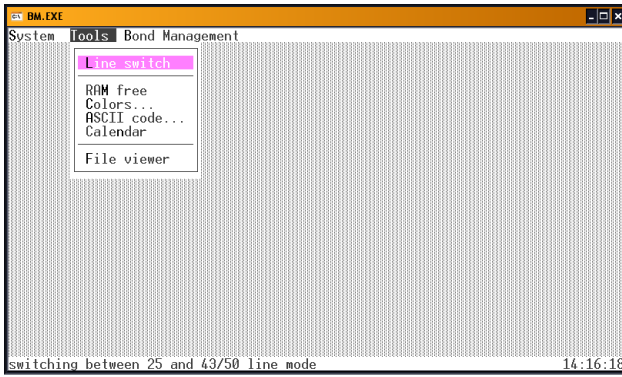
Fig. 3. Tools menu screenshot

The main part of the program is built in menu three or the Bond management module. There are a lot of basic financial calculations for investments in securities provided like the current yield of bonds (annual rate of return), the yield to maturity and present value of coupon bearing bonds, both for annual and semiannual coupon payments. The duration of bonds, which is an alternative measure of bond maturity and currency risk forecasting, are also included. Special attention is paid to scenario analysis (what if) or interest rate forecasting and how it affects the prices of bonds. In addition there is a complete so called "yield book" built in, which shows the students or the investors the relationship between prices and yields of fixed income securities. (Fig. 4)

Fig. 4. Bond management menu screenshot

III. THE CALCULATIONS IN THE BOND MANAGEMENT MODULE

The algorithm for calculating the necessary indicators for bond management in the program Bondmaster was developed in Microsoft QuickBasic, which is very similar to BASIC. The program code was based on the recommended verified programming code for investments published by the Institute of Chartered Financial Analysts in Charlottesville, Virginia. It is necessary to point out that the program Bondmaster is only for educational purposes and not for commercial use. Therefore there are no days between days function built in the program.

A. Current yield

The current yield is the annual rate of return of coupon bearing bonds and is calculated by dividing the nominal interest rate, i.e. the coupon rate by the bond price in percent [1].

$$Y_c = \frac{i_n}{P_b}$$

Y_c - current yield
P_b - bond price
i_n - coupon rate

The current yield is not taking into account the price at which a bond is bought or sold and no reinvestments of interests are considered.

In the computer program Bondmaster after entering the data for the coupon rate and the bond price (in %) the current yield is calculated. (Fig. 5.)
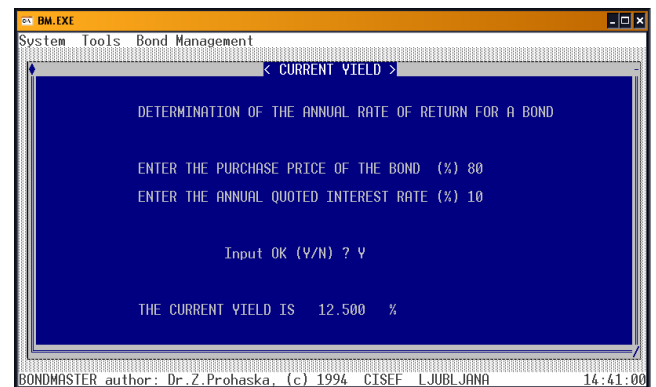

Fig. 5. Current yield window

B. Yield to maturity

The yield to maturity is a measure of the rate of return that will be earned on a bond if it is bought now and held until maturity. To calculate the yield to maturity it is necessary to solve the bond price equation for the interest rate given the price of the bond.

$$PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \ldots + \frac{C}{(1+r)^n} + \frac{FV}{(1+r)^n}$$

PV - present value of the bond
C - coupon
n - number of years/periods
r - rate of return/yield to maturity
FV - future value of the bond

According to the equation presented above the program Bondmaster determines the yield to maturity of a bond given the current purchase price. This is the true rate of return on a bond in the case that all coupons are reinvested at the rate of return when the bond was bought. (Fig. 6)
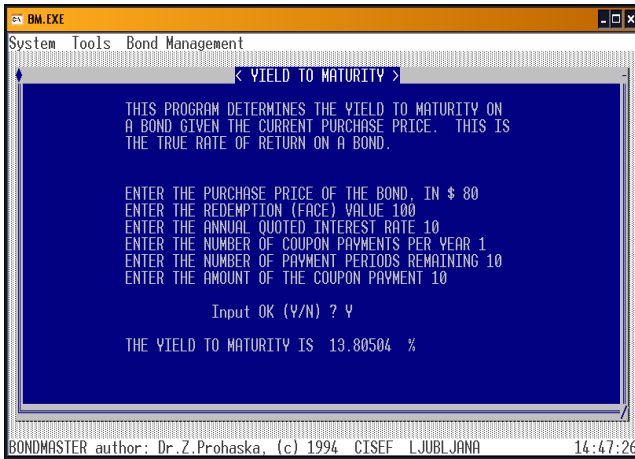
Fig. 6. Yield to maturity window

C. The present value of a bond

The present value of a bond is the sum of present values of coupons and the present value of the par or nominal value of a bond. It means that the equation presented above is to be solved calculating the present value or PV.

The program Bondmaster determines the present value of a coupon bond at the rate of interest selected by the student. It is necessary to give the computer the interest rate and the financial information on the bond. After that the present value is calculated. (Fig. 7)
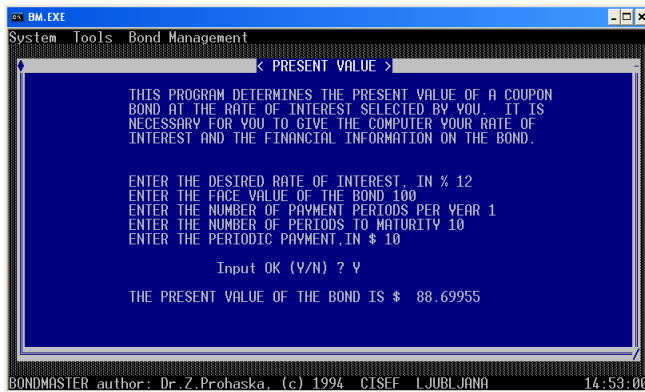

Fig. 7. Present value of a bond window

D. The duration of a bond

The duration is a measure of the average life of a bond, defined as the weighted average of the times until each payment is made, with weights proportional to the present value of the payment [4].

$$D = \left[\sum_{t=1}^{N} \frac{t_C}{(1+y)^t} + \frac{NF}{(1+y)^N} \right] : \left[\sum_{t=1}^{N} \frac{C}{(1+y)^t} + \frac{F}{(1+y)^N} \right]$$

D - duration of a bond
N - maturity in years
C - coupon
F - face value

y - rate of return/yield to maturity
t - year when the payment is made

Using duration instead of maturity it is possible to minimize interest rate risk affecting investments in bond portfolios. In the program Bondmaster duration is calculated for coupon bearing bonds both for annual and semiannual payments of interests and presented in a graph. (Fig. 8)
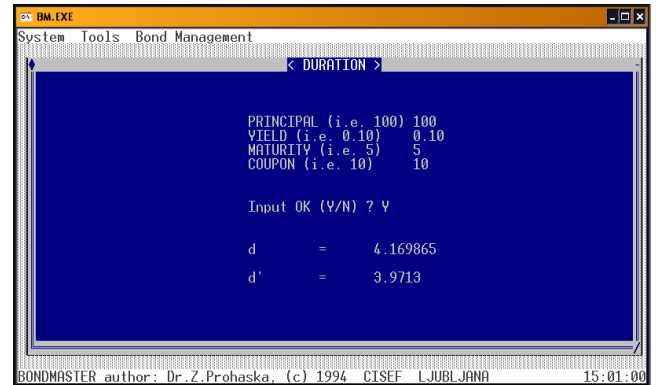

Fig. 8. Duration of a bond window

E. Currency risk

Currency risk is defined as the change of investments value because of the change of the foreign exchange rate. In the program currency risk is simulated by comparing an investment according to the change of the exchange rate for a longer time period. (Fig. 9)
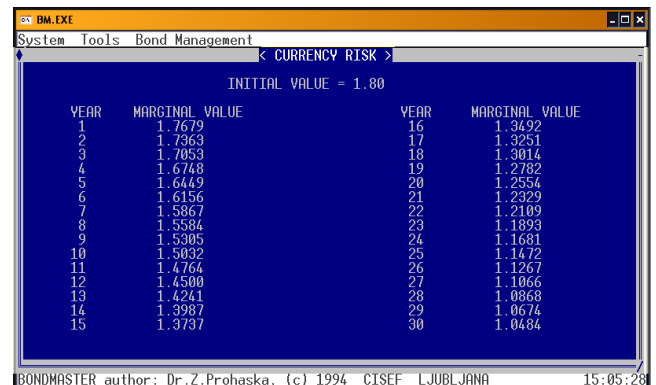

Fig. 9. Currency risk window

F. Interest rate risk

Interest rate risk means when interest rates are rising then prices of bonds are falling and vice versa, when interest rates are falling prices of bonds are rising. In the program Bondmaster the interest rate risk is taken into account in form of a scenario analysis or what-if analysis where the future interest rate is simulated via a step function (rise or fall of for example 5%) and how it affects the bond portfolio investment. (Fig. 10.)

Fig. 10. Interest rate risk window

G. Yield book

The module yield book in the program Bondmaster is actually a bond table generator explaining the relation between bond prices and yields like listing a real yield book. This program generates three bond tables – one for annual compounding and two for semiannual compounding. The semiannual (new) table uses a geometric mean approach, while the semiannual (old) uses the current valuation approach. (Fig. 11.)

Fig. 11. Yield book window

IV. DISTRIBUTION AND INSTALLATION OF THE PROGRAM

Since Bondmaster is an educational computer program its distribution and installation is kept simple. The program consists of seven files, i.e. four application files (bm.exe, bm01.exe, bm02.exe, bm03.exe) and three additional files (one help file and two readme files).

To install the program Bondmaster it is necessary to copy all the files to a directory on the hard disk of a PC (for example C:\BM) and to start the program by typing (BM) (Enter). Help is always available by pressing (F1) and pull down menus can be activated by typing (Alt) or (F10). Microsoft compatible mouse support is included whenever it was necessary and possible. At the beginning of the program a password is requested and by typing the wrong password twice a soft boot of the computer is initiated. The password should stimulate that the users participate in the investment courses where they can of course acquire the right password, but what is more important they can get the basic skills about theory and practice of securities investments in financial markets.

V. CONCLUSION

Bondmaster is an educational computer program with the main purpose to calculate basic indicators for investments in bonds and other fixed income securities. The basic indicators are for example the current yield, yield to maturity, present value and duration of coupon bearing bonds. The more sophisticated methods are trying to determine and immunize bond investments against currency risk and interest rate risk (scenario analysis). A bond table generator, which is actually a complete yield book and other helpful utilities like a calculator, calendar and file viewer with search function are also built in.

Because of its design and computer language used (Microsoft QuickBasic with several professional libraries) this program is running on PCs with Operation Systems ranging from MS DOS to Windows XP Professional.

REFERENCES

[1] Bodie, Z., Kane, A., Marcus, A.J., Investments, Irwin, Chicago, 1996
[2] Dittrich, Data Beckers grosse Quick Basic Toolbox, Data Becker GmbH, Duesseldorf, 1990
[3] Drews, D., Quick Basic Toolbox, Version 4.5, Tewi Verlag GmbH, Muenchen, 1991
[4] Fabozzi, F., Investment Management, Prentice Hall, Englewood Cliffs, New Jersey, 1995
[5] GraphPak Professional, Users Manual, Crescent Software Inc., Stamford, CT, 1991
[6] Hergert, D., Microsoft QuickBasic, Developing Structured Programs in the Microsoft QuickBasic Environment, Microsoft Press, Redmond, Washington, 1989
[7] Microsoft QuickBasic, Programming in Basic, Microsoft Corporation, Redmond, Washington, 1988
[8] Rugg, T., Feldman, P., Quickbasic, Programmer's Toolkit, Que Corporation, Carmel, In, 1993