

ORIGINAL SCIENTIFIC PAPER

BASIC CHARACTERISTICS OF BONDS AND THEIR DYNAMICS ON THE CROATIAN SECONDARY MARKET

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ABSTRACT In light of recent announcements of the Ministry of Finance about the emission of the so-called national bonds, this paper deals with the problems related to bonds as the most widely accepted financial instrument on the Croatian secondary market. Although the meaning of the bond as a debt security financial instrument is probably clear to everyone, trading and utilization of all the advantage this financial instrument offers is still insufficiently developed. Moreover, since bonds appear to be a possible alternative to bank deposits, it is necessary to determine the basic concepts of the difference in the calculation of yield between these two potential investments. Considering these facts, the contribution of this paper is aimed at taking a closer look and simplifying the overall understanding of this significant financial instrument. On top of that, the purpose of this paper is to raise the awareness of the broader public with respect to understanding of the basic characteristics of bonds, their advantages and disadvantages and ultimately to elaborate in detail the investment possibilities offered by bonds, as one of the most popular debt security financial instrument in Croatia. The first chapter describes the general problems related to bonds, their basic characteristics and current divisions. The paper then elaborates current dynamics of bonds in the secondary capital market in the Republic of Croatia, providing a comparative presentation of purchase and sale trade channels in the secondary market. The final chapter shows a practical example of price and yield calculation until maturity of the bond issued by the Ministry of Finance of RoC, being traded on Zagreb Stock Exchange.

1. INTRODUCTION

The development of bond emission and trading in the RoC was followed by the development of the overall stock exchange trading, as well as the development of the stock exchange institution as such. It can be said that the growing or dropping trends in issuing and trading with bonds, or the utilization of all the advantages or disadvantages of that financial instrument, follow the overall development of the financial market (capital market) in most countries, Croatia being no exception. Also, it is well-known that bonds,

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along with stocks, are the best known type of securities, to be found on all larger stock exchanges and almost in all countries in the world. However, due to factors influencing the change in their value, they are by far more conservative financial instrument than stocks and, on the average, their prices are not as distinctly volatile as the prices of stocks. The trade price of bonds is defined by the discount rate that has to reflect three basic components: the component of non-risk interest rate, macroeconomic inflation component and the component of additional risk premium arising from various bond characteristics such as credit risk, liquidity risk, etc. to be established from the bonds' rating. As opposed to that, the market value of stocks can be influenced by a whole range of micro and macroeconomic factors which may, but not necessarily, be connected with the joint stock company. Initially, bonds are being issued for the purpose of achieving the primary goal, and that is fund raising. Upon their emission, the bonds are traded also in the secondary market, which offers the investors the possibility to invest into them and to gain yield on invested capital.

2. BASIC CHARACTERISTICS OF BONDS

A bond is a financial debt instrument, establishing a loan commitment between the borrower and the lender. In a loan relationship, the borrower, i.e. the issuer is committed by the bond to pay to the lender, i.e. investor or bondholder the amount of money received, increased by the amount of interest accrued until a particular date or until bond's maturity date. Although this definition suggests that, by their basic characteristics, bonds are very similar to loans, there are certain differences between the two. The basic difference between a loan and a bond is that in the case of loan, only one loan is being granted and the total value of the debt equals the total value of the loan. Also, a loan establishes a loan relationship between two identified parties, most often between a bank and its client. However, in the case of debt security financial instruments, the debt structure is a bit different. Namely, the value of the total debt is divided into smaller parts, each becoming an individual transferrable security. In this debtor-creditor relationship, the initial issuer of the bonds remains unchanged. However, with respect to debt structure, the possibility of changing the lender, i.e. investor opens up. In line with this, the Capital Market Act in effect as of 1st January 2009 (Official Gazette No 88/08, 146/08 and 74/09), classifies bonds as transferrable securities, i.e. as securities establishing the right to acquire or to sell such securities, or enabling cash payments.

Furthermore, upon their issuance, the bonds are traded with in the secondary market. To consider a bond trade successful, besides making smart and timely choices, it is also important to define the way or channels of sale or purchase, which by their structure correspond to the goals one wishes to achieve. Also, when purchasing or selling this kind of financial instrument, whether through a financial intermediary or a brokerage firm, there are certain costs involved, purchase fees or fees for the service rendered. Since it is only natural for any rational investor to try and avoid any additional costs, or to reduce the existing ones, in this paper we shall, among other things, point at trade channels where bonds trade takes place in the RoC, offering lower purchase and sale costs related to this financial instrument.

As already stated above, bonds are one of the most popular financial instruments in the world. Due to such popularity and the frequency of their usage, bonds have passed a logical path of development from their basic form, the so-called coupon bonds, to much more complex varieties having emerged as a result of creation and innovation of investment banks on the capital market. So, several divisions of bonds are distinguished, meaning that bonds can be classified according to various dimensions. For better understanding, bonds should be divided at least according to some of these dimensions. However, before the classification and a more detailed analysis, let us briefly focus on some of the most prominent differences between stocks and bonds as the most dominant financial instruments currently listed on the Zagreb Stock Exchange (hereinafter referred to as - ZSE).

2.1. Basic differences between stocks and bonds

The capital of a joint stock company is represented by its stocks. These stocks represent the share of ownership of a shareholder in the joint stock company ownership, hence their name equity stocks. The total capital of a joint stock company is divided into a certain amount of stocks and each co-owner holding them, owns a proportionate part of that particular joint stock company. If the shareholders' assembly decides so, a part of net profits gained over the past period will be split pro rata among the shareholders according to their shares, in form of dividends.

On the other hand, the owners of bonds have no right to participate in company's ownership, i.e. they are not entitled to payments from net profit expressed through dividends. Namely, since bonds represent a debtor-creditor relationship, the bondholders are entitled to redeem the invested principal amount increased by the interest and within the term agreed upon in advance. So, it can be concluded that the basic difference between bonds and stocks is that stocks are proprietary and bonds are debt financial instruments, where bondholders are creditors of the issuers and shareholders are partial owners of a joint stock company. Furthermore, as opposed to stocks, bonds have a maturity date, meaning that after a certain period of time the issuer has to return the borrowed funds to the owner, and this by redeeming the bonds at their nominal value. During the bond's maturity period, the issuer has the legal obligation to pay the contracted interest, whereas the dividend is not considered to be a legal obligation as long as it is not confirmed by the assembly. From the aspect of risk regarding the return of invested capital, the essential difference between these two instruments is that bondholders have precedence over shareholders for the collection of their claims from the liquidation - bankruptcy estate. This means that in the case of bankruptcy of a company, the bondholders will be the first to collect their claims and then the shareholders. The last described difference refers to the comparison of bonds and stocks issued by a joint stock company or a corporation. As shown later on in this paper, there are several types of bond issuers. However, the basic difference in acquired rights between these two financial instruments remains the same, being that stocks are proprietary and bonds are debt financial instruments.

3. TYPES OF BONDS

As previously mentioned, bonds can be defined according to different criteria. Each of them classifies bonds into particular subtype or group. For easier recognition, below are some of the most frequently used classifications of bonds.

1. Bonds according to the type of issuer:
 - government bonds,
 - municipal bonds,
 - corporate bonds.
2. Bonds according to cash flow:
 - coupon bonds,
 - zero coupon bonds,
 - annuity bonds.
3. According to interest rate characteristics:
 - variable interest rate,
 - fixed interest rate.
4. According to maturity:
 - short-term (maturity up to 5 years),
 - mid-term (maturity from 5 to 10 years),
 - long-term (maturity over 10 years).
5. According to issuer's domicile:
 - national (issued by institutions seated in the RoC),
 - foreign (issued by institutions not seated in the RoC),
 - eurobonds (bonds issued in a currency that is not domicile currency of the country in which bonds are being issued).
6. According to the possibility of their early call or repurchase ahead of schedule:
 - bonds with the issuer's right to buy back the bond earlier than stated maturity date,
 - bonds with the investor's right to collect ahead of schedule.
7. According to currency in which bonds are issued:
 - national currency (bonds denominated in kunas)
 - foreign currency (bonds denominated in foreign currency).
8. Special types of bonds
 - bonds with collateral,
 - convertible bonds (providing the right of conversion into other financial assets),

- STRIPS bonds (where the right of individual coupon interest is being sold separately at a discount).

All the above listed characteristics are relevant when making a decision about the purchase of bonds in the secondary capital market. According to investor's preferences, he will choose the bonds best suited for his investment requirements, time horizon of the investment, portfolio structure, etc. However, since this paper is focused on the research of the domestic capital market, this paper further deals in more detail with the characteristics of bonds currently listed on the Zagreb Stock Exchange, along with their structure. So, the bonds being currently traded with on ZSE can be classified through two basic divisions: bonds according to the type of issuer and bonds according to cash flows.

3.1. Bonds according to the type of issuer

Bonds are transferrable debt financial instruments, initially created for the purpose of raising funds on the primary capital market through initial public offering¹. Since the number of issued bonds is measured by the millions, even billions of kunas in their nominal value, and since the process of public offering requires engagement of several participants², the possibility of their issue on the primary market is currently used only by large issuers having the need for substantial funds. We said that according to the type of issuer we may classify bonds into government bonds, municipal bonds and corporate bonds.

Government bonds - as the name itself suggests, government bonds are the ones being issued by the bank and other state authorities and agencies - such as the Ministry of Finance of the Republic of Croatia, or the Fund for the Restitution of and Compensation for Expropriated Property in the Republic of Croatia. The bonds issued by the state and its agencies carry the least credit risk, since in this kind of debtor-creditor relationship, the Government of the RoC guarantees the repayment of funds by its state budget. On foreign capital markets there are different types of long-term government bonds, such as: *bonds*, *debentures* and *notes*. Although there are slight differences among them in the context of maturity terms and payment insurance of investor's claims, their fundamental meaning is the same. They are long-term debt securities issued with the purpose to raise state capital.

Municipal bonds - are issued by local authorities, i.e. by cities, districts (regions), municipalities or other local government units. The capital funds raised by the issuance of municipal bonds are intended primarily to build local infrastructure such as: schools, hospitals, roads, sewage systems, but also to finance other projects characterized as public assets and/or services. Since through their issuance local infrastructure development

¹ Initial Public Offering (IPO) is the process of the first issue of securities (stocks or bonds) to the primary capital market.

² The process of bond issuance requires the assistance of authorized institutions, most often banks, organizing the initial public offering and preparing the required documents. Banks play the role of bond issuance advisory, issue arranger and provide support in trading with issued bonds also in the secondary market.

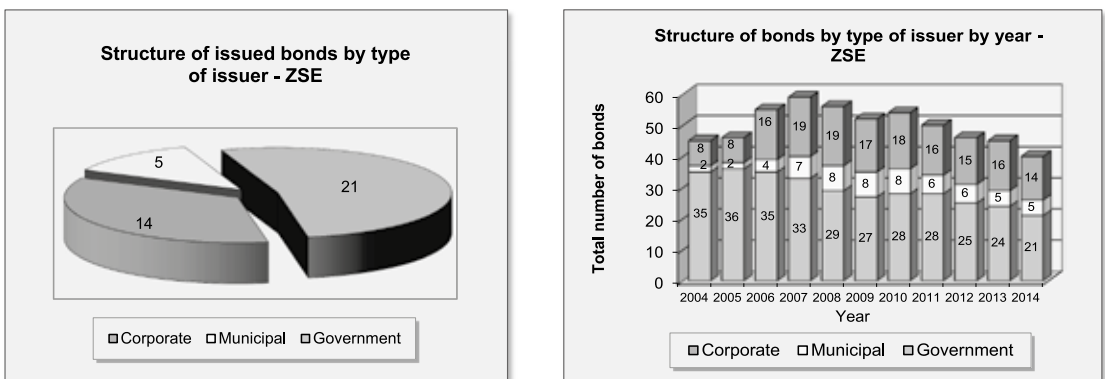
project are being financed - which bears social significance, the income generated from interest and capital gain of municipal bonds can be declared for tax relief. As well as government bonds, the municipal bonds also carry a lower credit risk for the investor, since local government guarantees for them. There are two types of municipal bonds:

- **general obligation bonds (GOs)** whose purpose is to fill up municipal budgets. The money raised by issuance of municipal bonds is used for general purposes, i.e. such funds are used to bridge current gaps in liquidity of general requirements of local government. For that reason, the payment of interest or of the principal amount upon maturity of the bond may be guaranteed from various sources of income of the local government.
- **revenue bonds** are bonds whose funds raised are mostly predetermined for a certain purpose or project. The payment of interest and of the principal amount at bond's maturity are financed from that particular project for which the funds were originally raised. For this reason, revenue bonds carry a higher credit risk than the general obligation bonds.

Corporate bonds - From the aspect of credit risk, corporate bonds fall into the highest risk category. Namely, the issuers of corporate bonds are companies pursuing various lines of business. As opposed to government bonds, i.e. municipal bonds financing their liabilities from various state and local government income sources, the repayment of funds received since the issuance of corporate bonds is guaranteed only from the core business of the company issuing the bonds. It is therefore clear that corporate bonds represent long-term liabilities of a company and for this reason they are often insured by part of or by the entire assets of the issuing company.

Below is an illustration of the current status of valid bonds on the Zagreb Stock Exchange according to the type of issuer in 2014, i.e. a comparative view of trends dynamics in the total number of bonds according to the type of issuer in the period from 2004 till the third quarter of 2014.

Figure 1: Structure of issued bonds by type of issuer on ZSE in 2014 (left figure) and structure of bonds by type of issuer by year on ZSE (right figure)



Source: Made by the author according to www.zse.hr. [accessed on 2nd Oct. 2014]

The first figure clearly shows that the total number of bond issues currently being traded with on ZSE is forty. Out of the total number, eleven issues were placed by the Ministry of Finance of the Republic of Croatia and ten issues were placed by the Fund for the Restitution of and Compensation for Expropriated Property in the Republic of Croatia. These bonds enter into the category of government bonds, making 52.50% of all observed bonds on ZSE. After the government bonds, corporate bonds follow, with the total number of issues being fourteen, i.e. with the share of 35%. The smallest number of issues, from the aspect of issuers, was recorded with the municipal (city) bonds, five in total, making 12.50% of all observed bond issues. The other figure shows the structure of bond issues by type of issuer in the period from 2004 till the third quarter 2014. With the developing capital market in the RoC, along with the recognition of all the advantages offered by bond issues, the number of municipal and corporate bond issues on ZSE has grown. Over the observed period of time, the number of bonds issued by corporations almost doubled, pointing at the growing trend of financing further development of business by bond issuance. Also, ever more local governments have recognized the advantages of financing by this debt instrument, so that the number of municipal bonds issued has increased, too. The next noticeable fact is the total drop of bond issues by the Ministry of Finance. The reason for the reduction of the total number of issues is the maturity of the old issues without any new issues. Also, one of the reasons that could be singled out is the intensified indebtedness of the state on money market through the issue of short-term treasury bills.

3.2. Bonds according to cash flows

Regardless whether the purchase or sale of a bond was carried out on the primary or secondary capital market, each related transaction sets in motion certain cash flows between the issuer and the bondholder (the investor). Accordingly, the legal entity issuing the bonds, may expect two types of cash flows:

- The first cash flow is the inflow of the funds initially raised through bond sale, being at actually borrowed funds (principal amount).
- The second cash flow consists of the outflow of funds being paid out to current bondholders (interest and principal amount), depending on the structure of cash flows that will be elaborated later on.

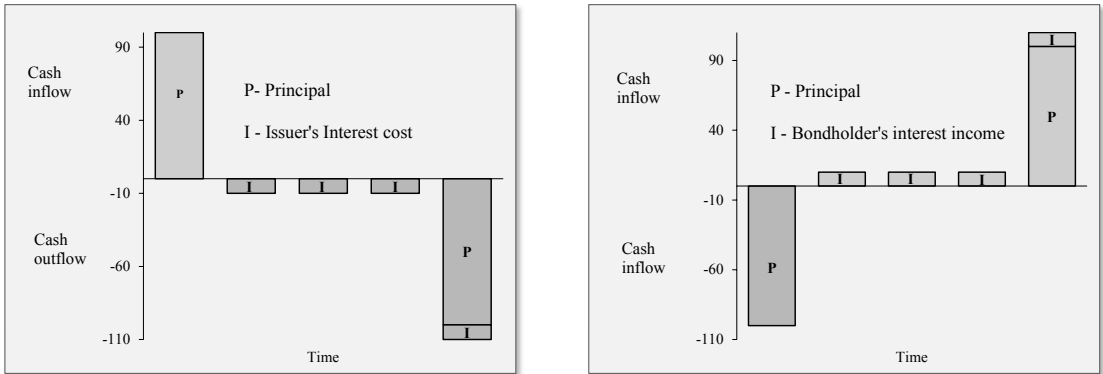
On the other hand, the purchase of bonds produces two cash flows for the investors, but with opposite signs.

- The first cash flow consists of the outflow of investor's funds for the purchase of bonds (principal amount).
- The second cash flow consists of the investor's cash inflow (interest and principal amount), also dependent on the structure of the bond's cash flows.

It should be pointed out that the contract between the issuer and the investor commits the issuer to pay the contractual amounts to the bondholder on certain dates, thereby meeting the basic prerequisite to divide the bonds by cash flow into coupon bonds, zero coupon bonds and annuity bonds.

Coupon bonds - are the type of bonds that generate earnings for their investor (bondholder) in equal periodic amounts - coupons. Each coupon represents a fixed annual interest equalling the product of the bond coupon interest rate and its nominal value (principal amount). During the bond's lifetime, periodic coupons can be paid on an annual basis, semi-annual basis or quarterly, where the principal amount (nominal value) is settled at maturity date, increased by the amount of the last coupon. If the coupons are paid on semi-annual basis, their value is proportionate to the half-year period. In other words, the value of the annual coupon is divided into two equal parts, being paid on a semi-annual basis. If the coupons are being paid on a quarterly basis, the value of the annual coupon is being divided into four equal parts, being paid on a quarterly basis. Figure 2 shows cash inflows and outflows created by the purchase of a coupon bond, in order to additionally illustrate related cash flows.

Figure 2: Issuer's cash inflow and cash outflow by coupon bonds (left figure) and coupon bondholder's cash inflow and cash outflow (right figure)



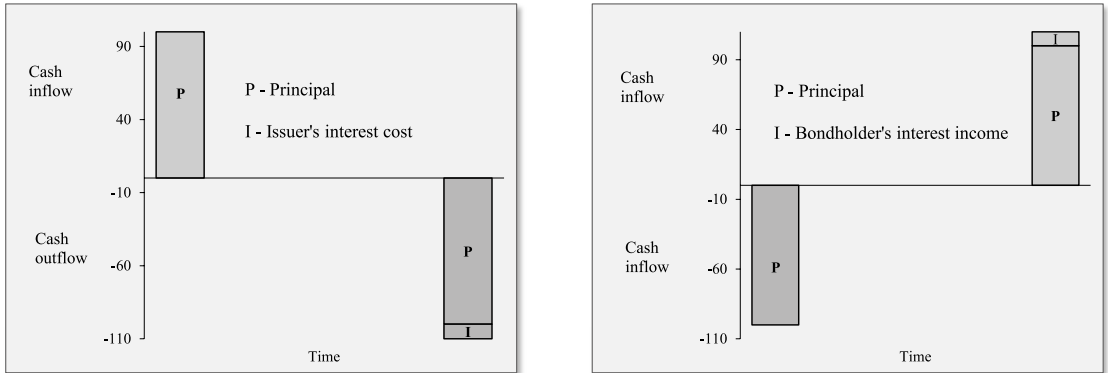
Source: Made by the author

The term „coupon“ is left from earlier times, before the computer era, when most bonds really had coupons that would be torn off by the investors and sent by post to the issuer for the purpose of interest payment³.

Zero coupon bonds - as the name itself suggests, the zero coupon bonds don't bring any cash inflows to their holders through coupons in certain intervals over the bond's lifetime. Namely, that is the kind of bond by which the issuer commits to effect only one payment on a certain future date and that payment is equal to the bond's nominal value, increased by the corresponding amount of interest. This type of bonds is being sold at the price significantly lower than its nominal value, so that the investor's yield arises only from the difference of the amount of invested funds at the moment the bond was purchased and the amount of funds received at bond's maturity. The difference between the purchase and the nominal value is the investor's realized interest rate. The investor's and the issuer's cash flows by this type of bonds are shown in figure 3.

³ Cvjetičanin, M.: *Burzovno trgovanje*, Masmedia, Zagreb, 2004, page 104.

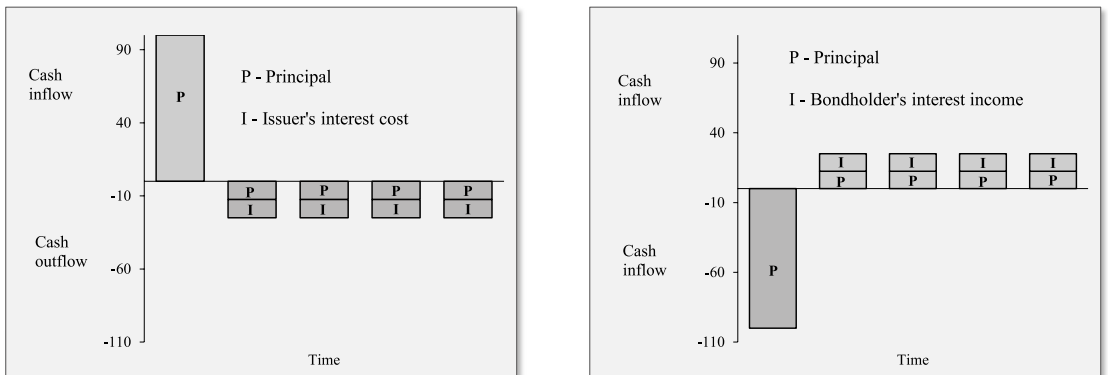
Figure 3: Cash inflow and cash outflow of the issuer of zero coupon bond (left figure) and cash outflow and cash inflow of the holder of zero coupon bond (right figure)



Source: Made by the author

Annuity bonds - The cash flows of annuity bonds are very similar to the cash flows of bank loans. The difference between cash flows of annuity bonds and of granted bank loans can be only in the way of interest calculation. In this case, the investors make a one-time purchase of bonds, while the issuers undertake to pay the investors equal annuities throughout the bond's lifetime. As in any other standard loan relationship, the annuities consist of the interest and a part of the principal amount. The dynamics of their payment may be annual or semi-annual. Figure 3 shows the dynamics of cash flow of annuity bonds.

Figure 3: Cash inflow and cash outflow of issuers of annuity bonds (left figure) and cash outflow and cash inflow of the holder of annuity bond (right figure)



Source: Made by the author

Taking into account their strategy and their ultimate goals, the investors will choose the structure of cash flow that best suits their purpose. Although there is infrastructure on the Zagreb Stock Exchange enabling trading with all of the above presented types of bonds, most frequent ones, with by far the highest turnover, are the coupon bonds of the Ministry of Finance of the RoC.

The allocation of capital into bonds has certain advantages, but also some disadvantages. The advantage of purchase of coupon bonds and of zero coupon bonds is that the principal amount invested is returned as one-time payment, and not in parts. Accordingly, investors don't have to worry about re-investing the bulk of their funds until the bond maturity. Also, the liquidity of the instrument is also indicated as an advantage, as it enables quick sale in the case of changed investor's strategy or in the case of an increased risk of the bond's issuer. Besides this, the investors have the opportunity of a comparative analysis of several various bonds in order to make the best decision about their investment.

On the other hand, the disadvantages being mentioned in the context of investment into bonds are connected with the change of market interest rates and the secondary market. Namely, if an investor possesses a bond in his portfolio that brings him a fixed interest rate, the change in the value of market interest rates will affect the change of the bond's value. Also, in the calculation of yield until maturity of the bond, reinvesting of received coupons is being understood. Since the market interest rates continuously change over time, the investors are not able to achieve their desired yields. Also, the deterioration of credit rating of the bond's issuer should be mentioned here, resulting in capital losses through the changed value of the bond in the secondary market. In the worst scenario, the deterioration of the credit rating may be an indicator of significant problems, which puts on the line even the return of the initially invested principal amount of the investor.

4. TRADING WITH BONDS ON THE CROATIAN SECONDARY MARKET

After the bonds have been placed on the market for the public through the Initial Public Offering, the investors are free to purchase and sell bonds in the secondary market - on the stock exchange, as well as on OTC markets. Generally, the stock exchange is defined as a trading institution, meaning a specifically organized and permanent market where at particular times and in compliance with certain previously developed set of rules, usances and procedures, certain standardized goods, services, money, foreign currencies and securities are traded, which in the statutes or regulations of the stock exchange are defined as its line of business⁴. From this definition of the stock exchange it is clear that stock exchange trading has to operate within the framework of adopted rules and procedures, i.e. that the participants in such trade are subject to certain legal rules and regulations. Accordingly, the stock exchange gets certain fees for each transaction carried out in the secondary market, defined depending on the type of financial instrument and on the trade channel through which the transaction was done. Since all investors, and especially the institutional ones (funds, banks, etc.) - creating a substantial part of bond trading on ZSE, wish to reduce their transaction costs, the investors use the channels with lower fees. According to that, the bond trading on the Croatian secondary market may be divided into three groups:

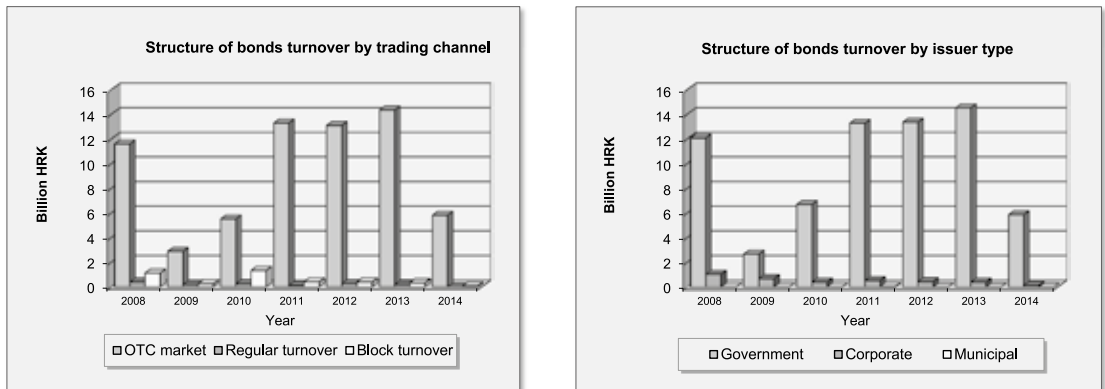
- regular turnover - transactions taking place on the regulated market - the stock exchange,

⁴ Andrijačić, I. and Vidaković, N.: *Poslovanje na robnim burzama-načela i praksa*. Effectus, Zagreb, 2015.

- OTC (*Over The Counter*) trading - transactions done outside the boundaries of regulated markets,
- block turnover - transactions done by exchange of messages over the trading system. The minimum size and other parameters of a block transaction for certain financial instruments are set by the stock exchange and published on its website.

The costs of transactions on the OTC market are significantly lower. There are also no brokerage fees in connection with the OTC trading, because the deals on purchase and sale are made directly between the interested parties. Another advantage of the OTC trading are lower depository costs. For these reasons, the OTC market, especially in the time of financial crisis, has become the main channel for the purchase and sale of bonds in the secondary market. For an additional illustration of bond trading in the RoC through various trading channels, figure 4 (left figure) shows a comparison of the structure of realized turnover in the period from 2008 till the third quarter of 2014.

Figure 4: The structure of bonds turnover by trading channel by year (left figure) and the structure of bonds turnover by issuer type by year on the ZSE (right figure)



Source: Made by the author according to www.zse.hr [accessed on: 2nd Oct. 2014]

The first figure suggests that a substantial portion of bonds trading takes place on the OTC market. After the spillover of the financial crisis in 2008 to the eurozone area and later on to Croatia, a dramatic drop occurred in the transactions with bonds registered on the ZSE, as well as with other securities. The reduced scope of trading persisted throughout 2010 and in 2011 the OTC market recovered, having reached substantial turnover. Although this result might suggest the recovery of the overall turnover of securities, this however did not occur. Namely, the increased trading with bonds emerged from an increased diversification of risk, i.e. from an increased reluctance of investors towards the risk arising from trading with proprietary financial instruments. The investors are willing to get significantly lower yields on the capital market, by investing their free funds into far more secure instruments, such as government bonds, than they would get by investing into much riskier instruments - stocks. The dynamics of high turnover in bonds on the

OTC market continued in the following years, 2011, 2012 and 2013. As opposed to the OTC trading, the regular turnover and the block turnover has not recovered. Comparing their dynamics over the years, it may be concluded that the trading with bonds on the observed markets is still at low levels. The figure on the right shows the structure of bonds trading by issuer type. Comparing the bond turnover trend by trading channel (left figure) with the bond turnover trend by issuer type (right figure), an almost identical dynamics of their values can be detected. Observing both figures together, it can be concluded that a large portion of the total registered bonds turnover in the RoC occurs with the government bonds of the Ministry of Finance, and this on the OTC market. Since government bonds of the Ministry of Finance are exclusively multiple coupon bonds, this paper further elaborates the technique of calculation of the price and yield per coupon bonds as the most widely used financial instrument on the Croatian secondary market.

5. BOND PRICE AND YIELD

Bonds are debt security financial instrument which, like all other instrument, brings possibilities to investors to allocate free funds with the purpose to get yield over a certain investment period. Generally, the yield in the investment period is the basic measure of success of investment on the capital market, where the logical goal of every investor is to achieve the highest yield possible from the invested funds. The rational approach to investing is evident through realization of the highest possible yield for a given risk level, i.e. through realization of the highest possible yield along with accepting as little risk as possible. For this reason it is necessary to be familiar with all the characteristics of the financial instrument to which funds are being allocated, with its cash flows and the level of risk that the investor assumes when trading with that instrument. The Ministry of Finance bond is considered to be a risk free investment or an investment with the minimum credit risk because, as already mentioned before, the state guarantees by its budget the payment of the interest and the principal amount at maturity.

Furthermore, there are different variations of yields with respect to the time horizon of the investment, as well as in the techniques of its expression. The measure of success should be unambiguous at all levels, so that potential investors may be able to determine the investment that brings highest anticipated yield, without having to think of opportunity costs possibly arising from a mistake, or a bad estimate of an investment. In other words, if the estimate of investment viability overestimates the cash flows of one investment, or underestimates the cash flows of some other investment, opportunity cost problem related to investment may arise because the investor does not actually know which investment is better. In order to avoid that, the anticipated long-term cash flows are most often estimated and expressed at an annual level by application of complex interest techniques (for instance yield till bond maturity), whereas investments maturing within a year are evaluated and expressed at an annual level by application of simple interest techniques (for instance yield on treasury bills)⁵. In view of all these facts, the technique of calculation

⁵ Some investors apply also the complex interest technique on investments shorter than a year, so that the generated yields, regardless of the time horizon, could be comparable.

of interest per long-term deposits offered by banks for their client's term deposits⁶, should equal the interest rate - yield per long-term bond. Although, when evaluating these cash flows, the complex interest calculation (interest on interest) is being applied in the initial calculation, there are certain differences in the calculation of these yields that potential investors should be aware of. However, before describing these differences, one should define the determinants that make up the bond price, in compliance with the desired investor's yield.

5.1. Determining the bond price in the secondary market

Depending on the yield an investor wishes to get from his investment, the investor defines the bond price, i.e. the bond price is in direct function of the annual yield that the investor wants to achieve. It should be pointed out that the price of any financial instrument equals the current value of anticipated cash flows generated from that financial instrument. Accordingly, in order to determine the bond price, the following data must be available:

- amount of anticipated cash flows,
- interest or discount rates to calculate present value.

Table 1. Data on bond issue: RHM-F-O-172A

Details	Values
Security type	Bond
Last price	102.20
Number listed	5,500,000,000
Nominal value	1.00 HRK
Issue date	8.2.2007
Maturity date	8.2.2017
Interest rate (coupons)	4.750 %
Payment period	semi-annual

Source: *www.zse.hr* [accessed on 2nd Oct. 2014]

Table 1 shows actual data on bond issue of the Ministry of Finance of the Republic of Croatia listed on the Zagreb Stock Exchange under the symbol: RHM-F-O-172A. The bonds issued on 8th February 2007 are shown, maturing in ten years, on 8th February 2017. The bonds were issued in HRK with the nominal value of 1 HRK, being also the smallest bond part on which interest is calculated. The annual rate on the bond is 4.750%, being paid semi-annually (2.375%), the last semi-annual interest becoming due on the maturity date of the principal amount.

⁶ It should be pointed out that the interest rate on deposit offered by the banks to their clients actually the yield that the clients will achieve if they make term deposits for a certain period of time.

Example 1

Let us assume that the investor wants to purchase 10,000.00 HRK nominal value of the mentioned bond of the Ministry of Finance on 2nd October 2014. What would be the price (discount amount) of the bond if the investor wants to achieve an annual yield until maturity of 3.00%? The bond price is calculated by means of expression 1⁷:

$$Price = \sum_{t=1}^{BPK} \frac{\frac{coupon}{2}}{\left(1 + \frac{YTM}{2}\right)^{\left((t-1) + \frac{BD}{UBD}\right)}} + \frac{NV}{\left(1 + \frac{YTM}{2}\right)^{\left((BPK-1) + \frac{BD}{UBD}\right)}} \quad (1)$$

Key to symbols:

BPK - number of coupon payments left, *YTM* - yield to maturity), *BD* - number of days since the date of settlement⁸ until the date of payment of next coupon, *UBD* - total number of days in a coupon period, *NV* - nominal value, *t* - number of periods till maturity, *coupon* - coupon interest rate per bond.

According to Table 1, the data required to calculate the bond price are the following: *BPK* - from 2nd October 2014 till 8th February 2017, there are 5 coupon semi-annual payments left, *YTM* - yield to maturity 3.00%, *BD* - from 2nd October till the date of payment of the next coupon on 8th February 2015 there are 129 days left, *UBD* - total number of days in the semi-annual coupon period is 184 days, because the coupons are paid on a semi-annual basis, *NV* - nominal value the investor wants to get at maturity and the value on which the interest is calculated in 10,000.00 HR, *t* - 5 coupon periods to maturity, *coupon* - the coupon value on nominal value is 475.00 HRK.

By entering required data about the Ministry of Finance bond into expression 1, we get the following bond price:

$$10,464.95 = \frac{\frac{475.00}{2}}{\left(1 + \frac{0.03}{2}\right)^{\left((1-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.03}{2}\right)^{\left((2-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.03}{2}\right)^{\left((3-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.03}{2}\right)^{\left((4-1) + \frac{129}{184}\right)}} \\ + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.03}{2}\right)^{\left((5-1) + \frac{129}{184}\right)}} + \frac{10,000.00}{\left(1 + \frac{0.03}{2}\right)^{\left((5-1) + \frac{129}{184}\right)}}$$

If an investor wants to achieve the annual yield to maturity of the bond amounting to 3.00%, he should offer a price exceeding 10.464,95 HRK, i.e. 104.65% of the bond's

⁷ MS excel programme may be used to calculate the bond price and the integral function „PRICE“. However, the price obtained in this way should be increased by accrued interests.

⁸ Settlement date is the date on which securities are transferred from the seller/delivering party to the buyer/receiving party and on which the payments are effected, all in compliance with the rights and obligations arising from the transaction.

nominal value, since the bond prices are indicated in a percentage of the nominal price. It should be mentioned that this kind of calculation accounts for accrued interest payable to the bond holder, pro rata to the time the bond was held by him⁹. Moreover, considering the desired investor's yield, the price thus obtained suggests that the bond was underestimated. Actually, to achieve the annual yield to maturity of 3.00%, the investor is willing to pay an even higher price than the price shown in Table 1. Now the question arises: if the investor decides to purchase the bond at its current market price, what kind of yield can be achieved if the bond is held till maturity date?

5.2. Determining the bond's yield in the secondary market

Yield to maturity is indicated as the internal profitability rate of an investment, which is also one of the basic measures in the investment feasibility analysis. The calculation of the internal profitability rate is determined by the assumption of reinvestment of the cash flows arising from the investments under evaluation. This assumption makes one of the basic differences in the technique of calculating the yield arising from investment into coupon bonds as opposed to investment into bank deposits. Namely, for the investors who decide to invest into bonds to achieve the desired yield, they should have to re-invest into future bond cash coupons at the very same interest rate - in order to meet the assumption of complex interest accrual, i.e. the calculation of interest on interest. On the other hand, by allocating their funds in bank deposits, the investors don't have to worry about reinvesting the interests because, if such savings model is chosen, the banks calculate themselves the interest on the total amount consisting of the principal amount and the interests accrued until that moment. This makes investments into bonds simpler than investing into bonds. However, the calculation of interest is most often done by the conformal method, meaning that regardless of the number of interest accruals over the year, the accrued interest rate, i.e. investor's yield is the rate offered by the bank for its deposits. As opposed to deposits, the annual interest rate on bonds is divided pro rata, depending on the number of coupons paid over a period of one year. Accordingly, it may be concluded that the yield achieved from bonds is calculated by compound interest calculation, but on the proportional interest - which makes investment into bonds a better investment choice.

Example 1

Let us assume that on 2nd October 2014 an investor intends to purchase 10,000.00 HRK nominal value of the mentioned Ministry of Finance bonds, at the price equal to current bond quotation given in Table 1, i.e. 102.20% of nominal value, or the total price of 10,220.00 HRK. Which yield on bond will the investor achieve if he holds the bond till maturity date? Before calculating the yield, the bond's market price should be increased by accrued interest payable to the bond holder. The accrued interests are calculated by means of expression 2:

⁹ If the settlement date is between coupon payment dates, then the bond seller will be entitled to a part of the interest for the period from the last coupon's payment date until the settlement date.

$$Accrued\ interest = \frac{coupon}{2} \times \frac{BDN}{UBD} = \frac{475.00}{2} \times \frac{55}{184} = 71\ HRK \tag{2}$$

Key to symbols:

BDN - number of days from the date of last coupon payment till settlement date, other symbols as before.

Total bond price is being increased by the value of accrued interest, amounting to 10,291.00 HRK. Bringing cash flows of the bond to the initial investment value, the investor calculates the discount interest rate, i.e. yield to maturity of the bond¹⁰. The expression applied to calculate the yield is expression 1.

$$10,291.00 = \frac{\frac{475.00}{2}}{\left(1 + \frac{0.0376}{2}\right)^{\left((1-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.0376}{2}\right)^{\left((2-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.0376}{2}\right)^{\left((3-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.0376}{2}\right)^{\left((4-1) + \frac{129}{184}\right)}} + \frac{\frac{475.00}{2}}{\left(1 + \frac{0.0376}{2}\right)^{\left((5-1) + \frac{129}{184}\right)}} + \frac{10.000}{\left(1 + \frac{0.0376}{2}\right)^{\left((5-1) + \frac{129}{184}\right)}}$$

The interest rate reducing future cash flows from the bond to current investment value is the interest rate of 3.76%. The interest shown is the yield an investor would achieve if he held the bond till maturity, provided that all due coupons have been reinvested at the same interest rate. Below is an overview of current yields to maturity of all active bonds of the Ministry of Finance achievable if the bonds were purchased on 15th November 2014 at current market prices that include accrued interest.

Table 2. Current yields of active bonds at ZSE

Symbol	Maturity Date	Yield to Maturity
RHMF-O-157A	14.7.2015	-1.07%
RHMF-O-15CA	15.12.2015	2.45%
RHMF-O-167A	22.7.2016	2.49%
RHMF-O-172A	8.2.2017	3.75%
RHMF-O-17BA	25.11.2017	3.51%
RHMF-O-187A	10.7.2018	3.66%
RHMF-O-19BA	29.11.2019	3.44%
RHMF-O-203A	5.3.2020	3.29%
RHMF-O-203E	5.3.2020	3.65%
RHMF-O-227E	22.7.2022	3.68%
RHMF-O-247E	10.7.2024	4.14%

Source: www.zse.hr. [accessed on 15th Nov. 2014]

¹⁰ Yield to maturity of bond is calculated by iteration and interpolation procedures, in order to find an unambiguous discount interest rate that would reduce future cash flows to the current investment value. In this paper, MS excel programme and the function „YIELD“, which is integrated in the programme, was used to calculate the yield.

One can easily notice that the longer the period till maturity, the higher the yield to maturity on bonds. This kind of dynamics is in line with the level of credit risk assumed by the investors. Namely, by allocating their funds for a longer period of time, the investors assume a higher risk and for this reason require a higher premium for the credit risk, i.e. a higher yield.

6. CONCLUSION

Bonds are debt security financial instruments offering the possibility of financing through their issue, but also of allocating surplus investor's funds, with the purpose of achieving yield over an investment period. They are issued by the government, by local authorities or cities and large corporations. After their primary issue, the bonds can also be traded in the secondary capital market. This paper presented the fact that investors are most confident with the government bonds that are predominant on the domestic market, i.e. that the highest turnover in the secondary market of the Republic of Croatia is achieved with the Ministry of Finance coupon bonds with semi-annual coupon payment. Besides this, the largest portion of the overall registered bond turnover takes place in the OTC market.

Depending on the desired yield, an investor determines the maximum bond price he is willing to pay to achieve that targeted yield. Since bonds may be considered an alternative to investment into bank deposits, this paper points at the differences in the evaluation of cash flow that each of these two investment types imply. In the context of realized profit for the investor, the problem of significance of yield to maturity is elaborated, as opposed to the yield the investor might achieve if he allocated his funds into bank deposits. The advantage of choosing bank deposits over bonds is that the investor doesn't have to worry about reinvesting the interests. By application of compound interest techniques, the banks calculate themselves the interest on the principal amount which is then increased by the interests accrued until that moment. However, most of the banks calculate interests on clients' deposits by the conformal method, meaning that regardless of the number of accruals over the investment period, the achieved yield is the rate offered by the bank for its deposits. On the other hand, investing into coupon bonds with semi-annual payments offers certain advantages. As opposed to the conformal interest rate offered by the bank on deposits, the coupon interest rate is divided into two equal parts, payable on a semi-annual basis. Moreover, if the received semi-annual coupons are reinvested, the investor may achieve higher yields than by placing his funds into bank deposits. Finally, it should be pointed out that according to the announcements of 1st January 2015, through the new Taxation of Interests on Savings Deposits Act, substantial term deposits shall be subject to taxation, which provides a slight advantage for bond investments, since coupon interests on bonds are not yet subject to taxation.

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