ISSN 2959-6130

Analyzing the Impact of Yields on Current Bond Prices Based on Bond Pricing Theory

Yahui Sun[1,*]

[1]Department of finance, Harbin Finance University,Shenzhen,China
*Corresponding author:syh15776825996@outlook.com

Abstract:
For businesses, financial institutions, and other organizations, funds can be raised through several methods, including issuing stocks or bonds or obtaining bank loans. Bond issuance is a crucial financing tool. When a business or institution decides to issue bonds, the yield is a key consideration because it determines both the financing cost and the cash flow required for repayment. This study used bond pricing theory and mathematical derivations to analyze the relationship between corporate bond prices and yields.The analysis showed that bond prices and yields are inversely proportional. This finding indicates that businesses can determine bond pricing and interest payments, as well as the repayment amount and term of bank loans, based on their expected cash flows and acceptable financing costs, thereby ensuring cash-flow stability and reducing financing risk.

Keywords: Bond Pricing Theory, Yield To Maturity, Bond Valuation, Financing Decisions, Cash-Flow Management

1.Introduction

Financing for enterprises and institutions is typically classified as direct or indirect. Direct financing refers to raising funds by issuing stocks or bonds, whereas indirect financing generally involves bank loans. For some entities, issuing stocks may not meet eligibility requirements or may entail the risk of equity dilution, while bank loans can be constrained by lenders' approval limits. Consequently, many enterprises and institutions choose to issue bonds. When raising funds through bond issuance or bank loans [1], an enterprise must consider both the financing cost and the regular cash-flow outlays required for repayment [2]. The yield is therefore a central metric, as it determines the bond' issue price and the size of the periodic cash flows to be repaid. The issue price, in turn, determines the total process raised. Firms also need to keep scheduled repayment cash flows within a controllable range [3], which safeguards creditworthiness, enables planned repayment ,reduces financial risk[4], and helps maintain stable operations.

By examining the relationships among three types of bonds and their yields and considering their applications in bank lending businesses and other institutions can better understand each bond's pricing model, repayment profile, and issuance requirements, thereby identifying the most suitable issuance method. Based on the relationship between yield and bond price, firms can issue bonds that align with their current financial condition, funding needs, and cash-flow capacity. This supports stable cash flows, manageable

ISSN 2959-6130

debt-repayment risk, and controllable financing costs. This study analyzed the relationship between bond prices and yields through theoretical derivations and model analysis and provided case studies illustrating issuance options for several businesses and institutions. These insights enable firms to tailor their issuance structures and scales to their specific needs.

2.Financial Asset Pricing Theory

2.1 Time Value

2.1.1 Basic Concepts and Comparisons of Simple and Compound Interest

Generally speaking, every financial asset has a value, and the value of a financial asset changes over time. For example, if you have $100 today and the current bank savings interest rate is 5%, if you deposit this money in the bank, you will receive $105 in one year ,(100*(1+5%)=105.

This $100 is the present value, or current value. The interest rate is r = 5%, it is simple interest [5], and the $105 you receive in one year consists of $100 principal and $5 interest.

Generally, customers have two options. The first is to continue depositing the principal of 100 yuan in the bank in the second year. If the interest rate remains unchanged in the second year, they will receive an additional 105 yuan in income in the third year. This interest rate is called simple interest. Simple interest is often used in many aspects, such as some financial products such as bank time deposits. That is, customers can make a regular deposit at the bank with a 3-year interest rate of 5%. If the customer's principal is US$100, they will receive 115 yuan in three years, (100+100*5%*3)=115.

The second option is to deposit the $105 received in the first year. Assuming the interest rate remains constant at 5% for three years, the customer will receive $110.25 in the second year (105 * (1 + 5%) = 100 * (1 + 5%) * (1 + 5%) = 100 * (1 + 5%) ^ 2 = 110.25). Similarly, if the customer continues to deposit $110.25 in the second year, the customer will receive $115.7625 in the third year, 110.25*(1+5%)=100(1+5%)(1+5%)(1+5%)=100*(1+5%)^3=115.7625. This situation is compound interest.

2.1.2 The Difference Between Simple and Compound Interest

In this example, the returns from simple interest and compound interest appear similar. For a three-year term with a 5% interest rate, the simple interest yields principal plus interest of 115 yuan, while the compound interest yields 115.7625 yuan. However, over the long term, the difference between simple and compound interest is significant. Assume the principal is c. If the interest rate is r and the term is t, the simple interest return formula is:

$$c + c \cdot r \cdot t \tag{1}$$

The compound interest formula is:

$$c \cdot (1+r)^t \tag{2}$$

The difference between compound interest and simple interest is

$$\begin{aligned} &= c \cdot (1+r)^t - (c + c \cdot r \cdot t) \\ &= c \cdot (\sum_{k=0}^{t} C(t,k) 1^k r^{t-k} - C(t,t) 1^t r^0 - C(t,t-1) 1^{t-1} r^1) \\ &= c \cdot (C(t,0) 1^0 r^t + C(t,1) 1^1 r^{t-1} + \ldots\ldots + C(t,t-2) 1^{t-2} r^2) \end{aligned} \tag{3}$$

So when t is greater than 2, the return differential is positive. The larger t is, the greater the return differential. Therefore, when investors save, compounding their investments maximizes returns. Therefore, many bond pricing models are based on compound interest[6] .

2.2 Definition and Function of Present Value and Yield to Maturity

Because banks exist, assets have time value, meaning that the value of $100 today is different from the value of $100 in the next year. If other factors are not considered, if you deposit $100 today and earn an annual interest rate of r, you will receive $100(1 + r) next year. Therefore, if r remains constant, $100 this year is equal to $100(1 + r) in the first year.

Therefore, it can be deduced that if one deposits $100(1+r) in the bank in the first year, one will receive $100(1+r)^2 in the second year. This is the return of compound interest, or

$$\begin{aligned} &100, (y=0) \\ &= 100 \cdot (1+r), (y=1) \\ &= 100 \cdot (1+r)^2, (y=2) \\ &= \ldots\ldots = 100 \cdot (1+r)^t, (y=t) \end{aligned} \tag{4}$$

So, if the expected receipt of in year t is $100(1+r)^(t), the present value discounted to the present is $100[7].

Present value

$$p = \frac{100(1+r)^t}{(1+r)^t} = 100 \tag{5}$$

So, if pv is the principal, CF is the cash flow in year t, and the interest rate is r, the present value formula is

$$p = \frac{CF}{(1+r)^t} \tag{6}$$

In this formula,

$$CF = 100 \cdot (1+r)^t \tag{7}$$

CF varies for different financial instruments.

The r in the formula can be called the yield to maturity, which is the interest rate that makes the discounted future cash flow CF equal to the present value P. In this financial instrument, the yield to maturity is equal to the bank's annual interest rate.

The formula also shows that when other conditions are fixed, the yield r directly affects the bond price p.

3.Bond Pricing Model

3.1 Present Value of Coupon Bonds

Coupon bonds are a common type of bond in the capital market, typically issued by corporations and governments [8]. Coupon bonds typically have a specific face value and maturity date. Prior to maturity, the issuer pays the bondholder a fixed amount of interest each year. At maturity, the issuer repays the principal in full.

Assume a coupon bond has a face value of F, a term of t years, a fixed annual interest payment of c, and r is the coupon bond's yield to maturity. Therefore, the present value formula for the coupon bond is:

$$p = \frac{c}{(1+r)} + \frac{c}{(1+r)^2} + ... + \frac{c}{(1+r)^t} + \frac{F}{(1+r)^t} \quad (8)$$

Organizing this into a series formula yields:

$$p = c \cdot \sum_{t=1}^{t} (\frac{1}{1+r})^t + \frac{F}{(1+r)^t} \quad (9)$$

From the formula, we can analyze that: for coupon bonds, the annual interest payment is fixed, and the principal repayment on the maturity date is known. Since C and F in the formula are known and fixed, at a fixed time t, the yield r is inversely proportional to the coupon bond p.

That is, the higher the yield, the lower the present value of the coupon bond, and thus the lower the price. The lower the yield, the higher the present value of the coupon bond, and thus the higher the price.

If a company issues this type of bond, it can determine its price based on its creditworthiness in the capital market. Generally, companies or government agencies with better creditworthiness tend to issue bonds with lower yields, thus potentially obtaining a higher issue price, which is the present value of the bond.

3.2 Discount Bonds

Discount bonds are issued at a discount to par value, require no periodic interest payments, and are repaid to investors at par upon maturity. Treasury bonds, like those in many countries, are generally classified as discount bonds. Therefore, when the face value is F, the yield is r, and the time is t years, the present value formula of the discount bond is:

$$p = \frac{F}{(1+r)^t} \quad (10)$$

Similarly, when the face value F and the time t are fixed, the present value of the discount bond is inversely proportional to the yield, that is:

The higher the yield, the lower the present value of the discount bond, and thus the lower the price. The lower the yield, the higher the present value of the discount bond, and thus the higher the price.

Similarly, these interest-free bonds are generally issued by institutions with very high credit worthiness, such as :bank , country and local government [9].

3.3 Perpetual Bonds

Perpetual bonds are bonds with no term or maturity date, and pay fixed interest at regular intervals [10]. They are typically issued by banks or governments. They typically terminate through redemption. They are typically backed by the strong creditworthiness of the issuing institution, thus adopting a model of paying fixed interest indefinitely. When the annual fixed interest rate is C, the present value formula of a perpetual bond is:

$$p = \frac{c}{(1+r)} + \frac{c}{(1+r)^2} + ... + \frac{c}{(1+r)^t}, t \to +\infty \quad (11)$$

Using the series formula, we obtain:

$$p = c \cdot \sum_{t=1}^{t} (\frac{1}{1+t})^t, t \to +\infty \quad (12)$$

Assume

$$q = \frac{1}{1+r} \quad (13)$$

$$p = c \cdot \lim_{t \to +\infty} \sum_{t=1}^{t} q^t = c \cdot (\frac{q}{1-q}) \quad (14)$$

Because

$$q = \frac{1}{1+r} \quad (15)$$

$$q = \frac{1}{1+r}$$

$$\frac{q}{1-q} = \left(\frac{\frac{1}{1+r}}{1 - \frac{1}{1+r}} \right) = \left(\frac{\frac{1}{1+r}}{\frac{r}{1+r}} \right) \quad (16)$$

$$= \frac{1}{r}$$

Therefore, the present value formula for a perpetual bond is:

$$p = c \cdot (\frac{q}{1-q}) = c \cdot \frac{1}{r} = \frac{c}{r} \quad (16)$$

The present value formula of a perpetual bond is P = C/r, where C is the annual fixed interest rate, a constant. Therefore, the relationship between the present value of a perpetual bond and the yield to maturity is inversely proportional, that is:

The higher the yield to maturity, the lower the present value of the perpetual bond, and thus the lower the price. The lower the yield to maturity, the higher the present value of the perpetual bond, and thus the higher the price.

ISSN 2959-6130

4. Comprehensive Analysis of Yield and Bond Price

The above discussion discusses three common types of bonds: coupon bonds, discount bonds, and perpetual bonds. Present value formulas for each of these three types of bonds have been derived.

Coupon bond:

$$p = \frac{c}{(1+r)} + \frac{c}{(1+r)^2} + ... + \frac{c}{(1+r)^t} + \frac{F}{(1+r)^t} \tag{17}$$

Discount bond:

$$p = \frac{F}{(1+r)^t} \tag{18}$$

Perpetual bond:

$$p = \frac{c}{r} \tag{19}$$

The present value formulas for these three types of bonds all lead to the same conclusion: when the interest received and the principal are fixed, the present value of the bond is inversely proportional to the yield.

That is, as the yield increases, the present value of the bond decreases, and thus the price. As the yield decreases, the present value of the bond increases, and thus the price. Conversely, when the bond price is higher, the yield decreases; when the bond price is lower, the yield increases. Enterprises, financial institutions, and other institutions need to determine the bond price and yield offered to investors based on their own creditworthiness and funding needs.

5.Applications of Bond Pricing Theory

5.1 Bank Loan Pricing and Cash Flow Management

Bond pricing theory can be applied in many areas, the most basic of which is the calculation of corporate and individual bank loans, as many banks' loan structures are very similar to bond pricing theory.

For example, a company wants to borrow P dollars from a bank at an interest rate of r. It now wants to estimate the annual repayment amount to ensure stable cash flow. To do this, it can use bond pricing theory to analyze the relationship between the annual repayment amount and the term.

Assuming the company needs to repay an annual amount C, and the term is t, the loan formula is:

$$p = \frac{c}{(1+r)} + \frac{c}{(1+r)^2} + ... + \frac{c}{(1+r)^t} \tag{20}$$

$$p = c \cdot \sum_{t=1}^{t} \left(\frac{1}{1+r} \right)^t \tag{21}$$

Therefore, when a company borrows money, the amount it needs now is fixed, P, and the bank interest rate, r, is also fixed. The annual repayment amount to the bank is inversely proportional to the time t. That is, the larger t is, the smaller C is, and the smaller the annual repayment amount is. Companies can reasonably plan the repayment period and amount based on their cash flow to ensure a stable and healthy cash flow while also managing and mitigating various financial risks.

5.2 Comparing Issuance Costs for Enterprises with Different Credit Ratings

When a company plans to issue bonds [11], it must disclose its credit rating and publicly present its repayment capacity and financial condition so that investors can assess the issuer's debt-servicing ability and the bond's risk. Differences in capital scale and creditworthiness influence the market's assessment of a company's repayment risk. Credit rating agencies typically analyze a firm's operations and cash flows and have relied on financial data and operating activity from the preceding year; they then issue a credit rating report that evidences the firm's repayment capacity. This report is essential for bond issuance. Credit ratings vary, and although rating systems differ, they are broadly comparable. In general, higher-rated firms are associated with stronger repayment capacity and relatively stable cash flows and therefore tend to raise larger amounts at lower interest rates. Lower-rated firms, by contrast, typically must offer higher yields to attract investors and secure financing. In practice, large banks and government agencies usually enjoy strong ratings and can obtain larger financings at lower rates, whereas smaller companies often need to offer higher yields to remain competitive. Investors, in turn, balance risk and return to construct portfolios that maximize expected returns within their risk tolerance.

5.3 The Impact of Interest Rate Fluctuations on Bond Refinancing Strategies

From an issuance perspective, interest-rate fluctuations have a significant impact on corporate refinancing and debt replacement [12]. When rates fall, firms may issue lower-coupon bonds to refinance existing obligations and execute debt swaps to retire higher-coupon bonds while retaining the lower-cost issues, thereby reducing financing costs. When rates rise, by contrast, firms may reconsider bond issuance due to higher funding costs and turn to alternative financing channels. Issuers that continue to raise funds via bonds under rising-rate conditions also face heightened cash-flow strain and repayment pressure. Accordingly, before issuing bonds, companies should account for the cyclical and uncertain nature of market interest rates and make appropriate use of financial instruments to hedge interest-rate risk and alleviate repayment pressure.

6.Conclusion

Bond prices and yields exhibit an inverse relationship: the higher the yield, the lower the bond price, and vice versa. When a company raises funds through a bond offering, it can reasonably estimate the issue price based on its creditworthiness, funding needs, and prevailing market conditions, thereby ensuring both the targeted proceeds and stable future repayments. When a company relies on bank borrowing, it can use pricing theory to design a repayment plan consistent with projected long-term cash flows, helping to ensure timely debt service, maintain cash-flow stability, and reduce financial risk. For investors, interest-rate fluctuations materially affect current bond prices; applying bond-pricing principles enables timely and well-reasoned decisions that mitigate investment risk and help preserve asset value. Looking ahead, further research can examine actual trading data to quantify how interest rates affect bond prices across maturities, providing empirical evidence for the yield–price relationship.

References

[1] Rostamkalaei, A., & Freel, M. The cost of growth: small firms and the pricing of bank loans. Small Business Economics, 2016,46(2), 255-272.

[2] Kreß, A., Eierle, B., & Tsalavoutas, I. Development costs capitalization and debt financing. Journal of Business Finance & Accounting, 2019,46(5-6), 636-685.

[3] Harris, C., & Roark, S. Cash flow risk and capital structure decisions. Finance Research Letters, 2019, 29, 393-397.

[4] Kreß, A., Eierle, B., & Tsalavoutas, I. Development costs capitalization and debt financing. Journal of Business Finance & Accounting, 2019,46(5-6), 636-685.

[5] Rostamkalaei, A., & Freel, M. The cost of growth: small firms and the pricing of bank loans. Small Business Economics, 2016,46(2), 255-272.

[6] Popova, A. V., Pozhodzhuk, T. B., Belianevych, O. A., Povar, P. O., & Pozhodzhuk, R. V. Financial risk as a type of business risk. Studies of applied economics, 2021,39(6).

[7] Sasmitha, J. L., & Harto, B. Analisa perhitungan suku bunga pinjaman harian pada aplikasi pinjaman online legal menggunakan metode simple interest. ATRABIS Jurnal Administrasi Bisnis (e-Journal), 2021,7(2), 132-139.

[8] Janardana, K., & Wiriandi, D. I.The Application of Compound Interest in Investment Portfolios. International Journal of Quantitative Research and Modeling, 2024,5(4).

[9] Leyman, P., & Vanhoucke, M. Payment models and net present value optimization for resource-constrained project scheduling. Computers & Industrial Engineering, 2016,91, 139-153.

[10] Hilscher, J., Jarrow, R. A., & van Deventer, D. R. The valuation of corporate coupon bonds. Journal of Financial and Quantitative Analysis, 2025,60(5), 2259-2292.

[11] Freeman, M. C., Groom, B., Panopoulou, E., & Pantelidis, T. Declining discount rates and the Fisher Effect: Inflated past, discounted future?. Journal of Environmental Economics and Management, 2015,73, 32-49.

[12] Yu, Q., Chen, D., Wang, X., & Peng, W. The impact of penalty interest provisions on the issuance costs of perpetual bonds. International Review of Economics & Finance, 2024,93, 935-943.