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The Essential Financial Toolkit*

Tool 10 – Bonds

This article discusses a financial instrument that governments, companies, and investors could hardly do without. Bonds are an essential asset class, widely used by governments and companies to finance their investments and by investors to protect their portfolios. They come in many types and degrees of complexity, but the simple bonds discussed here, whose characteristics of risk and return are not difficult to understand, are the most widely used.

Witty Professor (WP): We have finally come to the end of our course, and last, but certainly not least, we're going to discuss bonds, one of the most widely used financial instruments.

Insightful Student (IS): I guess we all read about them in the papers, but some of the terminology related to them is not very clear to me. Can you start by briefly defining some of the basic terms?

WP: Sure, I was going to start with that. Think of a bond simply as a loan in which the issuer or seller is the borrower and the buyer is the lender. The issuer receives a lump sum when the bond is issued, and promises to pay back the amount borrowed called the *principal* or *face value*, at a specified point in time called the *maturity date*.

* All calculations in this note have been performed in Excel and the results reported are taken directly from the spreadsheet. If you want to reproduce the numbers discussed accurately and avoid rounding errors, you should also perform all calculations in a spreadsheet.

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IS: But lending you \$100 and getting back \$100 at some point in the future doesn't sound like a great deal to me!

WP: And it's not. That's why between the time the bond is issued and the maturity date most bonds pay interest, typically twice a year. The interest is determined by the *interest rate*, also called the *coupon*, and is calculated with respect to the face value. All the relevant terms of the contract between the buyer and the seller are contained in a document called the bond's *indenture*.

IS: Can you please put a few numbers behind the concepts you just described?

WP: You bet. Suppose a company issues a 5-year bond today with a face value of \$1,000 and an interest rate or coupon of 8%. That means the company receives \$1,000 today, will pay back \$1,000 five years from today, and will make five \$80 payments in annual interest, split into two semiannual payments of \$40. Is that clear?

IS: It is. But is the interest rate always fixed throughout the life of a bond?

WP: In the most common type of bonds, which are usually called *coupon bonds*, yes. But there are in fact bonds, which we'll leave out of our discussion, whose interest rate changes over time; they are called *floating-rate bonds*.

IS: And who can issue bonds?

WP: Governments and companies certainly can and do. But in fact, just about anybody can issue a bond, as long as the promise to return the principal and make the interest payments is believable and the terms offered are attractive. As a matter of fact even rock stars can issue bonds! Both David Bowie and Michael Jackson have done it in the past.

IS: Interesting!

WP: Now, you said before that you read about bonds often in the papers, and that is because once a bond is issued and bought by someone, that someone can sell it in the market later on, and anybody who buys it can in turn sell it too, and so forth. In other words, bonds trade in markets pretty much like stocks do.

IS: I've often seen the expression 'trading at a premium' or 'trading at a discount' but I don't quite understand what that means. At a premium or at a discount with respect to what?

WP: With respect to the face value of the bond. So if a company issued a bond with a face value of \$1,000, when the bond trades at a price higher than \$1,000, it is said to trade at a premium; and when it trades at a price lower than \$1,000, it is said to trade at a discount. And just in case you ever see or hear the expression, when the bond trades at \$1,000, it is said to trade 'at par.'

IS: What about those prices? Given that we know in advance all the cash flows we're going to receive, then pricing a bond should be relatively easy, right? It



should just be a straightforward present value calculation, with the coupons and principal being the cash flows to be discounted.

WP: Well, it's true that all the cash flows are known in advance, but the risk of those cash flows is not trivial to assess. As we'll discuss in a few minutes, the probability of receiving those cash flows may vary substantially across issuers. Some issuers are more likely to default than others, and of course that differential risk should be reflected in the discount rate.

IS: So are we going to discuss how to calculate those discount rates?

WP: No, and for two reasons. First, that goes quite a bit beyond the basic issues we discuss in this course. And second, as an individual investor, when considering bonds you should focus less on their price and more on their return.

IS: But if we know the cash flows and the price we have to pay for them, then it seems to me that the return we get is just a straightforward internal rate of return calculation, isn't it? It's pretty much like an investment project in which we have forecasts of the cash flows and we know the initial investment we have to make, with the obvious difference that the project's cash flows are expected and the bond's cash flows, default notwithstanding, are certain.

WP: Exactly! Very insightful! Precisely, the most widely-used magnitude to describe the return of a bond is the *yield to maturity*, which is nothing but the internal rate of return that you get by buying the bond at the market price and holding it until maturity.

IS: As usual, an example would help!

WP: And it's coming right up! By mid-September, 2008, a 10-year note issued by the US government, with a face value of \$100 and an interest rate of 4%, was trading at \$104.9 and had a yield to maturity of 3.41%. And as we mentioned before, although neither the face value nor the interest rate will change throughout the life of this bond, the market price and therefore the yield will change almost constantly.

IS: So if we buy this 10-year bond at \$104.9 and keep it until maturity, the 3.41% yield to maturity indicates our mean annual compound return if we hold the bond until maturity, right?

WP: Exactly. As we discussed earlier in this course, an internal rate of return is simply a mean annual compound return. And it's important that you keep in mind that that is the return we will receive if, and only if, we keep the bond until maturity.

IS: What if we sell the bond before maturity?

WP: Well, in that case, given that bond prices fluctuate over time, the price at which we sell the bond can be higher or lower than the price we paid for it, which means that, just like when we buy stocks, we can have a capital gain or a capital



loss. Put differently, the return we get by selling the bond before maturity can be anything, including a negative return.

IS: A negative return?!

WP: Sure. The appropriate discount rate for the cash flows of a bond has the same two components we discussed earlier in the course, a risk-free rate and a risk premium, the former related to inflationary expectations and the latter related to risk. So suppose inflationary expectations go up. Then discount rates will go up and, given that a bond's cash flows are fixed, its price will necessarily go down.

IS: And I assume the same can happen if the risk premium goes up, right? For example, if a company becomes riskier, investors will increase the return required on its bonds, pushing discount rates up and bond prices down.

WP: Exactly. Whatever pushes discount rates up necessarily pushes bond prices down, and the other way around. So, although bonds are usually thought of as a safe investment, it *is* possible to lose money by investing in them. In fact, US bonds, the safest in the world, delivered negative returns both in 1999 and in 1994.

IS: I see. So the bottom line is that although it may be less likely than when investing in stocks, if we sell before maturity it is still possible to lose money when investing in bonds, right?

WP: That's correct. When you buy a bond at a given price and hold it until maturity, you lock a mean annual compound return indicated by the bond's yield to maturity. But if you sell anytime before maturity, then your return can be anything.

IS: Now, correct me if I'm wrong, but by holding a bond until maturity we can only lock a *nominal* return, right? Because not knowing what the inflation rate is going to be in the future, we still have uncertainty about the *real* return we're going to perceive. And if that's the case, then we still face uncertainty about our future purchasing power.

WP: That's right. Your nominal return is guaranteed, but your real return is not. Good point. In fact, although we will leave them out of our discussion, the US government issues some bonds called TIPS which do guarantee a real return.

IS: Interesting. Now, the nominal return of a bond is easy to assess with its yield to maturity, but what about its risk? Is it also easy to assess?

WP: Well, as usual, risk is more difficult to assess than return. And as usual, risk comes from multiple sources. As far as bonds are concerned, though, the most important source is the so-called *default risk*, which is related to the probability that the issuer pays the coupons and principal it agreed to pay.

IS: But except in a few obvious cases, such as the US government, that probability must be very difficult to assess.



WP: It's not easy, particularly if you try to assess how much higher the probability of default of one issuer is compared to that of another issuer. But investors get help from rating agencies like Standard and Poor's or Moody's, whose main business is, precisely, to assess the probability of default of bond issuers, and to communicate it to the market in a simple way that investors can easily understand.

IS: And that simple way consists of the famous credit ratings, right?

WP: Exactly. So what rating agencies essentially do is to assess default risk and to summarize their assessment in credit ratings.

IS: And what is a good credit rating or a bad credit rating?

WP: Each rating agency has its own way of rating bonds. The easiest to remember is the one used by Standard and Poor's which, from best to worst, is summarized by the letters AAA, AA, A, BBB, BB, B, CCC, CC, C, and D. The first four rating categories, from AAA to BBB, are called *investment grade bonds* and they are very unlikely to default. The rest of the categories, from BB to C, are called *high-yield* (or *junk*) *bonds*, and have a much higher probability of default. The final category, D, simply indicates that the issuer has defaulted.

IS: So as we move from AAA to C the probability of default increases, right?

WP: Right.

IS: And how reliable are these ratings? I ask because over the last few months I've been reading articles in the press that suggest that rating agencies are not doing such a great job.

WP: I'm glad you bring that up. In fact, many times in the past the reliability of credit ratings has been questioned. This is a very controversial issue and we're obviously not going to resolve it here, but the consensus seems to be that rating agencies are pretty good at assessing the probability of default in the long term, and at the same time are somewhat slow to react in the short term.

IS: What do you mean by slow to react in the short term?

WP: Think of Enron, for example, which was rated investment grade by the rating agencies until just a couple of days before filing for bankruptcy! Or the bonds of some Asian countries during the 1997 crisis, which were downgraded to junk status after the really bad news hit the newspapers. Obviously, rating agencies are supposed to give *advanced* warning of trouble, not react *after* trouble becomes public.

IS: And what about in the long term?

WP: In the long term rating agencies do a pretty good job at assessing the probability of default. Take a look at Table 1, which shows so-called mortality rates between 1971 and 2003. The second column shows, for each rating category, the

proportion of issuers that have defaulted five years after issuing a bond; the third column shows the same proportions but ten years after issuance. What do you think?

Table 1

S&P Rating	5 Years	10 Years
AAA	0.03%	0.03%
AA	0.50%	0.55%
A	0.28%	0.82%
BBB	7.64%	9.63%
BB	12.17%	19.69%
B	28.32%	37.26%
CCC	47.30%	58.63%

Source: Adapted from Edward Altman and Gonzalo Fanjul (2004), "Defaults and Returns in the High Yield Bond Market: The Year 2003 in Review and Market Outlook," Working Paper.

IS: There does seem to be a very close relationship between ratings and mortality. Clearly, the worse the rating, the higher the proportion of companies that defaulted both five and ten years after issuance. Given that information, credit ratings look quite reliable to me.

WP: And they are, but just remember that this is a long term perspective. It is in the short term, not in the long term, that rating agencies have usually had trouble defending their record.

IS: Roger that. But it seems to me that one way to see whether market participants tend to rely on credit ratings when they assess the risk of bonds is to see whether, as credit ratings worsen, the yield that issuers have to pay increases.

WP: Good point. And it is indeed the case that there is a clear relationship between credit ratings and bond yields. In general, as the credit rating worsens, default risk increases, and so do the yields required by investors. You can check out the newspaper yourself and you'll see that as you move from AAA ratings down to C ratings issuers have to pay higher yields.

IS: Can you at least give us a quick example?

WP: Sure. Let's consider 5-year bonds in mid-September, 2008. The AAA-rated bond of Pfizer had a yield of 4.62%; the BBB-rated bond of Home Depot had a yield of 5.32%; and the CCC-rated bond of Toys R Us had a yield of 12.75%. So as you see, the lower the rating, the higher the yield.

IS: I see. But is there any difference between a yield and a spread? I seem to remember reading in the newspaper that as credit ratings worsen, spreads



increase, which is similar to the relationship you're telling us between credit ratings and yields.

- WP:** A spread is simply the difference between the yield paid by any given issuer and the yield paid by the US government at the same maturity. If we go back to our previous example, and considering that the yield on 5-year US bonds in mid-September, 2008, was 2.51%, then the spread on the Pfizer bond is 2.11% ($=4.62\%-2.51\%$); the spread on the Home Depot bond is 2.81% ($=5.32\%-2.51\%$); and the spread on the Toys R Us bond is 10.24% ($=12.75\%-2.51\%$). So as you see, it is true that the lower the rating, the higher the spread.
- IS:** Well, if the spread measures how much more an issuer has to pay relative to what the US government has to pay at the same maturity, then it does make sense that as we move from AAA-rated issuers to C-rated issuers spreads widen.
- WP:** It sure does.
- IS:** Now, it seems clear from our discussion that there is a very close relationship between credit ratings and yields; the worse the credit rating, the higher the yield an issuer has to pay, and the higher the return received by the buyer. Does that mean that default is the only relevant source of risk when evaluating a bond?
- WP:** Good question, and the answer is no. Yields and therefore returns are primarily driven by default risk, but there certainly are other relevant sources of risk. An important one is the so-called *market risk*, or *interest-rate risk*, and it basically measures the volatility of bond returns.
- IS:** So the higher the market risk, the higher the volatility, and the higher the bond yield?
- WP:** Yes, and a rough way to think about this market risk is that it increases as the maturity of the bond increases. In general, given bonds of similar characteristics, the longer a bond's maturity, the higher the market risk, and therefore the higher the yield it pays. Have you ever heard about the yield curve?
- IS:** No, what is it?
- WP:** It's simply a relationship that shows the yield the US government pays at each maturity. In general, but not necessarily always, the yield curve is upward sloping, which simply means that the longer the maturity, the higher the yield. Table 2 shows the yield curve for US government bonds in mid-September, 2008, and as you can see it is indeed upward sloping.

Table 2

Maturity (years)	Yield
0.5	0.69%
3	1.41%
5	2.51%
10	3.41%
30	4.08%

IS: And you're saying that, in general, a longer maturity implies a higher volatility and as a result a higher yield to compensate for the extra risk, right?

WP: Exactly.

IS: Are there any other important sources of risk that should be considered when evaluating bonds?

WP: Default risk is by far the most important, keep that in mind. And market risk does play a role in the determination of yields. Beyond that, there are many other sources of risk that play less significant roles and I'm going to mention only one, liquidity risk.

IS: What is that?

WP: Liquidity is not very easy to define but it is related to both the speed with which you can buy or sell an asset, as well as to the impact on prices when you buy or sell. The faster you can make a transaction, and the less you affect prices, then the more liquid the asset is.

IS: I can see that the more difficult it is for us to trade, the more risk we're going to perceive, and the higher the yield we're going to require. But I can't see why the impact on prices matters.

WP: Because when you want to execute a transaction in an illiquid market, prices always move in a direction that hurts you. If you want to buy an illiquid asset, its price will increase, perhaps substantially, which is of course not what you want. And if you want to sell an illiquid asset, its price will decline, again perhaps substantially, which again is of course not what you want.

IS: And you're saying that the more illiquid the asset the more that that will happen, right?

WP: Right. That is why, the more illiquid you perceive a bond to be, the higher the yield you will require to buy it.

IS: I think I'm beginning to understand what bonds are all about!



WP: That's good because this course is about to finish!

IS: But not before a wrap-up on bonds!

WP: Of course not, so here we go. Bonds are an essential asset class that governments and companies use to finance their investments and investors use to protect their portfolios. The most common bonds offer fixed interest payments and return the principal at maturity. The return obtained by buying a bond at the market price and holding it until maturity is given by its yield to maturity, which is simply the bond's internal rate of return. Risk, in turn, is primarily driven by default risk, which is related to the probability that the issuer makes the promised payments. Credit ratings play a crucial role in the assessment of credit risk and are widely used by investors. Finally, volatility and liquidity also contribute to the risk of bonds, and the higher they are, the higher the yield a bond has to offer.

IS: So, we've come to the end of the road!

WP: We have, and I hope that by now you have a better grasp of some essential financial tools that will help you understand better what you read or hear in the financial press, and hopefully to participate more intelligently in financial discussions. If you have achieved that, then this course was worth both your time and mine. And this, my dear insightful students, is as far as this course goes. Thanks and goodbye!