

readily available, thus it is impossible for them to go back after the fact and construct trades they “would have made” in previous weeks. A copy of the assignment page I distributed to students is included in the appendix as an example.

SURVEY OF STUDENT PERCEPTIONS

At the conclusion of the Fall 2008 semester, I administered a brief survey to students in order to gauge their perception of the value of this assignment in the context of the rest of the course. Results of the survey are presented in Table 1. Although inference is questionable with such a small sample size, *t*-statistics and associated probabilities are reported for a two-tailed test of the hypothesis that the mean of responses is equal to three (the “neutral” response to each question). In general terms, the results suggest that: (1) Students found the futures trading project (which did not utilize the CBOE system) more difficult than the options trading project. (Admittedly, it is not necessarily the case that use of the virtual trading system is the reason for the difference in perceived difficulty). (2) Students perceived the trading project to be valuable in gaining an understanding of the mechanics of these marketplaces. And (3), the CBOE system was a valuable resource in completing the assignment.

CONCLUSION

Although the survey responses are interesting, the informal feedback I received from students regarding this project was far more gratifying. Class members were much more engaged with the class material during the project, and many apparently found the project to be quite enjoyable. Having taught the course for several years prior to using the virtual trading system, I had continually struggled to keep the students engaged and connected to the real-world mechanics of option marketplaces. The CBOE Virtual Trading system has been of immense benefit, and will remain an important tool for me in future courses.

1. <http://www.cboe.com/tradtool/virtualtrade.aspx>

2. When I originally developed this assignment, the CBOE virtual trading system was set up to accommodate trading in futures contracts, and a part of the assignment was dedicated to futures trading. However, I found the futures portion of the system to be unreliable, often failing to execute valid trades. Consequently, I did not endorse the use of the CBOE site for the futures trading portion of the project. Hopefully, future improvements to the system will make it usable for the futures component of the course.

Statistical results of the student survey and a copy of the trading assignment are available on the website (www.jfcr.org/jitf).

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Using Mortgage Rates to Explain Risk Premiums in an Introductory Finance Course

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Devising an effective way to teach interest rate determinants and help students understand various risk premiums is an essential part of any introductory finance course. Unfortunately, because these topics are commonly taught in conjunction with the introduction of bonds, students often become confused while trying to simultaneously learn new terminology and concepts related to bond pricing. In this paper, we describe a more student friendly approach to teaching interest rate determinants. We believe students gain a better understanding of risk premiums when related to loan types they are already somewhat familiar with. Specifically, this paper describes how to use a simple comparison of various mortgage rates to more clearly explain concepts such as default risk, interest rate risk, and liquidity risk. This approach focuses students' attention on the concepts at hand rather than confusing them with multiple high level applications at one time.

INTRODUCTION

Introducing interest rate determinants in an introductory finance course is one of the most crucial lessons of the semester. Understanding the risk premiums built into required returns is vital for comprehending asset pricing, which is perhaps the most important topic in finance. Generally, instructors introduce interest rate determinants using bond yields. We advocate the use of mortgage loan rates for several reasons:

1. Introductory finance students are generally unfamiliar with bonds, which are a confusing topic by themselves for many students. Students are much more likely to be familiar with traditional amortizing debt, such as car loans and student loans, which will ease the understanding of rate determinants.
2. Learning about the different mortgage types is more “real-world” useful for many students. Undergraduate business students tend to have a range of majors, many of which may not encounter bonds in their career, but most of which will look into mortgage loans later in their lives. Many graduate students may have already experienced shopping for a mortgage.
3. Finally, introducing the different types of mortgages will advance students’ understanding of some of the issues contributing to the current financial crisis. Specifically, students will become aware of the secondary mortgage market, Fannie Mae, and Freddie Mac.

This paper describes how interest rates determinants can be introduced via mortgage rates and provides some examples and data that can be used to reinforce specific learning outcomes.

EXTENDED FISHER EQUATION

Irving Fisher first proposed the basic interest rate determinants in his 1930 book, *A Theory of Interest*. Fisher first postulated that a risk-free return can be expressed as the product of the real interest factor and an expected inflation factor. The simpler approximation can be written as:

$$r_{\text{nominal}} = r_{\text{real}} + E[\text{inflation}]$$

Fisher's equation can be extended to risky assets by adding risk premium (RP) terms:

$$r_{\text{nominal}} = r_{\text{real}} + E[\text{inflation}] + \text{default RP} + \text{interest rate RP} + \text{liquidity RP}$$

Bankrate.com provides current data on several different types of mortgages, including:

- 30-, 20-, 15-, and 10-year fixed rate (FRM)
- 30-year 3/1, 5/1, 7/1, and 10/1 adjustable rate (ARM)
- Jumbo mortgages for many of the above (Jumbo)
- Interest-only versions of the ARMs (IO)

See Table 1. Each of these mortgages brings different levels of risk to the transaction, thus the risk premiums and initial interest rates will vary. Using this data, it is relatively simple to explain and isolate each type of risk premium using pairs of mortgages. Data displayed in Table 1 come from Bankrate.com, and provide the basis for the various premiums discussed in Table 2. The historical data series displayed in the Figures are weekly frequency obtained from Bloomberg.

DEFAULT RISK PREMIUM

The default risk premium is relatively intuitive – the more likely the borrower is to fail to repay the loan, the higher initial rate the lender will charge. Default risk is perhaps the most manageable risk for lenders, as the lender can limit default risk by verifying that the borrower has adequate income to repay the loan, a sufficient down payment to reduce the likelihood of default, and an established credit history. All else equal, adjustable rate mortgages would be expected to have higher default risk than fixed rate mortgages because rising interest rates could cause monthly payments to become unaffordable. However, lenders have traditionally managed this extra risk by imposing tighter underwriting standards on ARMs. For example, Fannie Mae's conforming underwriting standards once required that borrowers' monthly housing costs (loan payment, hazard insurance, and property taxes) could be no more than 28% of their gross monthly income for FRMs, and no more than 25% for ARMs. Thus, varying default risk premiums are not extremely evident across ARMs and FRMs.

However, additional default risk premiums may be seen in interest-only (IO) loans. The risk of default tends to decline

as time passes with traditional amortizing loans, because the decreasing loan balance means that the borrower is building up more equity even if the property's value stays constant or declines slightly. With IOs, however, a borrower making the minimum monthly payments will only see his equity rise if the property's value rises. That additional default risk can be seen in the premiums of IO rates in Panel A of Table 2. For example, the rate on the 5/1 IO is 0.15% higher than the rate on the amortizing 5/1 ARM, and for the 7/1 IO, the additional default risk premium is 0.14%. This premium for IO ARMs relative to regular ARMs pinpoints the concept of default risk before the introduction of bonds and without complexities such as credit rating agencies and the various characteristics of bond issuers. Focusing the student's attention on a simple comparison of mortgages rates greatly enhances their comprehension of the topic at hand.

INTEREST RATE RISK PREMIUM

Using loans rather than bonds, the interest rate risk premium is also easy to explain – for a lender, interest rate risk occurs when the lender is not allowed to charge the market rate. That is, when a lender makes a 30-year mortgage loan at 6%, the lender loses if rates rise to 7% the next day because he has committed to providing funds at a (now) below-market rate for up to 30 years. As compensation for that risk, the lender will charge a higher initial rate on the 30-year loan than he would on a loan of shorter term.*

In times of normal, upward-sloping yield curves, interest rate risk premiums are extremely easy to see – all else equal, the longer a lender is locked into a rate, the more interest rate risk he faces and the higher the initial interest rate will be. Panel B of Table 2 displays this concept both for fixed-rate mortgages of differing maturity as well as 30-year mortgages with various initial rate lock lengths. Part 1 of Panel B displays the concept for fixed rate mortgages of varying maturity. As expected, the 10-year rate is the lowest of the FRMs, as the lender is only committed to offering the borrower that rate for 10 years. The 30-year rate is 63 basis points higher, as the lender is committing to the rate for a much longer period and thus is taking on much more risk in the event of an immediate increase in market rates. It is worth noting to students that risk premiums are not constant over time. Lenders would tend to charge a higher interest rate risk premium in times when they are more risk averse or when they believe rising rates are more likely. Using weekly data from Bloomberg, Figure 1 displays how these rates and the premium have changed over the past six years. While the 30-year rate on average was 0.44% higher than the 15-year rate, that premium reached as high as 0.72% in February 2004 and dropped as low as 0.07% in December 2009.

The interest rate risk premiums can also be seen in the ARMs. Part 2 of Panel B compares the rates for ARMs with varying rate-lock periods. As mentioned above, the longer the rate lock the more of an interest rate risk premium the lender will demand. The 5/1 ARM is a 30-year mortgage where the initial rate is locked for five years, then adjustable yearly afterwards. Likewise, the 7/1 ARM has a locked rate for the first seven years, while the 10/1 locks the initial rate for the first decade. As expected, the rates rise as the length of the initial rate lock increases because the lender is facing a longer period of interest rate risk. This is clearly seen in the reported premiums.

The premium for the 7/1 ARM versus the 5/1 is 0.32% and 0.59% for the 10/1 ARM relative to the 5/1 ARM. Again, it is easy to focus the discussion on the concept of interest rate risk and the associated premium before the complexities of bond pricing are introduced.

LIQUIDITY RISK PREMIUM

Finally, relative to bonds, mortgages much more clearly explain liquidity risk premiums. Liquidity risk arises from the uncertainty about being able to quickly sell an asset at market price. In bond markets, some types of bonds are more actively traded than others, but without having a matched pair of bonds that are identical except for trading volume it is difficult to isolate a liquidity risk premium. The secondary market for mortgages provides an extremely clear example. Mortgages can be separated into two types – those that conform to Fannie Mae and Freddie Mac’s underwriting standards and those that do not. The most common type of non-conforming mortgage is a “jumbo” mortgage, which has an original loan amount that exceeds the agencies’ limit (currently \$417,000 for a single-family home in most of the country). In the past decade Fannie Mae and Freddie Mac have been the dominant buyers in the secondary mortgage market, with a combined market share above 50% in most years and above 80% in the most recent years. Thus, while a lender who makes a conforming mortgage loan may sell it to any buyer in the secondary market, a lender who originates a jumbo loan has eliminated the two largest and most dependable potential buyers of mortgage loans. Therefore, the jumbo loan will be more difficult to sell, and the lender will charge a higher initial rate because of this liquidity risk.

Panel C of Table 2 shows just one pair of mortgages that could be used to isolate a liquidity risk premium, as there are jumbo versions of most of the FRMs and ARMs. As displayed in the Table, the conforming 30-year FRM has a 5.08% rate, while its Jumbo equivalent is charging 5.91%. The 0.83% premium reflects the additional risk that a jumbo lender would face trying to find a secondary mortgage market buyer other than Freddie Mac and Fannie Mae. The premium also experienced significant volatility in the recent mortgage crisis, as shown by Figure 2. The premium historically had been fairly stable around 0.25%, but spiked suddenly in August 2007 and eventually peaked at 1.82% in February 2009, as private buyers of mortgage-backed securities fled the secondary market and liquidity in the jumbo mortgage markets disappeared.

CONCLUSION

Identifying a straightforward and concise method for teaching advanced concepts in finance has long been a struggle for many professors. One such challenging area is effectively teaching students in introductory finance courses the concepts related to various risk premiums. Introductory textbooks usually combine the concept of risk premiums with the fundamentals of bond prices and bond yields. We believe this approach unnecessarily complicates the processes. Students are much more receptive and gain a more thorough understanding when rate premium concepts are explained in the context of comparing rates on financial instruments that are more familiar to them, such as amortizing loans, then proceeding to bond pricing. Further, this type of an approach proves to be more beneficial to

many students who are highly unlikely to encounter circumstances involving complex bond issues, whereas most will eventually deal with issues related to home mortgages. Accordingly, the approach is not only more tractable but also more practical for the typical business student.

*If students already have a basic understanding of bond pricing fundamentals, the interest rate risk premium can also be explained by introducing the secondary mortgage market. Most lenders now do not hold the mortgage loans they originate, but rather sell the loans in the secondary mortgage market, where the most active buyers are Fannie Mae and Freddie Mac. Though much more complex, mortgage pricing basics are similar to bonds, with the interest rate on the mortgage being equivalent to the bond coupon rate and the loan balance being analogous to the bond’s face value. The instructor can readily describe that if market interest rates rise above the loan interest rate (coupon rate), the mortgage (bond) will sell at a discount to its loan balance (face value).

REFERENCES

- National Overnight Average Mortgage Rates. Retrieved from <http://www.bankrate.com>.
- Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

Table 1. Example National Mortgage Rates (from www.Bankrate.com)

Mortgage Type	Today	Last Week
30 yr Fixed	5.08%	4.99%
20 yr Fixed	5.41%	5.16%
15 yr Fixed	4.48%	4.55%
10 yr Fixed	4.45%	4.43%
30 yr Fixed Jumbo	5.91%	5.82%
15 yr Fixed Jumbo	5.47%	5.37%
3/1 ARM	4.95%	4.96%
3/1 ARM I/O*	5.43%	5.40%
5/1 ARM	4.34%	4.39%
5/1 ARM I/O	4.49%	4.46%
7/1 ARM	4.66%	4.79%
7/1 ARM I/O	4.80%	5.08%
10/1 ARM	4.93%	4.90%
1 yr Jumbo ARM	4.05%	4.20%
3/1 Jumbo ARM	5.12%	4.52%
3/1 Jumbo ARM I/O	5.34%	4.38%
5/1 Jumbo ARM	4.95%	4.68%
5/1 Jumbo ARM I/O	5.19%	4.75%

*I/O represents Interest Only.

National Overnight Average Mortgage Rates. Retrieved from <http://www.bankrate.com>.

Table 2. Mortgage Rate Risk Premiums.

Panel A – Default Risk Premium*

	Term	
	5/1	7/1
Interest Only ARM	.49%	4.80%
Regular ARM	4.34%	4.66%
Default Premium	.15%	.14%

Panel B – Interest Rate Risk Premium**

Part 1 – Time-to-maturity premium

	Term		
	10 Years	15 Years	30 Years
Fixed Rate	4.45%	4.48%	5.08%
Default Premium	.03%	.60%	N/A
Longer Term	.63%		
– Shorter Term			

Part 2 – ARM Varying Rate Lock Lengths

	Term		
	5/1	7/1	10/1
Regular ARM	4.34%	4.66%	4.93%
Default Premium	.32%	.27%	N/A
Longer Term	.59%		
– Shorter Term			

Panel C – Liquidity Risk Premium

	Term	
	15 Years	30 Years
Fixed Jumbo	5.47%	5.91%
Regular Fixed	4.48%	5.08%
Liquidity Premium	.99%	.83%

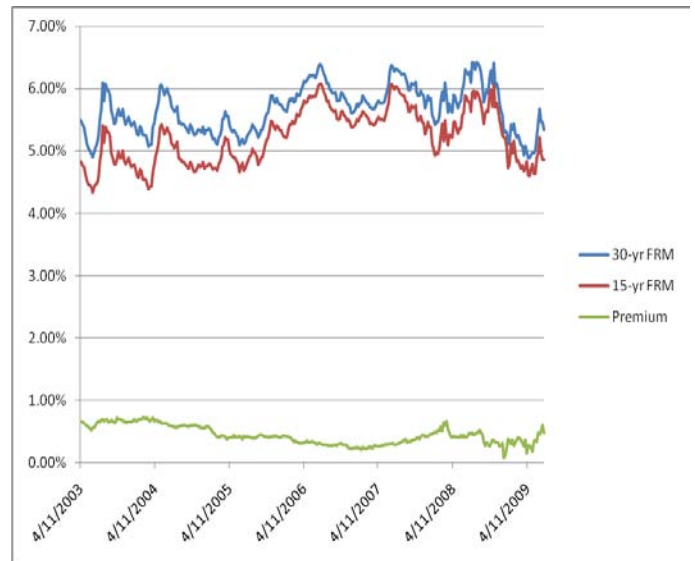
	Term	
	3/1	5/1
Jumbo ARM	5.12%	4.95%
Regular ARM	4.95%	4.34%
Liquidity Premium	.17%	.61%

*Note: The 3/1 mortgage is rarely offered by lenders, thus the “national average” rates that Bankrate.com reports can be misleading, and are therefore excluded.

**Note: The 20-year mortgage is rarely offered by lenders, thus the “national average” rates that Bankrate.com reports can be misleading, and is therefore excluded.

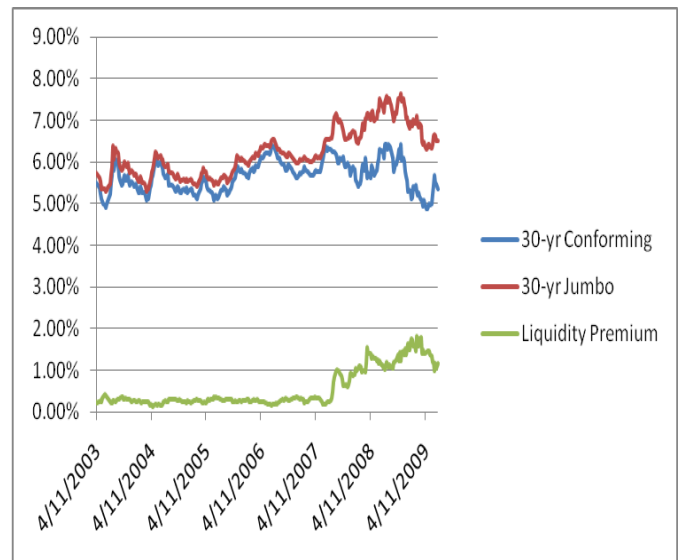
Premiums given in Table 2 come from data provided in Table 1. Table 1 data is from Bankrate.com.

Figure 1. Fixed Rate Mortgage Interest Rate Risk Premiums



Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

Figure 2. 30-Year Fixed Rate Mortgage Liquidity Risk Premiums



Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

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