ANALYSIS OF INDONESIA BOND'S DURATION: CORPORATE VERSUS GOVERNMENT BOND

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ABSTRACT

The duration of a bond is a measure of its interest rate risk. The objective of this research is to test whether corporate bond duration is higher compare to government bonds. The higher duration mean that bond's price is more affected to the change in its yield. Effective Duration and Modified Duration Approaches are used to calculate the duration. The sample used is bonds that traded in Indonesia Stock Exchange. The result shows that there is no enough evidence that Indonesia corporate bonds duration is higher compare to government bonds. The implication for this is that there is no difference in interest rate risk between corporate bonds and government bonds

Keywords: *interest rate risk, bonds risk, bonds duration*

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INTRODUCTION

Interest rate risk is the risk to bond's price arising or decreasing from the movement of interest rates. The price of a typical bond will change in the opposite direction from a change in interest rate. The actual degree of sensitivity of a bond's price to changes is depending on various characteristics of the issue, such as coupon and maturity.

Investors are interested in estimating the price sensitivity of a bond to changes in market interest rates. There is a parameter to measure the price sensitivity of a bond which is called duration.

Although duration has a long history, it is still an important and widely used tool in the risk management of portfolios of interest rate sensitive assets. Generally, bonds with a high duration have higher price volatility.

Most papers studying duration focus on default-free (Government) bonds, but for the many portfolio managers also investing in default-able (corporate) bonds, it is important to understand the sensitivity of default-table bonds to interest rate changes.

There is some contradiction about duration research or paper. Chance (1990) states that ". . . default able bonds have durations lower than their maturities and, thus, are less sensitive to interest rates than their default-free counterparts . . ." Most recent paper, Kraft and Munk (2007) is modeling the durations (the percentage price sensitivity with respect to the default-free short rate) of corporate and Treasury bonds in the reduced-form, intensity-based credit risk modeling framework. In a frequently used intensity-based model for corporate bond valuation showing that, given the parameter estimates found in empirical studies, the duration of a corporate coupon bond may very well be larger than the duration of a similar Treasury bond. This finding contrasts with conclusions of previous studies.

In this paper, I test the difference of duration between corporate and government bonds. The duration of a bond is a measure of its interest rate risk. I use two approaches to measure duration. First approach is modified duration and the second is effective duration. I compare the duration of Government Bond to Corporate Bond. The bonds that I analyze are the bond that traded in Indonesia Stock Exchange.

Through this research, there is a question that needs to be answered:

- Does Indonesia Corporate Bonds duration is higher compare to Indonesia Government Bonds?

LITERATURE REVIEW

A bond is a long-term debt security. It represents debt because the bond buyer actually lends the face amount to the bond issuer. The certificate itself, if there is one, is evidence of a lender-borrower relationship. It is a security because, unlike car loan or home improvement loan, the debt can be bought and sold in the open market. In fact, a bond is a loan intended to be bought and sold.

Duration is a measure of the approximate sensitivity of a bond's value to rate changes. More specifically, it is the approximate percentage change in value for a 100 basis point change in rates. To improve the estimate provided by duration, a measure called "convexity" can be used. Hence, using duration combined with convexity to estimate the percentage price change of a bond to changes in interest rates is called duration/convexity approach.

Sarkar and Hong (2004, has estimated empirically the effective durations for a large sample of long-term US corporate, from monthly data on bond prices and long-term interest rates. Time series regression analysis is used to estimate the effective duration of a sample of long-term corporate bonds (both non-callable and callable), based on their price changes over time in response to interest rate changes. They also include a squared term to capture any second-order effects (related to convexity, for instance). Thus the following regression is run:

$$\frac{\Delta P}{P} = B_0 + B_1(\Delta y) + B_2(\Delta y)^2 + \varepsilon$$

Where P is the bond price, y is the long-term interest rate, (ΔP, Δy) refer to monthly increments (since they are using monthly data), ~e is a random error term, and (B1; B2) the regression coefficients. The bond's effective duration is then given by -B1.

Based on the ownership, this study argues that corporate bonds tend to have higher interest rate risk than government bonds. Therefore, it is hypothesized that the duration of corporate bonds is higher than the duration of government bonds

RESEARCH METHODOLOGY

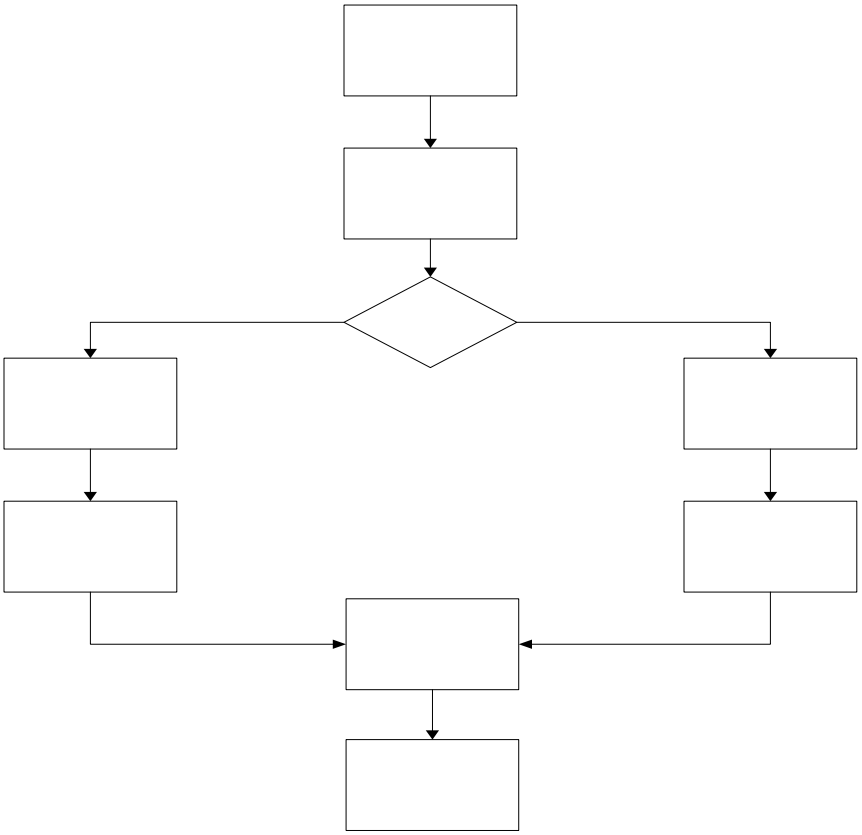

Figure 1. Research Model

Theory

Firstly, the bonds weekly prices data is collected for the last 3 years. This data is collected from Danareksa, the Debt Research Division. Other information such as maturity date, coupon, risk free rate (BI rate) is collected from other resources. Maturity date, rating, coupon information is collecting from company financial report, and Indonesia Stock Exchange website (www.idx.co.id). For historical risk-free rate is collecting from Bank Indonesia website (www.bi.go.id)

To compare duration of government to corporate bond, the bonds are selected by matching some criteria. The criteria are:

1. Maturity of bonds has to be in the same month in the same year.
2. The bond is giving fixed coupon rate

After filtering the data, bonds that match criteria are:

Table 1. List of sample Bond

Government Bond Name	Maturity	Gov Bond Coupon	Corporate Bond Name	Maturity	Corp Bond Coupon
FR002	15/06/2009	14.000%	WOMF02C	07/06/2009	13.900%
			WOMF03B	07/06/2009	15.150%
			ADMF02A	08/06/2009	14.400%
			CMNP03B	08/06/2009	12.750%
			ASDF07E	13/06/2009	14.100%
			BDKI04	17/06/2009	12.500%
			OTMA05A	19/06/2009	9.400%
			TBLA01	24/06/2009	14.750%
			ASDF08C	28/06/2009	9.375%
			KLBF01	28/06/2009	13.625%
			SONA01A	28/06/2009	14.750%
FR005	15/07/2007	12.250%	TUFI03B	08/07/2007	12.825%
			PLJA01A	12/07/2007	12.375%
			ADHI03	13/07/2007	13.250%
			TLKM01	16/07/2007	17.000%
			ASDF05F1	26/07/2007	10.900%
FR010	15/03/2010	13.150%	ASDF09C	06/03/2010	9.625%
FR012	15/05/2010	12.625%	FIFA07C	02/05/2010	10.500%
			KREN01C	08/05/2010	13.000%
			BSLT03	12/05/2010	12.750%
			FIFA08B	13/05/2010	12.125%
			MAYA02A	29/05/2010	11.750%
			WOMF04A	29/05/2010	11.250%

FR013	15/09/2010	15.425%	BEXI03B	28/09/2010	12.700%
FR014	15/11/2010	15.575%	PTPV01A	12/11/2010	12.875%
FR015	15/02/2011	13.400%	TUFI05C	20/02/2011	11.000%
			BCAF02D	27/02/2011	11.375%
FR018	15/07/2012	13.175%	BLTA03	05/07/2012	10.350%
			ADHI04	06/07/2012	11.000%
			SCTV02	10/07/2012	10.950%
			DUTI05	11/07/2012	12.850%
			JPFA01	11/07/2012	12.750%
			PLJA01D	12/07/2012	13.875%
FR019	15/06/2013	14.250%	MYOR03	05/06/2013	13.750%
			DNRK03C	20/06/2013	13.500%
			SMRA02	25/06/2013	14.100%
FR021	15/12/2010	14.500%	BFNC02	03/12/2010	12.750%
			JMPD10O	04/12/2010	16.150%
			ASDF08F	28/12/2010	10.300%
FR022	15/09/2011	12.000%	BEXI03C	28/09/2011	12.800%
FR024	15/10/2010	12.000%	ISAT03B	22/10/2010	12.875%
FR025	15/10/2011	10.000%	BSDE02	20/10/2011	15.000%
FR026	15/10/2014	11.000%	INKP02A	01/10/2014	13.000%
			PIDL02A	01/10/2014	13.000%
FR028	15/07/2017	10.000%	PPLN09A	10/07/2017	10.400%
FR029	15/04/2007	9.500%	ASDF05E2	26/04/2007	10.625%
FR030	15/05/2016	10.750%	PPGD11A	23/05/2016	13.100%
FR033	15/03/2013	12.500%	BDKI05A	04/03/2013	11.250%
			MAIN01	06/03/2013	11.800%
			ELTY01B	11/03/2013	12.850%
			AIRJ01B	13/03/2013	12.500%
			APOL02A	18/03/2013	12.000%
			LTLS03	26/03/2013	11.650%
FR034	15/06/2021	12.800%	PPLN08B	21/06/2021	13.750%
FR043	15/07/2022	10.250%	PPLN09B	10/07/2022	10.900%

Duration calculation is divided into two approaches. The first approach is calculating Modified Duration on each weekly transaction and compares it between Government bond and corporate bond. The following method is used to calculate Modified duration

$$\text{Macaulay Duration} = \frac{\frac{(1)C}{(1+y)} + \frac{(2)C}{(1+y)^2} + .. + \frac{(n)C}{(1+y)^n} + \frac{(n)M}{(1+y)^n}}{P}$$

Investor commonly refer to the ratio of Macaulay duration to 1+y as modified duration; that is,

$$\text{Modified duration} = \frac{Macaulay.Duration}{1+y}$$

The second approach is by calculating effective duration. A time-series regression as in Ogden (1987) is conducted by regressing the change in interest rate on the change in bond price. However, a squared term is also included to capture any second-order effects (related to convexity, for instance). Thus the following regression is run:

$$\frac{\Delta P}{P} = B_0 + B_1(\Delta y) + B_2(\Delta y)^2 + \varepsilon$$

Where:
- P is the bond price
- y is the long-term interest rate
- (ΔP, Δy) refer to weekly increments (since the data is weekly data)
- ε is a random error term, and
- B1, B2 are the regression coefficients.

The bond's effective duration is then given by B1.

To test the hypothesis, this study measures the delta of duration between government and corporate bond). Delta (Δ) Duration is defined as follow:

ΔDuration = Duration Government bond – Duration Corporate bond

In line with the hypothesis we expect that μ of Δ Duration has to be less than 0.

For this research, the null and alternative hypothesis is:

H_o: $\mu \geq 0$

H_1: $\mu < 0$

A t test and critical value approach is used to test the hypothesis.

t test of hypothesis for the mean (σ unknown)

RESEARCH RESULT

Δ Modified Duration Approach Result

The result summary of ΔModified Duration , can be seen in the table below:

Table 2. Result Summary of Δ Modified Duration Approach

Descriptive statistics	Value
Mean	-0.00144
Standard Error	0.005187
Median	-0.01724
Mode	-0.0064
Standard Deviation	0.169496
Sample Variance	0.028729
Kurtosis	20.50141
Skewness	2.905367
Range	2.304695
Minimum	-0.85212
Maximum	1.452574
Sum	-1.5399
Count	1068
Confidence Level(95.0%)	0.010177

The table shows the statistic descriptive of Δ Duration of Modified Duration Approach.
Δ MDuration = Modified Duration Government – Modified Duration Corporate
For the distribution data modified duration approach, can be seen in figure 2 below:

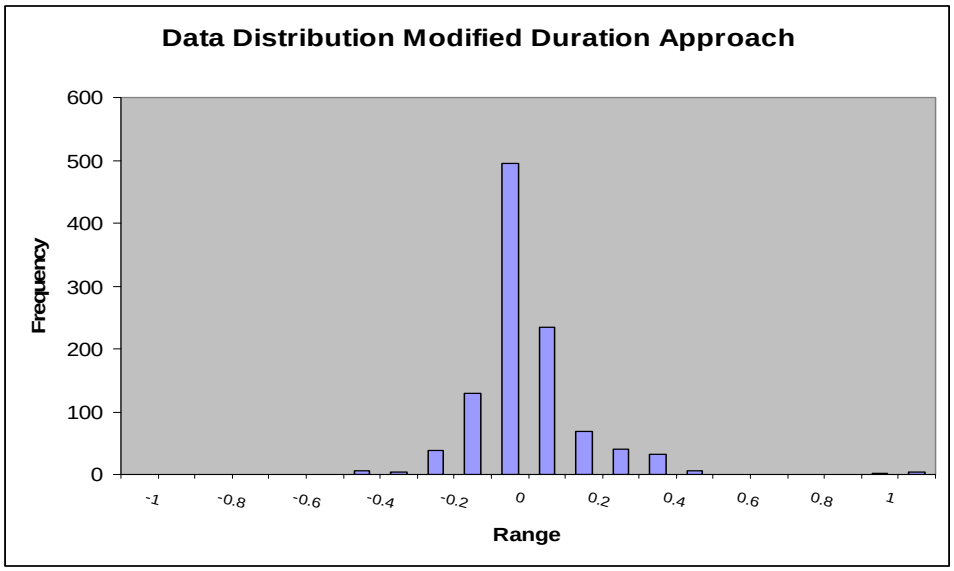

Figure 2. Data Distribution of ΔModified Duration

Effective Duration result

After all data has been done for the regression, the summary table of the duration of government bond and its comparable corporate bond can be seen in table 3 below:

Table 3. Result Summary of ΔEffective Duration Approach

Descirptive statistics	Value
Mean	-2.76195
Standard Error	1.597731
Median	-0.92477
Standard Deviation	6.7786
Sample Variance	45.94942
Kurtosis	1.290241
Skewness	-1.18265
Range	26.61809
Minimum	-20.017
Maximum	6.601123
Sum	-49.715
Count	18
Largest(1)	6.601123
Smallest(1)	-20.017

The table shows the statistic descriptive of Δ Effective Duration.
Δ EffDuration = Effective Duration Government – Effective Duration Corporate
For the distribution data Effective duration approach, can be seen in figure 3 below:

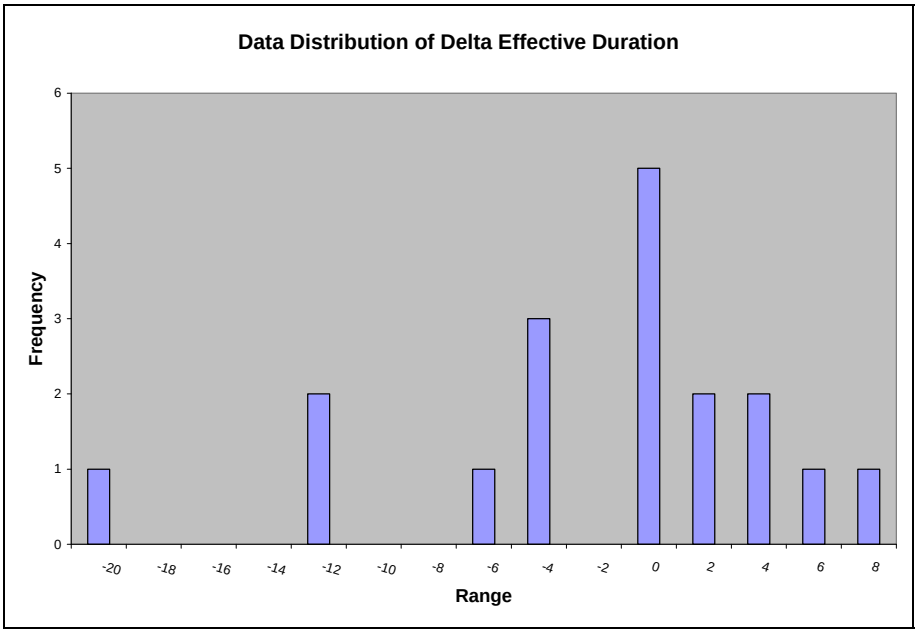

Figure 3. Data Distribution of ΔEffective Duration

Hypothesis Testing

In this section, I test the hypothesis for both approaches using t test and critical value approach.

Modified Duration Approach

To perform this hypothesis test, the ten step method is used:

Steps 1 and 2: Ho: $\mu \geq 0$

H1: $\mu < 0$

Step 3: $\alpha = 0.05$

Step 4: n = 1068

Step 5: A t test is used.

Step 6: For a given sample size n, the test statistic t follows a t distribution with n-1 degree of freedom. Due to the level significance of $\alpha = 0.05$ is selected, the critical value of the t distribution with 1068 – 1 = 1067 degrees of freedom can be obtained from t Table. From t table, the critical value is -1.6449. The decision rule is: reject Ho if t < -1.6449; otherwise do not reject Ho

Step 7: n = 1068, mean = -0.00144, $\sigma = 0.169496$

$$t = \frac{-0.00144 - 0}{\frac{0.169}{\sqrt{1068}}} = -0.277644238$$

Step 8: since t = -0.277 > -1.6449, the observed statistic is in the region of non rejection.

Step 9: Accept Ho

Step 10: The data provided provide insufficient evidence to conclude that the mean of ΔModified Duration is less than 0.

Effective Duration Approach

Again, to perform this hypothesis test, the ten step method is used:

Steps 1 and 2: Ho: $\mu \geq 0$

H1: $\mu < 0$

Step 3: $\alpha = 0.05$

Step 4: n = 18

Step 5: A t test is used.

Step 6: For a given sample size n, the test statistic t follows a t distribution with n-1 degree of freedom. Due to the level significance of $\alpha = 0.05$ is selected, the critical value of the t distribution with 18 – 1 = 17 degrees of freedom can be obtained from t Table. From t table, the critical value is -1.7341. The decision rule is: reject Ho if t < -1.7341; otherwise do not reject Ho

Step 7: n = 18, mean =-2.76195, $\sigma = 6.7786$

$$t = \frac{-2.76 - 0}{\frac{6.7786}{\sqrt{18}}} = -1.728$$

Step 8: since t = -1.728 > -1.7341, the observed statistic is in the region of non rejection.

Step 9: Accept Ho

Step 10: The data provided provide insufficient evidence to conclude that the mean of ΔModified Duration is less than 0.

From hypothesis testing (Modified Duration and Effective Duration Approach), it is concluded that there is no enough evidence that Indonesia corporate bonds duration is higher compare to Indonesia government bonds. The implication for this is that there is no difference on the interest rate risk between corporate and government bonds. Investment manager can use duration as a measure of interest rate risk for their investment strategy, but can not differentiate which one is more risky to interest rate risk between corporate and government bond.

CONCLUSION & RECOMMENDATIONS

Conclusion

In Indonesia, there is no enough evidence that duration of corporate bond is higher compare to government bond. The higher duration mean that it more affected to the change in interest rate. The implication for this is that there is no difference between corporate bond and government bond in term of interest rate risk.

Recommendations

1. Research in Indonesia on corporate bond is not many. With this research, we hope there will be more research on Indonesia corporate bond.
2. More research on Indonesia corporate bond might be interesting such as corporate bond yield spread and liquidity.

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