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RESEARCH ARTICLE

The Yields That Bind: Treasury Bill Yields and the Philippine Corporate Bond Yield Spreads (pre-Covid 2012–2019)

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The paper's base reference is Duffee (1998). He examined the inverse relationship between the U.S. Treasury bill yields (TBY) and the corporate bond yield spreads (CBYS). Eight years of historical data on the Philippine CBYS from 2012–2019 and data on TBY were analyzed using OLS regression. To examine, if the results hold in the Philippines and given that the bond market in the country differs from the U.S. bond markets, will the results of Duffee (1998) persist? Although the paper focused on providing evidence on one of the most basic, well-established inverse relationships between TBY and inflation to CBYS, the study sets the groundwork and embarks on a solid foundation leading to the development of the Philippine bond market in the years to come.

Keywords: Philippine corporate bond yields, Treasury bill yields, inflation, pre-COVID

JEL Classifications: E3, E5, E6

Before COVID-19, the Philippine economy was fast-growing, and the Philippine conglomerates issued bonds to fund capital expenditures. It can be noted, however, that despite the growth in the bond market, it was still underdeveloped compared to the major bond market in East Asia by the end of June 2018.

The Bangko Sentral ng Pilipinas (BSP) often uses an inflation-targeting approach to maintain economic growth and control inflation. The BSP's Monetary Board reduces the interest rate on its overnight reverse repurchase (RRP) facility, thus increasing inflation. Amidst the easing inflation in the country, the rate was reduced by 25 basis points to 4.5% in May 2019. It was followed by three more interest rate reductions in the overnight RRP facility by only 4%. The Monetary Board also reduced the reserve requirement ratio (RRR), lowering banks' reserve requirements to 3%, effective November 1, 2019.

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The decision of the Monetary Board was made to incentivize banks and quasi-banks to encourage investors to join the bond market in managing its liquidity (Noble, 2019). Noble (2019) further elaborated that this decision of the Monetary Board affected the interest rates, resulting in a decrease in TBY. In addition, De Vera, B. O. (n.d.) cited that the Asian Development Bank's (ADB) Asia Bond Monitor report shows that the current rating of the Philippines has been increased to BBB+ by Standard & Poor's (S&P). This improvement in the Philippine credit rating caused TBY to go down even further by the middle of 2019.

As the Philippine bond market has been expected to grow, the need for capital from corporations has surged, and concerns about the pricing of the bond and inflationary pressures continue to confront the market. Zhou Y. et al. (2022) empirical paper proved significant in establishing that no structural breaks were identified in nominal and real yields in the period covering the COVID-19 pandemic. They further added that such results provide evidence of the effectiveness of the government's fiscal and monetary policy responses to combat the effects of the pandemic and maintain stability in the domestic financial markets. Such a result may set the groundwork for the need for a reasonable, workable program of action, especially among the Philippine corporations attempting to expand their presence in the Philippine bond market and hopefully, pave the way for stimulating robust private sector response to the development of the Philippine bond market in the coming years.

Literature Review

Lepone and Wong (2009) conducted a study to examine the empirical determinants of credit spread changes on corporate bonds in an Australian setting. They used several variables: changes in the credit spread, bond yield, volatility, and several more. They concluded that changes in the spot rate and the yield curve slope have the most significant impact and have a negative relationship with credit spreads.

Duffee (1998) also discovered the relationship between Treasury Yields and yield spreads of callable corporate bonds in his study. The strength of the relationship between the two variables depends on the grade quality of the bond. As such, higher-rated bonds would reflect higher sensitivity than lower-rated bonds. Similarly, Ayturk (2017) conducted a study on the relationship between government borrowing and corporate financing that shows an inverse relationship. This time, the study compared the sensitivities of corporate bonds to government debt depending on the size of the firms. Results prove that large credit-worthy firms are more sensitive to government debt. Research from Georgoutsos and Kounitis (2016) tried to shed some light on these variables, resulting in an inverse relationship using the vector error correction (VEC) model and cointegration. Furthermore, the development of new models improved research in this field. The Bayesian Model by Karlsson and Österholm (2018) investigated the relationship and assessed the relevance of the stochastic volatility and the drifting parameters. The model resulted in an inverse relationship between the two once more.

The implication of the external factors of bonds should be considered because, according to Haughey (2016), the main concern that investors should address is that the yield on Treasury bills could change based on supply and demand and actions of the Central Banking system. Corporate bonds are also susceptible to risk because industry risks cause shifting rates that would otherwise be considered safe. A change in basis points would either increase or decrease the bond price, thus causing price volatility. Corporate bonds are not exempt from the risk of inflation. A study by Bakaert et al. (2010) reflects that different markets have different behaviors toward expected and unexpected inflation. The study states that markets except for Asia and Africa have a positive relationship with the government treasury bill yields towards expected inflation. However, the more developed a market is, the stronger the negative relationship the yields have on unexpected inflation. It is worth noting that Latin America and non-EU Europe have positive relationships. Therefore, we shall further examine its effect on corporate spreads.

The effect of inflation on CBYS is conducted by Jacoby et al. (2014). The predictions from this study are also found in other structural models with an asset-based default process, stating that credit spreads have a negative relationship with a riskless rate. Moody's indices were used to test the predictions because a negative relationship is assumed. Their paper concludes that the negative relationship between CBYS and Treasury Yield is dominated by call risk. With the asset factor considered, there is no significance in

influencing the sensitivity of the two. The structural models in this paper apply to our study. According to Richelson and Richelson (2016), bond prices fluctuate continuously, and the coupon rate pivots to the price. When the market price changes, so do the returns of the bond interest rate. The value of bonds decreases when interest rates rise, which has an inverse relationship to price.

Several empirical studies have been conducted focusing on different countries. Nonetheless, there is no evidence of this in the Philippines. The current study will offer an additional milestone, particularly in the Philippines. I hypothesized that changes in TBY, treasury term structure, and inflation significantly affect the changes in CBYS. Similarly, this will help policymakers under consideration when maximizing the CBYS.

Methodology

The many studies done on Treasury Yield and Corporate Bond Yield Spread gave insights into the methodologies that could be implemented. Duffee (1998) examined the relationship between the Treasury Yield and yield spreads of callable corporate bonds and considered the relationship between the two variables in terms of the grade quality of the bond. Higher-rated bonds would reflect higher sensitivity than lower-rated ones. As posited early in the review, Ayturk (2017) similarly conducted a study on the relationship between government borrowing and corporate financing that showed an inverse relationship. The study compared the sensitivities of corporate bonds to government debt depending on the size of the firms. Results prove that large credit-worthy firms are more sensitive to government debt. Research from Georgoutsos and Kounitis (2016) tried to shed some light on these variables, resulting in an inverse relationship using the vector error correction (VEC) model and cointegration. Furthermore, the development of new models, the Bayesian model of Karlsson and Östrholm (2018), enabled them to assess the relevance of the stochastic volatility and the drifting parameters resulting in an inverse relationship.

The work of Duffee (1998) consisted of month-end data on the bonds that made up the Lehman Brothers Bond Indexes with semiannual coupon payments covering January 1973 up to March 1995. Moody's and S&P were used for the bond ratings. He then proceeded to use summary statistics as his initial method and then used Value At Risk to look for the persistence of the response of change in the Treasury Yield. Finally, he utilized cointegration to remove any biases. Ayturk (2017) used country-level aggregate panel and firm-level microeconomic panel data in their econometric analyses, excluding all financial institutions from 1989 to 2014. The work of Basci (2015) examined the abnormal return and cumulative abnormal return of Australia, Canada, the Euro Zone, the U.K., Japan, and the U.S.'s 10-year government benchmark. He utilized the bond 30-day rate from January 2000 to April 2015, totaling 184 nominal repurchase rates. He used cointegration to know if there was a long-term relationship with the benchmark bonds, then used the VEC model to determine the coefficient that holds the balance for cointegration.

Georgoutsos and Kounitis (2016) employed monthly data for the 1-year and 10-year maturity, the first being short-term and the latter being long-term U.S. Treasury bonds and the Moody's Baa seasoned bond index. The study consisted of two stages. Where they first used cointegration analysis using multivariate estimation to find the relationship between their variables. They further shifted their attention to the short-run dynamics of their model and explored the Markov-switching vector error correction model (MS-VECM). Lastly, Karlsson and Österholm (2019) used the same data Österholm (2018) used, such as the CBYS, Treasury bill rates within three months, and the slope of the TY. Unlike Österholm's (2018) research, it utilized the newly developed Bayesian VAR model.

In contrast, some methodologies show a direct relationship between Treasury Bond Yield and CBYS (Jonkhart, 1979). The study incorporated the risk of default in the unbiased expectations theory, and the resulting model became useful in assessing interest rate risk differentials. Some methodologies revealed an indistinct relationship between the TBY and the CBYS. The work of Jarrow and Turnbull (1995) utilized two types of credit risks. The first is where the asset underlying the derivative security may default. The second is where the writer of the derivative security may default. Arbitrage-free valuation techniques were used on corporate debt and over-the-counter derivatives.

With these methodologies considered, the paper decided to base the methodology of Österholm (2018) to examine the relationship between TBY and CBYS.

To illustrate the roadmap of the paper, the paper explores the following questions:

1. What is the effect of the change in TBY, change in term structure, and change in inflation on CBYS?
2. What are the implications of the segregated data for the model?

Finding these implications would determine the degree of sensitivity towards the relationship of these variables. Lepone (2009) sought to identify the determinants of credit spread. He concluded that changes in the yield curve and the spot rate are important determinants of a credit spread. To determine if the same can be said in the Philippine setting, the objectives of the paper are:

1. Establish the effect of the changes in TBY, treasury term structure, and inflation on the changes in CBYS.
2. Examine the relationship between the changes of TBY, term structure, and inflation on the changes of CBYS by first deriving the changes of TBY, term structure, and CBYS.
3. Determine the degree of sensitivity of the segregated data towards the model.

Assessing the different credit qualities and maturities of the Philippine data has significance in determining the behavior of the variables in the model and the risk premiums arising from the segregation of bond ratings. Duffee (1998) found that there is an inverse relationship between these. Dupoyet, B., Jiang, X., & Zhang, Q. (2019) made a similar study and found a negative relationship between the two variables. The paper also considers the effect of inflation on my model because of studies done by Fridson, M., Garman, C., & Wu, S. (1997) and Bakaert et al. (2010). Although Duffee (1998) used the ordinary least squares (OLS) model in the U.S. bond market, I conducted the study using panel data regression in the Philippine setting.

Figure 1, the conceptual framework, shows the relationship between the changes in the 3-month Treasury yield, the changes in the Treasury term structure, and the changes in inflation to the changes in the CBYS.

The conceptual framework revolves around the negative relationship between the changes in the 3-month Treasury yield, the changes in the Treasury term structure, and the changes in inflation to the changes in CBYS. The liquidity preference theory expects changes in the 3-month Treasury yield, the changes in the Treasury term structure, and the changes in inflation to negatively impact the CBYS because people demand higher rates of return when Treasury bills have a higher rate due to the equity risk premium. Given the movement, the corporate bond yield would move at a higher rate than the increase in the TBY.

The changes in CBYS are the difference between the monthly CBYS. The 3-month TBY changes differ from the monthly 3-month Treasury yields. The changes in the Treasury term structure are the difference between the monthly Treasury term structure. The change in inflation is the difference between the monthly inflation rates. The negative relationship is established by the liquidity preference theory, which is consistent with the findings of previous research done by Longstaff & Schwartz (1995), Duffee (1998), and Jacoby et al. (2009).

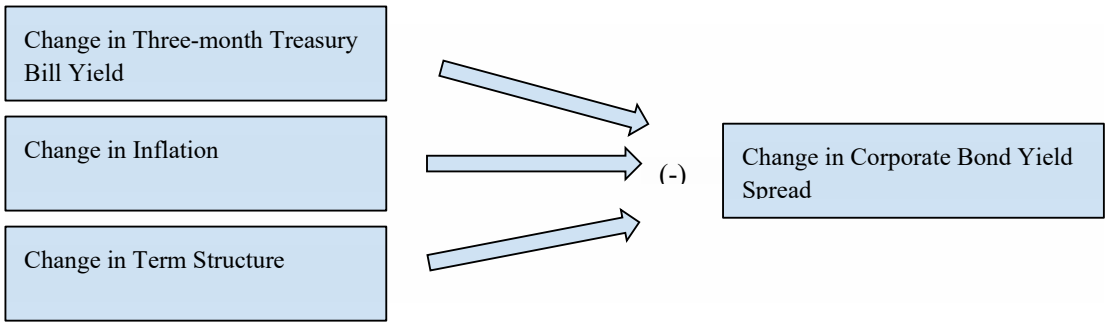

Figure 1. Conceptual Framework

Table 1. *Definition of Terms*

Variables	Description	Expectations	
Treasury Bill Yield	TBY is the return on investment of government securities.	There is an expected effect of this variable on CBYS Spreads	Chen, 2019c
Corporate Bond Yield Spreads	The Yield Spread is the difference in yield between two bonds, usually of the same maturities.	This is expected to be inversely related to TBY.	Kenny, 2019
Term Structure	It is the relationship between interest rates, bond yields, and different terms or maturities.	Expected to have an inverse relationship with the changes in CBYS	Chen, 2019b
Inflation	The quantitative measure of a selected basket of goods' average price level increases over time.	Expected to have an inverse relationship with the changes in CBYS	Chen, 2019a

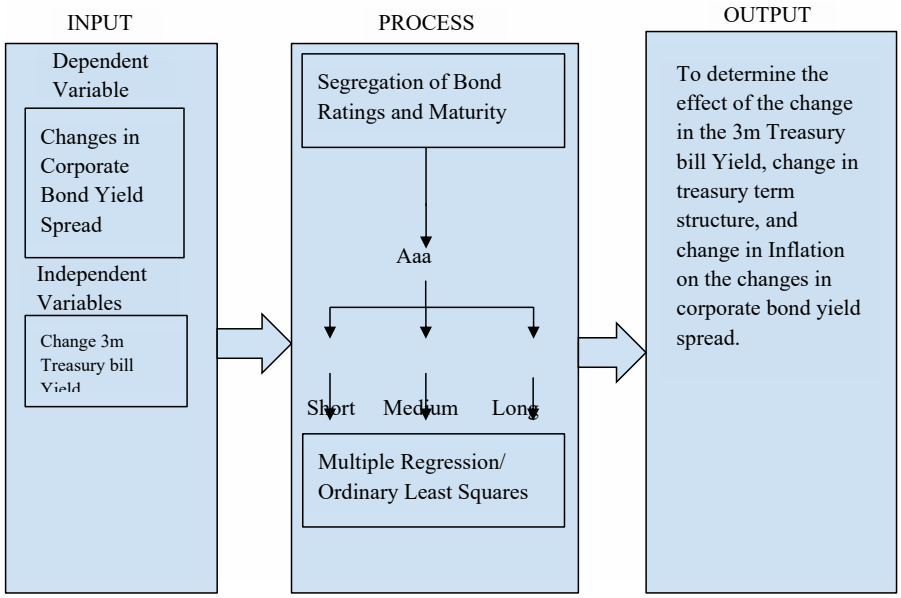

Figure 2. *Operational Framework*

In Figure 2, the operational framework exhibits the factors and their movements between the change in the 3-month Treasury yield, Treasury term structure, and the inflation to the changes in the CBYS (Jacoby et al., 2009). The independent variables will be the changes in the 3-month Treasury yield, changes in the Treasury term structure, and changes in inflation. In contrast, the changes in the CBYS will be the dependent variable. The data will be segregated under bond ratings and maturities (Duffee, 1998).

Corporate bonds were stratified according to maturity and investment grade, consistent with the market segmentation theory. The corporate bond yields of Aaa-rated corporations had been categorized into (a) 2–7 years, (b) >7-15 years, and (c) >15 years. The 3-month Treasury yields from the BSP came from its monthly establishment of the Treasury bills rates, whereas the monthly inflation rate came from the BSP and PSA official disclosures. The daily data on corporate bond yields was collected from the PDS Group. The remaining maturity of the corporate bond yields was established based on the difference between the issuance date and maturity date provided by the PDS Group. The corporate bond yields, now segregated, were averaged for the month based on their bond ratings and range. Afterward, the monthly corporate bond yields were matched to the corresponding monthly Treasury bill rate to get the

difference (CBYS). The methodology is consistent with Duffee (1998).

$$\Delta SPREAD_{i,\,m,t+1} = b_{i,m,0} + b_{i,m,1}\Delta Y_{T,¼,t+1} + b_{i,m,3}\Delta \boldsymbol{\pi}_{t+1} + e_{i,m,t+1} \quad (1)$$

Where ΔSPREAD = the mean of change from *t* and *t+1* in the spreads, ΔY changes in the 3-month Treasury bill yield, the ΔTERM changes in the Treasury term structure, and ΔI for the change in the inflation rate. The subscripts are denoted in the equation: *i* is the bond rating, *m* is the maturity, and *t* is time. The study used panel regressions to account for categorizing the CBYS as denoted by the subscripts *i* for bond rating and *m* for maturity.

Secondary data were retrieved from the BSP, PSA, PDS Group, and Eikon. The initial data collected will be the yields of the 3-month Treasury, the monthly inflation rate, and the yields of the corporate bonds. The 3-month Treasury yields collected from the BSP come from its monthly Treasury bill rates. The monthly inflation rate comes from the official disclosures of the BSP and PSA. The daily data of the corporate bond Yields are collected from the PDS Group and categorized based on the bond ratings by Phil Ratings. The study will be limited to using the bonds issued by companies rated by Phil Ratings. The segregation of corporate bond yields will be listed only in the bond ratings of Aaa bonds. The data will be further segregated based on the remaining maturity of the corporate bond yields. The remaining maturity of the corporate bond yields will be established based on the difference between the issuance date and the maturity date provided by the PDS Group. The corporate bond yields, now segregated, will be averaged for the month based on their bond rating and range. After getting the monthly corporate bond yields, they will be matched to the corresponding monthly Treasury bill rate to get the difference between the two variables. The result is the CBYS. The segregation of the CBYS will then be under the ranges of 2-7 years, >7-15 years, and >15 years (Duffee, 1998). After getting the monthly CBYS, I will get the changes in CBYS by getting the difference between the monthly CBYS.

In acquiring the 3-month TBY, the interest rates issued by the BSP on the specific months were used. The 25-year Treasury bond rate, the longest maturity, was retrieved in the PDS Group and will be used as the constant in getting the slope (Duffy, 1998). The slope or the term structure will be constructed by getting the difference between the monthly 3-month Treasury bill rate and the constant 25-year Treasury bond rate. The change in the 3-month Treasury yield will be calculated by getting the difference between the monthly 3-month Treasury yields. The changes in the term structure will be calculated by getting the difference between the monthly term structure. Lastly, the monthly inflation rates acquired from the disclosures of the PSA and BSP were calculated by getting the difference between the months.

Data Analysis

R statistical software calculates the mean, standard deviation, and correlation coefficient. The mean was used to measure central tendency, whereas the standard deviation was utilized to see the relative distance of the mean values from one another. A significance level of $p < .05$, the standard significance level, was adopted for the regression analysis (Gujarati & Porter, 2009).

Results and Discussion

Data Availability

Like the study of Duffee (1998), data on treasury bills for eight years from 2012 to 2019 were used. This is the only available data for government securities in the Philippines. The focus also largely falls on studying the nature of long-term securities such as bonds and Treasury yields. The paper does not cover the effect of market speculation on rates, such as the market's reaction if rates fluctuate.

Table 2 shows the summary of data sources extracted for this study.

Pre COVID (2012-2019)

Table 3 shows that Ayala Corporation and Ayala Land Inc. had the most number and probably the most significant bond issuances from 2012–2019 with Filinvest Land, S.M. Investments, and San Miguel Brewery. It indicated that the bulk of corporate financing came from debt capital. The borrowings among these companies also indicated bullish business prospects from real estate, food, and brewery.

In Table 3, the average maturity for the short, medium, and long-term bonds and the CBYS were 6.1

Table 2. *Data Source*

Variables	Date	Description	Data Source
Corporate Bond Yields	January 2012 - December 2019	The data contains the trade date, the time it was traded, institution name/code, coupon, maturity date, clean price, and face amount.	www.pds.com.ph
Treasury Yields	January 2012 - December 2019	The data contains the trade date, trade time, institution name, coupon rate, maturity date, clean price, yield, and face amount.	www.pds.com.ph
Bond Ratings	As of June 30, 2019	The data contains the available bond ratings in the Philippines, according to PhilRatings.	www.philratings.com
Treasury Bill Rates	January 2012 - December 2019	The data contains the 3-month risk-free rates issued by the Philippine government.	www.bsp.gov.ph
Inflation Rate	January 2012 - December 2019	The data contains the monthly inflation rate of the Philippines in a specific period.	www.bsp.gov.ph www.psa.gov.ph

Table 3. *Philippine Companies with Aaa Bond Rating (PhilRatings)*

		(# of bond issuances per company per period)		
Ticker Symbol	**Company**	**Short**	**Medium**	**Long**
AC	**Ayala Corporation**	7	21	2
AEV	Aboitiz Equity Ventures	3	9	
ALI	Ayala Land Incorporated	20	22	35
A.P.	Aboitiz Power	1	2	
CHI	Cebu Holdings, Inc.	2		
EDC	Energy Development Corporation	4		
FLI	**Filinvest Land, Inc**.	11		
GLO	Globe Telecom Inc.	1	3	
GTCAP	GT Capital Holdings, Inc.	1	4	
JGS	JG Summit Holdings, Inc.	2		
MEG	Megaworld Corporation	4		
NLEX	North Luzon Expressway	1		
PCOR	Petron Corporation	3		
PSB	Philippine Savings Bank	1		
RLC	Robinsons Land Corporation	1		
SM	SM Investments Corporation	13	3	
SMB	San Miguel Brewery	9	7	
SMC	San Miguel Corporation	3	9	
SMCGP	SMC Global Power Holdings Corporation	2	4	
SMPH	SM Prime Holdings	6	4	
Total		95	88	37

(−0.031668), 9.7 (−0.026818), and 17.3 (−0.030061), respectively. The more robust results of the medium-term bonds, like the short-term bonds, state that for every 1% change in terms of Treasury bills, there is a (-0.73%) change in CBYS, whereas for every 1% change in inflation, there is a (-0.12%) change in CBYS. These changes indicate an inverse relationship between the TBY and inflation to the corporate bond yield at an adjusted R square of 56.6%.

Short-Term Philippine Corporate Bonds

The short-term datasets were put on a series of tests before running the datasets in the ordinary least squares regression model. In the collinearity tests, multicollinearity was detected between the changes in the 3-month Treasury bill yield and in the Treasury term structure. The collinearity was perfectly negative, so I decided to remove the changes in the 3-month TBY as recommended by the program. Further results show very weak collinearity between the changes in inflation to the changes in the Treasury term structure and the changes in the 3-month TBY, which is a good sign. As per the stationary test, every variable of the changes in CBYS, such as the changes in the 3-month TBY, the changes in the Treasury term structure, and the changes in inflation, was below the p-value of .05, thus indicating the dataset to be stationary. Therefore, they can give meaningful values of means, variances, and correlations with other variables and can be useful in describing future behavior.

Table 4. *Number of Observations per Period, Aaa-Rated Bonds (Short Term)*

Short		
Ticker Symbol	Company	Number of Observations
AC	Ayala Corporation	7
AEV	Aboitiz Equity Ventures	3
ALI	Ayala Land Incorporated	20
AP	Aboitiz Power	1
CHI	Cebu Holdings, Inc.	2
EDC	Energy Development Corporation	4
FLI	Filinvest Land, Inc.	11
GLO	Globe Telecom Inc.	1
GTCAP	GT Capital Holdings, Inc.	1
JGS	JG Summit Holdings, Inc.	2
MEG	Megaworld Corporation	4
NLEX	North Luzon Expressway	1
PCOR	Petron Corporation	3
PSB	Philippine Savings Bank	1
RLC	Robinsons Land Corporation	1
SM	SM Investments Corporation	13
SMB	San Miguel Brewery	9
SMC	San Miguel Corporation	3
SMCGP	SMC Global Power Holdings Corporation	2
SMPH	SM Prime Holdings	6
	Total	

Ordinary Least Squares Regression

Short-Term

The short-term datasets that passed the initial tests were finally plugged into the ordinary least squares regression model. The following p-values resulting from the model were less than .05 for the changes in Treasury term structure and .0578 for the changes in inflation. Changes in Treasury term structure have a significant effect in predicting changes in CBYS, whereas changes in inflation are not significant in predicting changes in CBYS. The adjusted R-squared produced 32.22%, meaning that far more variables are involved in predicting the changes in CBYS. For every 1% change in the change in Treasury term rates, there is a corresponding 0.73% change in the change in CBYS, and for every 1% change in the change in inflation, there is a corresponding 0.17% change in the change in CBYS. The model has passed without heteroskedasticity, and its residuals are normally distributed.

Table 4. *OLS Using Observations 2012:02-2019:11 (T = 94), Dependent Variable: CBY1_change*

	Coefficient	Std. Error	t-ratio	p-value	
const	−0.0141276	0.0359815	−0.3926	0.6955	
change_term	0.733036	0.110339	6.643	<0.0001	***
change_inf	0.167583	0.0872183	1.921	0.0578	*

Mean dependent var	−0.031668	S.D. dependent var	0.421978
Sum squared resid	10.98346	S.E. of regression	0.347415
R-squared	0.336750	Adjusted R-squared	0.322173
F(2, 91)	23.10154	P-value(F)	7.70e-09
Log-likelihood	−32.47573	Akaike criterion	70.95146
Schwarz criterion	78.58134	Hannan-Quinn	74.03337
rho	−0.238322	Durbin-Watson	2.446175

Medium-Term Philippine Corporate Bonds

The medium-term datasets were put on a series of tests before running the datasets in the ordinary least squares regression model. In the collinearity tests, multicollinearity was detected between the changes in the 3-month TBY and the changes in the Treasury term structure. The collinearity was perfectly negative, so I decided to remove the changes in the 3-month TBY as recommended by the program. Further results show very weak collinearity between the changes in inflation to the changes in the Treasury term structure and the changes in the three-month TBY, which is a good sign. As per the stationary test, the changes in CBYS, the changes in the 3-month TBY, the changes in the Treasury term structure, and the changes in inflation all came well below the p-value of .05, thus indicating the datasets to be stationary. Therefore, it can give meaningful values of means, variances, and correlations with other variables and can be useful in describing future behavior.

Table 5. *Number of Observations per Period, Aaa-Rated Bonds (Medium Term)*

Medium		
Ticker Symbol	**Company**	**Number of Observations**
AC	Ayala Corporation	21
AEV	Aboitiz Equity Ventures	9
ALI	Ayala Land Incorporated	22
AP	Aboitiz Power	2
FBC	FBC Global Trading Philippines Corporation	5
GLO	Globe Telecom Inc.	3
GTCAP	GT Capital Holdings, Inc.	4
SM	SM Investments Corporation	3
SMB	San Miguel Brewery	7
SMC	San Miguel Corporation	9
SMCGP	SMC Global Power Holdings Corporation	4
SMPH	SM Prime Holdings	4

OLS Regression

Medium-Term

After the data was segregated into 7 to 15 years and was run using the model, the results were as follows: The p-value is less than 0.05 for changes in term structure and changes in the inflation rate, which is <0.0001 and 0.0235. It indicated that the result of the model is significant and, in turn, rejects the null hypothesis. As a result, it can be inferred that the results are significant such that changes in the Treasury bill term and inflation rates influence changes in CBYS. The model explains 56.6% of the total movement of the dependent variable, as reflected by the adjusted R square. The Akaike criterion shows a result of -23.70. However, the data did not pass the normality test consistent with the results of Duffee (1998). This can be explained by the model using Aaa bonds with higher ratings and, on average, lower yields. Lastly, based on the model's coefficients, for every 1% increase in changes in the Treasury bill rate, there is a corresponding 0.73% decrease in changes in CBYS, and for every 1% change in inflation, there is a 0.12% change in CBYS.

Table 6. OLS, Using Observations 2012:02-2019:11 (T = 94), Dependent Variable: CBY1_change

	Coefficient	Std. Error	t-ratio	p-value	
const	−0.0105865	0.0217478	−0.4868	0.6276	
change_term	0.733932	0.0666911	11.00	<0.0001	***
change_inf	0.121473	0.0527163	2.304	0.0235	**

Mean dependent var	−0.026818	S.D. dependent var	0.318800
Sum squared resid	4.012494	S.E. of regression	0.209984
R-squared	0.575483	Adjusted R-squared	0.566153
F(2, 91)	61.68074	P-value(F)	1.17e-17
Log-likelihood	14.85222	Akaike criterion	−23.70444
Schwarz criterion	−16.07456	Hannan-Quinn	−20.62253
rho	0.149937	Durbin-Watson	1.686765

Long-Term Philippine Corporate Bonds

Finally, the long-term datasets were put on a series of tests before running the datasets in the ordinary least squares regression model. In the collinearity tests, multicollinearity was detected between the changes in the TBY for more than 15 years and the changes in the Treasury term structure. The collinearity was perfectly negative, so I decided to remove the changes in the long-term TBY as recommended by the program. Further results show very weak collinearity between the changes in inflation to the changes in the Treasury term structure and the changes in the long-term TBY, which is a good sign. As per the stationary test, the changes in CBYS, the changes in the long-term TBY, or the changes in the Treasury term structure have a p-value less than .05, thus indicating the datasets to be stationary and, thus, can give meaningful values of means, variances, and correlations with other variables, and useful in describing future behavior. Changes in inflation have a p-value of more than .05, which means it is not significant to influence CBYS.

Table 7. *Number of Observations Per Period, Aaa-Rated Bonds (Long Term)*

Long		
Ticker Symbol	Company	Number of Observations
AC	Ayala Corporation	2
ALI	Ayala Land Incorporated	35

OLS Regressions

Long-Term

The p-value is less than 0.05, which indicates that the result of the model is significant at 0.0002, which in turn rejects the null hypothesis. However, this is only true to changes in terms of the Treasury bill, as the change in inflation has a p-value of more than .05 at 0.6109 and thus is insignificant. As a result, we can infer that the results are material enough to be considered and that change in term structure influences changes in CBYS. The model explains 12.5% of the total movement of the dependent variable as reflected by the adjusted R square, which is way higher than the short-term. The Akaike criterion shows a result of 144.72. However, the data did not pass the normality and collinearity test, much like the short-term. The data did not pass the normality test because the model used Aaa bonds, characteristics of a safer nature of higher quality bonds, and, on average, would have lower yields. Lastly, based on the model's coefficients, for every 1% increase in changes in term structure, there is a corresponding 0.63% increase in changes in CBYS.

Table 8. *OLS, Using Observations 2012:02-2019:11 (T = 94), Dependent Variable: CBY1_change*

	Coefficient	Std. Error	t-ratio	p-value
const	−0.0170794	0.0532695	−0.3206	0.7492
change_term	0.638620	0.163354	3.909	0.0002 ***
change_inf	0.0659309	0.129124	0.5106	0.6109

Mean dependent var	−0.030061	S.D. dependent var	0.549975
Sum squared resid	24.07350	S.E. of regression	0.514338
R-squared	0.144205	Adjusted R-squared	0.125397
F(2, 91)	7.666955	P-value(F)	0.000837
Log-likelihood	−69.35761	Akaike criterion	144.7152
Schwarz criterion	152.3451	Hannan-Quinn	147.7971
rho	0.207468	Durbin-Watson	1.585052

Recent COVID Reports on Corporate Financing

Liang (2020) of Hutchin's Center on Fiscal and Monetary Policy examined how the U.S. investment-grade corporate bond market functioned well in the global financial crisis. However, it did not exist during the COVID-19 crisis. Liang cited that the COVID-19 crisis triggered sharp falls in the prices of investment-grade corporate bonds. Measures of market liquidity, such as bid-ask spreads and price impact, deteriorated as it was more costly to trade an investment-grade bond as a high-yield bond. Furthermore, the paper presented documents of the acceleration of large redemptions from investment-grade corporate bond mutual funds, putting downward pressure on the prices of investment-grade corporate bonds and contributing significantly to the "dash for cash" by worried investors. Moreover, Maiello (2020) and He et al. (2020) explained that investors rush to buy U.S. Treasury bills when stock markets plunge as safe-haven assets. The assertions have been that the Treasury market goes up during a stock market crash. During the COVID-19 stock crash last March and April (2020), demand was sluggish as U.S. Treasury markets seized. As government institutions refinance debt with Treasury instruments, its demand has been expected to remain stable even during strenuous economic times. A different pattern emerged during the COVID-19 stock sell-off: great demand for U.S. Treasuries for shorter maturities, between two and ten years, to Treasury bills, with maturities of less than a year. The situation describes the uncertainties plaguing market sentiment. Now closing near the Philippines, among the emerging economies in the ASEAN, from Table 9, the Philippines showed dismal performance (ADB, 2020). As the Equity Index fell to 14%, the demand for two-year and 10-year government bonds dropped to their highest forms, 133bps and 116bps in the region.

Table 9. *Changes in Financial Conditions*

Emerging East Asia	2-Year Government Bond (bps)	10-Year Government Bond (bps)	5-Year Credit Default Swap Spread (bps)	Equity Index (%)	F.X. Rate (%)
Indonesia	83	40	64	(12.8)	(2.0)
Malaysia	(42)	(2)	27	(0.6)	(3.0)
Philippines	*(133)*	*(116)*	*15*	*(14.0)*	*0.7*
Singapore	(103)	(56)	–	(16.6)	(1.4)
Thailand	(25)	9	15	0.2	(0.9)
Viet Nam	(40)	28	111	(2.0)	(0.2)

( ) = negative, – = not available, bps = basis points, FX = foreign exchange. Data reflect changes between 28 February and 29 May 2020. Sources: Bloomberg LP and Institute of International Finance

Conclusions

This study examined the relationship between TBY (term structure) and inflation on the Philippine CBYS changes. Consistent with Duffee (1998) and Jacoby et al. (2014), the relationship between TBY and CBYS persisted in the Philippine setting. The results demonstrated that the TBYs significantly affected short-term, medium-term, and long-term Philippine CBYS.

The paper adheres to the following thoughts from a literature review for future research. Faugere, C. (n.d.) sought to answer stock market valuation and Treasury yield determination using the required yield theory. They found that Treasury yields are determined by the required yield and business cycle risk premium and that inflation and fear-based risk premia only have a secondary impact. Stock market valuation could be further researched. Moreover, market factors also affect the volatility of corporate bonds. Lee et al. (2017) studied the Taiwan bond fund crisis in 2004 and the effectiveness of the policies implemented in response to the crisis. The study shows that volatile forward rates cause negative spreads and implausible survival probability curves the longer they mature, five years or longer. However, the survival probability curves are more reliable in estimating lower-grade bonds than higher-grade bonds. Corporate bonds are also

Table 10. *Research Gap Summary (Future Research Directions)*

	Current Study	Base Article 1 (Duffee, 1998)	Base Article 2 (Jacoby et al., 2014)
Variables	Three-month treasury bill rate CBYS Yield curve slope Inflation rate	- Three-month T-bill yield, Treasury slope, Baa spread - (Callable and non-callable)	Three-month treasury bill rate, the slope of the yield curve, CBYS, and inflation rate
Methodology	Data sampling, time series regression (OLS regression)	OLS regression, GMM estimation, VAR	OLS regression, GMM estimation, GARCH
Period	January 2012 - June 2019	May 1985 - March 1995	August 1976 - July 2001
Frequency	Monthly	Monthly	Monthly
Country	Philippines	United States	Canada
Samples	Philippine Treasury and Corporate Bonds	U.S. corporate bonds and Treasury bills	Treasury Board of Canada and Corporate Bonds

susceptible to risk because industry risks cause a rate shift that would otherwise be considered safe. A change in basis points would either increase or decrease the bond price, thus causing price volatility. Kowalewski and Pisany (2019) investigated the corporate bond market development in 10 Asian countries and what drove the countries' development. The article focused on several factors that may impact bond market development: the economy, financial system, banking sector, and institutional framework. The study showed an association between bank credit growth and corporate bond market issuance value.

As posited early on, although the paper focused on providing evidence on one of the most basic well-established inverse relationships between TBY, inflation, and CBYS in the Philippines, the study sets the groundwork and embarks on a solid foundation leading to the development of the Philippine bond market in the years to come.

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