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An Explanation of Underwriting Spread Differentials on Complex Securities

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This paper considers underwriting costs for complex securities which involve special tax treatment, conversion features, bond put options, and structural complexity resulting from combining several such features in a single security. Such securities are more difficult to understand and to value than regular coupon bonds, and they put greater administrative burden on the holder. In order to effect a sale and to meet due diligence requirements of the SEC, more information must be communicated by the underwriter to the potential investor. At the same time, investor option features reduce underwriter inventory risk. Increased information costs related to tax and structural complexity are shown by empirical tests to result in increased underwriting spread, while investor-option features result in decreased underwriting spread.

■ In recent years, there has been a large increase in the variety of securities which corporations issue, going well beyond traditional debt and equity (Merton, 1995). Some complex securities combining elements of debt and equity, such as convertible bonds and bonds issued in a package with stock warrants, have existed for some time. Others, such as zero coupon bonds, zero coupon convertible bonds (most commonly, Merrill-Lynch's Liquid Yield Option Notes, or LYONs), puttable bonds, and high-yield or junk bonds are relatively new. The various complex securities may allow both parties to gain: issuing firms, by tailoring securities to their particular capital structure and cash flow timing needs, and investors, by providing a greater variety of risk, return, and timing of cash flows. Certain security designs may also provide favorable income tax treatment. These gains may have to be balanced against increased costs of communicating information to prospective investors in order to effect a sale and to meet due diligence requirements of the Securities and Exchange Commission. Increased information costs for complex securities may include the complex tax treatment to which holders of securities classified "original issue discount" (OID) are subject, the bond-put and equity-conversion options included with some securities, and the structural complexity when several such features are packaged in a single security. Investor options reduce underwriter inventory risk, while they simultanously increase information costs, which makes their effect on underwriting spreads uncertain; therefore it can be approached only through empirical testing.

This paper focuses on the measurement of

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underwriting spread effects for information costs, for bonds with structural or tax complexity, and for bonds containing equity-conversion options or bond-put options. Empirical tests, after controlling for issue size and risk, demonstrate that underwriting spreads are significantly higher than regular bonds for bonds with complex structure or tax treatment. Proprietary features may also increase spreads on some complex structure bonds, namely LYONs. Spreads are significantly lower for bonds which contain investor options.

The paper contributes to a better understanding of how underwriting spreads are affected by the complexity of bonds, including information costs, investor options which reduce underwriting risk, and proprietary features. New securities must provide a benefit to either the issuer or the investor which is greater than the added issuing costs. Understanding these relationships will improve cost and benefit analysis as new complex securities are introduced.

Section I of the paper contains a review of previous literature; Section II develops the information-cost and option-risk-reduction hypotheses; Section III describes the sample of regular coupon bonds and complex securities; Section IV describes the empirical tests and results; and Section V contains summary comments and conclusions.

I. Previous Research

The underwriting spread compensates investment banks for three basic services: 1) assistance in design and timing of the security, 2) assumption of all or part of the market risk of the security, and 3) distribution of the issue (Mandelker and Raviv, 1977; Baron and Holstrom, 1980). The price, or spread, for the underwriter's services is well-known to be influenced by the size of the offering and its riskiness.

Certain costs related to issuance of the security have fixed elements, regardless of size (Hansen and Pinkerton, 1982). The resulting inverse relationship between underwriting spread and offering size has been empirically demonstrated by Ederington (1975), Kessel (1971), Fabozzi and LiCalzi (1978), and Rogowski and Sorenson (1985), among others, and more recently by Tufano (1989) and Long and Sefcik (1990).

In guaranteeing the proceeds of a security issue, underwriters assume the market risk associated with carrying an inventory of securities until distribution to the public (Marr and Thompson, 1985). The relationship between risk and underwriting spread has been demonstrated empirically by Ederington (1975), Smith (1977), Fabozzi and LiCalzi (1978), Kidwell, Marr, and Thompson (1984), Bhagat, Marr, and Thompson (1985), Rogowski and Sorenson (1985), Foster (1989), Tufano (1989), Long and Sefcik (1990), and Becker (1995).

Issuing costs are also known to vary by the form of security used to raise funds. For example, Mikkelson and Partch (1986) find that underwriting spreads for a large sample of common stocks and regular-coupon debt average 5.5% and 1.0%, respectively. Tufano (1989) also showed that underwriting spreads are significantly higher for equity securities over debt. That study fails to find a difference between spreads on "equity-linked debt" and mortgage-backed debt, his control category. Tufano's "equity-linked" category groups together securities with widely ranging information and tax complexity and degree of underwriting risk. In separately examining two types of equity-linked debt issues, Long and Sefcik (1990) find average spreads of 1.8% for convertible bonds, and 3.4% for bonds issued in conjunction with warrants. After controlling for issue size and risk, Long and Sefcik find straight bonds issued in conjunction with warrants are 1.2% of the issue size more expensive to issue than convertible bonds. They suggest that the differential results from information costs, which increase with the number of variables necessary to parameterize the offering, and from the tax administrative costs associated with certain issues. Long and Sefcik's sample, consisting of two types of securities only, did not allow for tests to differentiate between information cost characteristics. This paper focuses on information costs and the risk reduction features of investor options as determinants of underwriting fees in a study of six debt-based security types.

II. Hypotheses, Information Costs, and Option Effects on Underwriting Spreads

The debt-based securities included in this study consist of up to four principal elements: 1) their contractually guaranteed cash flows, described by maturity date and amount, coupon rate, and payment dates; 2) equity conversion features; 3) bond put options; and 4) special income tax treatment. Regular coupon bonds are fully described by the first element. Description of bonds with conversion options requires conversion ratios and option expiration dates. Bonds with put options require redemption amounts and dates. OID bonds require additional information regarding discount

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amortization for tax purposes.[1] Description of LYONs requires information on all four elements.[2] The degree of information which must be communicated to potential buyers affects the underwriter's costs to sell, and probably the underwriting spread as well. Complex income tax handling for some bond types, which will coincide with favorable tax treatment for the issuer, may further justify higher underwriting fees. Investor options, which also decrease underwriter inventory risk (as described below), further increase information communication costs. The six bond types in this study are classified in Table 1 according to tax and option features that increase the information costs to fully describe the bonds.

Totaling the number of information-cost features per bond facilitates a naive prediction of underwriting spreads. We might expect convertible bonds, OID bonds (no conversion options), and bonds with puts to have higher spreads than regular coupon bonds; bonds issued with warrants to have still higher spreads; with highest spreads for LYONs. Beyond such a naive analysis, it should be considered that information costs on bonds having more than one of the information cost features may exceed the sum of costs associated with each feature. Potential interactions between the features must also be communicated, such as how the investor's tax position with an OID bond changes when it is converted to equity. Additionally, LYONs, as a proprietary product of Merrill Lynch, may allow the firm to achieve an additional spread premium.

While bond-put and equity-conversion options increase information costs, they reduce underwriting risk at the same time. That is, such option features reduce inventory risk by making the complex security prices less volatile. Bond-put options effectively place a floor under the security's yield, thus reducing interest rate risk. Equity options reduce volatility through diversification, the security becoming a portfolio consisting of a bond and a quantity of options. This adds no value to the security itself if investors already hold diversified portfolios. The reduction in volatility of the bond with conversion options[3] reduces the underwriters' risk on the normally quite limited number of stocks in process of issuance (inventory), however.

The premises being tested in this paper are 1) that the additional information needed to describe complex bonds leads to higher spreads to enable underwriters to recover their costs of communicating information to prospective investors, 2) that underwriting spreads are higher for securities subject to complex income tax treatment, and 3) that investor options packaged with securities lead to lower underwriting spreads through inventory risk reduction.[4] Since inclusion of bond-put options or equity-call options in securities both add to information costs and reduce underwriter risk, the net effect of such options cannot be predicted and must be measured through empirical study.

High underwriting spreads will be incurred only when justified by increased benefits to the issuer or to the investor, of course. Possible benefits of complex securities to the issuer include reduced agency costs resulting from bonds with equity features, lower borrowing costs in the absence of conversion, tax savings, and lower time-adjusted

[1]For example, a five-year, zero-coupon bond with a $1,000 maturity value providing an 8% pre-tax yield to maturity, is issued at $675.56. The zero-coupon bond holder, if subject to income tax, must pay taxes annually even though no cash payments are received until maturity. The difference between the bond's value at maturity and purchase price must be amortized over the holding period as follows, for the example bond held by an investor in the 40% bracket.

Year	Discount Amortization (Constant Yield Method with Semi-Annual Compoundings)	Income Tax
1	$55.12	$22.04
2	59.63	23.85
3	64.49	25.80
4	69.75	27.90
5	75.45	30.18
	$324.44	$129.77

Prior to the 1982 tax code changes, original issue discount bonds provided lower interest costs to the issuer as a result of alternative methods of taxing issuer and holder. Issuers could amortize the discount on a straight-line basis rather than by the constant yield method. The acceleration of tax deductions gave the issuer of an OID a lower after-tax cost than that of a bond paying coupon interest at the market level when issued, even though both bonds provided the holder the same after-tax yield to maturity. Net benefits could be several times as large as the additional costs to issue (Fisher, Brick, and Ng, 1983).

[2]McConnell and Schwartz (1986) describe a typical LYON, that of Waste Management, which was issued April 12, 1985. The investor has put options exercisable on June 30 of each year beginning three years after issuance, at a scheduled series of prices to yield 6.0% after three years, with the put price yield increasing by an additional 1.0% per year until the sixth year when the yield levels at 9.0% for all years thereafter. The issuer has a call option at a price to yield 9.0% to the investor after 10 years, with higher yields provided if the issuer exercises earlier. Call options are exercisable any time after June 30, 1986. Put option prices are less than call option prices until June 30, 1995 and are equal thereafter.

[3]Bonds with equity-option features will be more volatile than regular bonds under most circumstances. However, equity risk and bond risk are controlled separately in the regressions in this study so that the underwriter's inventory diversification factor should be reflected in the option feature variable as well as information costs associated with that feature.

[4]Call options retained by the issuer tend to increase underwriting risk. Until recently, bonds which are not callable were seldom issued (Brick and Palmon, 1993, and Crabbe and Helwege, 1994).

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Table 1. Additional Information Costs Arising in Complex Bonds

In this table, a "1" represents a bond that has the feature, and a "0" represents a bond without the feature.

	Additional Information Costs Arising From:			
	Conversion Options	Put Options	Discount Amortization	Total Information Features
Bond Type:				
Regular	0	0	0	0
Convertible	1	0	0	1
OID w/o Conv. Options	0	0	1	1
Regular / Puts	0	1	0	1
Regular / Warrants	1	0	1	2
LYON	1	1	1	3

costs of equity issuance if bonds are converted (Becker, 1994). Conversion features may be necessary for riskier firms to sell any form of debt security.[5]

III. The Sample

In order to determine whether additional information costs explain underwriting spread differentials, we consider the five complex bond types described above, and compare them to a group of regular coupon bonds. All bonds in the sample are public issues of US industrial firms. Regular bonds, including those having put options, come from the sample used by Malitz (1994), and consist of bonds issued between 1961 and 1991.[6] Bonds rated Aaa were eliminated from the sample because none of the other bond type samples contain bonds rated this high, and the sample was further reduced to more closely match the size of the other bond type samples by simply eliminating every third bond. The convertible and regular bonds with warrants samples are those samples used for the 1990 Long and Sefcik paper. All new issues of convertible bonds and regular bonds issued in conjunction with warrants by firms traded on the New York Stock Exchange, from 1965 to 1985, where the issued constitutes at least 5% of total capitalization (book value), were selected by comparing consecutive annual lists of convertible bonds outstanding in *Moody's Industrial Manuals*. Data on non-convertible OID bonds and LYONs issued between 1981 and 1990 were collected after reviewing three sources: *Moody's Industrial Manual*, the *Registration and Offerings Register (ROS)* tape, and *The Wall Street Journal* listings of bonds traded.[7] LYONs, OIDs, and regular bonds with puts did not appear prior to the 1980s, whereas the other bond-type samples include bonds as early as 1965. A series of date-dummy variables is used to control for this, as described below. Summary statistics for the full sample of 385 bonds, by bond type, are shown in Table 2.

Underwriting spreads in total vary considerably between the bond categories, from 0.7% to 3.3% of the offer price. Total spreads increase with complexity on the average, similar to the increases predicted by the naive analysis of Table 1, except that bonds with puts have lower spreads than regular coupon bonds, and the order of LYONs and Regular bonds with warrants is reversed. This observation suggests that put options, which reduce underwriting risk, may lead to reduced underwriting spreads. There is considerable variation in average issue size and risk between the groups of bonds, however. These factors must be controlled for as they are known to affect spreads.

IV. Empirical Tests

Underwriting spread, expressed as a percent of offer price, is regressed on multiple dummy variables for

[5]Long, Malitz, and Sefcik (1992) find that most firms' first public debt offerings are in the form of convertible securities.

[6]The sample "initially consisted of all long-term, senior, non-convertible industrial debentures issued by publicly traded firms and described in *Moody's Bond Survey*, and/or *Moody's Industrial Manual*...When a firm had multiple long-term issues, the issue containing the most restrictive indenture provisions was selected. More than one debt issue for the same firm was used if the restrictions on each issue were identical and the issues were separated by at least ten years, or, in three cases, when a later issue contained more binding restrictions than an earlier issue." (Malitz, 1994).

[7]A breakdown of underwriting spread into underwriting fees, management fees, and selling concession was obtained for a part of the bond sample from *Investment Dealers' Digest*, and from the Securities Data Company. The three elements of underwriting spread, expressed as percentages of issue price, were found to be highly correlated (coefficient 0.80 or higher in all cases). Predictably, regressions of the separate elements adds nothing to the study.

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Table 2. Descriptive Statistics of Industrial Bond Sample

	Type of Bond						
	Regular Coupon	Regular/ Warrants	Regular/ Puts	Convertible	OID w/o Cv Options	LYON	Full Sample
Sample Size	151	52	13	123	22	24	385
	Mean Values						
Underwriting Spreads	0.0177	0.0333	0.0073	0.0182	0.0199	0.0277	0.0203
Issue Size, 1972 $ Millions	52.0000	36.8000	60.8000	37.0000	39.7000	68.6000	45.8000
Coupon Rate %	9.7000	10.0000	16.0000	7.6000	3.6000	0.0000	8.4000
Maturity	22.2000	16.7000	23.2000	21.1000	17.4000	16.5000	20.5000
Std. Dev., Stock Return	0.0190	0.0240	0.0180	0.0150	0.0210	0.0200	0.0190
	Number of Bonds with Moody's Rating						
Aa	6	0	1	0	7	0	14
A	40	4	10	7	9	7	77
Baa	38	3	2	19	2	10	74
Ba	31	10	0	59	1	2	103
B	34	20	0	23	3	5	85
Caa or Less	2	15	0	15	0	0	32
Total	151	52	13	123	22	24	385

information and tax characteristics, EQUITYOPTION, PUTOPTION, and TAXCOMPLEX, with control variables for issue size and risk. Since the two option variables reduce underwriting risk as well as represent information costs, their sign cannot be predicted. Two additional dummy variables are added to test for the effects of structural complexity, STRUCTCOMPLEX for securities having two or more of the information or tax characteristics, and LYON for securities having three of these characteristics. The latter sample consists of 24 convertible OID bonds with puts, of which 21 are actually LYONs, the proprietary product of Merrill Lynch. The LYON variable thus can be expected to be affected by any proprietary advantage that underwriter has enjoyed. Regressions are reported with and without the last two mentioned variables.

Size of issue is controlled for in both regressions using the natural log of issue size, LNSIZE, following the practice of Long and Sefcik, Tufano, and others, with issue size standardized in millions of 1972 dollars. Firm risk is controlled for using the standard deviation of stock returns for the period 220 to 21 days prior to the announcement date, STDDEV, and by dummy variables for Moody's bond ratings A or higher, Baa, Ba, and B. The time periods in which sample bonds were issued vary by bond type, as some types are only recently devised while others (OIDs) have become less popular in recent years. To control for the variation in dates, a series of date dummy variables was used in the full sample, plus regressions with subsamples of all bond types issued within the time periods in which OIDs, LYONs and puttable bonds have existed. Results of the regressions are shown on Table 3.

The variables in the two regressions of underwriting spread (with and without the LYON variable) explain 62% and 61%, respectively, of the underwriting spreads. Control variables have the expected signs and are significant, with the exception of the dummy variables for issue periods,

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Table 3. The Importance of Information Costs and Option Features to Underwriting Spread

In the table, "spread" is the underwriting spread/process of bond sale; "LNSIZE" is the natural log of issue size in millions, in 1972 dollars; "A, Baa, Ba, B" equals 1 for bond so rated by Moody's, 0 otherwise; "STDDEV" is the standard deviation of stock returns for the period -220 to -20 days prior to the issue announcement; "EQUITYOPTION" is 1 if the bond has an equity conversion option, i.e., regular bond issue with warrants, convertible bond, or LYON, 0 otherwise; "TAXCOMPLEX" is 1 if discount amortized for tax purposes, i.e., regular bond with warrants, LYON, or nonconvertible OID, 0 otherwise; "STRUCTCOMPLEX" is 1 if the bond has two or more complex features (regular with warrants or LYON), 0 otherwise; and "LYON" is 1 if the bond is a LYON (three complex features), 0 otherwise. The regressions were also run with a series of dummy variables for five-year periods covered in the sample pre-1970, 1970-1975, 1975-1980, etc., to control for any structural changes which may have taken place within the 35-year span of the sample. No coefficient for any time period dummies is even marginally significant, while coefficients and significance for other variables is similar to that shown.

	Five Features	t-Statistic	Three Features	t-Statistic
Sample Size	385		385	
CONSTANT	4.167	16.89***	3.394	16.01***
LNSIZE	-0.271	-4.63***	-0.235	-3.98***
STDDEV	12.280	3.67	12.390	3.63***
Dummies for Moody's Credit Ratings[a]				
A or Higher	-2.154	-9.87***	-2.268	-10.46***
Baa	-2.032	-9.99***	-2.009	-9.85***
Ba	-1.435	-7.85***	-1.456	-7.94***
B	-0.803	-4.65***	-0.779	-4.45***
Dummies for Options and Complex Features				
EQUITYOPTION	-0.369	-3.46***	-0.221	-2.19***
PUTOPTION	-0.426	-1.82**	0.292	1.90**
TAXCOMPLEX	0.424	2.27***	0.898	8.38***
STRUCTCOMPLEX	0.525	2.29***		
LYON	1.053	3.46***		
Adjusted R^2	0.623		0.606	
Model F Ratio	58.668		66.589	

***Significant at the 0.01 level, single-tailed t-test.
**Significant at the 0.05 level, single-tailed t-test.
[a]Omitted categories are bonds rated Caa or less and regular coupon bonds.

which are not reported.[8]

The five-bond feature model, reported in the first two columns of Table 3, shows increased underwriting spreads for bonds requiring discount amortization and those having structural complexity. Bonds requiring discount amortization are 42 basis points more expensive to issue while bonds with two and three complex features are 53 and 105 basis points more expensive respectively. The latter figure may also include a spread premium for Merrill Lynch when it issues its LYON security. Underwriting spreads are shown to decrease for bonds with either equity conversion options or bond put options, 37 and 43 basis points, respectively. These are probably net effects as such features imply increased information costs, while simultaneously reducing underwriting risk.

[8]Results of regressions with subsamples of bonds issued within periods which contain OIDs (1981 to 1986) and LYONs and other puttable bonds (1985 to 1990) gave similar results to those reported, although they were less significant.

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Because the dummy variable, LYON, consists of LYONs only, its inclusion does not provide a full test of the hypotheses concerning additional information costs related to its multiple features and/or monopoly profits to Merrill Lynch. The model is therefore presented without the LYON and STRUCTCOMPLEX variables used to indicate securities with more than one complex feature (Table 3, columns three and four). Results are similar to those for the first regression except that the coefficient for PUTOPTION has the opposite, positive sign. Omission of the STRUCTCOMPLEX and LYON variables leaves unexplained the large difference in spreads between regular bonds with and without put options, suggesting that the second model in Table 3 is underspecified.

Regression of underwriting spread,[9] in a subsample consisting of only regular bonds and regular bonds with puts indicates that put options have a negative effect on spread (24 basis points, with significance at the 0.10 level). The five-bond feature model (Table 3, columns one and two) is consistent with this result, and is believed to be the correctly specified model.

Inclusion of dummy variables for the first two years of issuance of new security products showed a positive and significantly higher spread for LYONs in the introductory period and no significant difference for regular bonds with put options. Spreads may be reduced as investors and underwriters become more familiar with issues and as competition increases over time. (See Tufano, 1989.) Spreads for OID bonds containing no investor options actually showed a significant increase after the introductory period, an effect which may be related to the necessity of getting the bonds issued prior to implementation of the 1982 tax code, which removed the tax advantage of such bonds. (See footnote 1.)

Table 4 contains a comparison of average underwriting spreads for the six bond types in the sample with spreads predicted using the coefficients of the five-bond feature model (Table 3).[10] The model underpredicts in every case, but between 2% and 20% of the spread is left unexplained by the model, depending on bond type.

A similar comparison of the three-feature model (excluding the STRUCTCOMPLEX and LYON variables) gives comparable results except for bonds with put options where the three-bond feature model overestimates the spread by 68%. This suggests again that the three-bond feature model, which omits the structural complexity of LYONs and regular bonds with warrants, and has no control for Merrill Lynch's proprietary advantage, is underspecified.

V. Summary and Conclusions

Debt-based securities with special tax treatment, equity-conversion options, or bond-put options require more information for valuation and may require the underwriter to assume an additional administrative burden, as compared to regular coupon bonds. Greater amounts of descriptive information must be communicated to prospective investors in such securities to induce them to purchase and to meet the due diligence requirements of the SEC. At the same time, option features which increase information costs also reduce underwriting risk.

It is shown empirically that underwriting spreads increase as the information required to describe tax features or the structural complexity of multi-feature bonds increases, and/or where a product monopoly exists. It is also shown that underwriting spreads decrease when equity conversion or bond put options are included in the security design.

A better understanding of the relationships between security design and underwriting costs will improve analysis of the costs and benefits of complex securities. Added costs to issue complex securities and the inclusion of investor options in securities can be justified if agency costs, interest expense, taxes, or security borrowing costs are reduced sufficiently. ■

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[9]Controlling for size and risk as in the previously described regressions.

[10]The difference in underwriting spreads for regular bonds with warrants versus convertible bonds is 0.95%, somewhat below the 1.2% difference unexplained by size and risk in the Long and Sefcik study (1990), which used only traditional convertible bonds and bonds with warrants. The inclusion of Moody's ratings in the current study, which they did not use, may account for this difference.

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Table 4. Average Spread Premiums Compared to Predictions of Regression

	Type of Bond					
	Regular Coupon	Regular/ Warrants	Regular/ Puts	Convertible	OID w/o Cv Option	LYON
Sample Average Spreads	1.771	3.332	0.730	1.820	1.986	2.772
Model Predictions						
Constant	4.167	4.167	4.167	4.167	4.167	4.167
Adjustments for						
LNSIZE	(1.072)	(1.152)	(1.114)	(0.979)	(0.999)	(1.147)
STDDEV	0.232	0.291	0.224	0.182	0.253	0.251
Rating	(1.665)	(1.220)	(2.135)	(1.452)	(1.926)	(1.762)
EQUTIYOPTION		(0.369)		(0.369)		(0.369)
PUTOPTION			(0.426)			(0.426)
TAXCOMPLEX		0.424			0.424	0.424
STRUCTCOMPLEX		0.525				0.525
LYON						1.053
Predicted Spread	1.662	2.667	0.715	1.548	1.919	2.716
Unexplained by Model	0.110	0.665	0.015	0.272	0.067	0.056
Percent Explained by Model	93.80%	80.00%	98.00%	85.10%	96.60%	98.00%

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