Theory and Evidence..

Spread Convergence with Defaulted Same Seniority/ Same Coupon Different Maturity Bonds

by

Frank Han

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Professor Marti G. Subrahmanyam	Professor Edward Altman
Faculty Adviser	Thesis Advisor

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Abstract

This paper examines defaulted same seniority/same coupon different maturity bonds in relation to capital structure arbitrage. Such bonds should trade at the same level or at predictable spreads. However, this study observes that spreads often widen and become more volatile as the company moves deeper into distress. If abnormal spreads tend to converge over time, a lucrative trading opportunity may present itself. An analysis of a set of 58 defaulted bond issues from 25 firms from 1987 to 2004 will determine if such convergence occurs, and if so, the time period of convergence. The study shows that such pairs of bonds are extremely positively correlated, and that the price of one security is a very good predictor of the price of the other. Results also show that abnormal spreads do converge over time. Given estimated transaction costs, a potentially profitable strategy is possible.

1. Introduction

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Broadly, distressed trading strategies have been broken down into three subgroups: Active/Control, Active/ Non Control, and Passive [Altman 2004]. Active/ Control involves taking control of a distressed company through a debt/equity swap. The intent is to restructure the company and then continue active management to improve operations. The investor typically exits after two or three years and seeks an annualized return of 20-25%. Active / Non Control focuses on senior secured and senior unsecured securities. It also calls for active participation in the restructuring process, yet does not seek to manage the company after restructuring takes place. Investors typically exit after one to two years and seek an annualized return of 15-20%. Finally, the Passive strategy seeks to profit by investing in undervalued securities trading at distressed levels. Sub strategies include trading, buy-hold, senior or senior secured, sub-debt, capital structure arbitrage, long – short , and value. Securities are held for six months to a year and the target annualized return is 12-20%.

As a trading strategy, Capital Structure Arbitrage has at first glance considerable potential. Traditionally, Capital Structure Arbitrage is a sub-strategy of fixed income trading, more specifically dealing with distressed securities. However, one can argue that capital structure arbitrage can theoretically be applied to any two securities that have a reasonably predictable spread in a company's capital structure. For example, one could long bonds and short equity, long bonds and short credit default swaps, or long bonds and short loans. In all these cases, each pair of securities should trade at the same relative levels. An opportunity arises when the actual spread diverges greatly from the predicted or expected spread. In this case, the arbitrageur would construct a convergence-type trading strategy to take advantage of the abnormally wide spread. The convergence strategy will help hedge against all price movements

except for a widening in the spread. Statistical analysis can be applied to determine the probability of the spread widening given that variability in the spread is characterized by a normal distribution.

Capital Structure Arbitrage with Identical Coupon / Seniority Securities

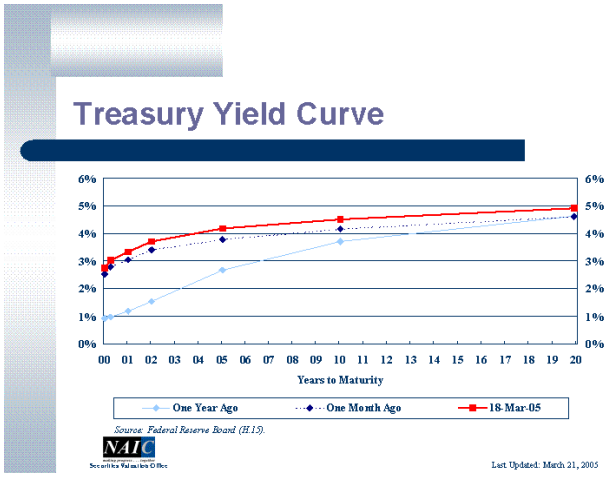
This study focuses on a similar strategy that involves two bonds from the same company with identical seniority and coupon, but different maturity. Given these conditions, one can make several assumptions regarding the spread between these two securities. The securities can be priced using the following formula:

$$\text{Price} = C_1 / (1 + r) + C_2 / (1 + r)^{\wedge 2} + \ldots + C_t / (1 + r)^{\wedge t}] + P / (1 + r)^{\wedge t}$$

Where:
$C_n = N^{th}$ coupon payment
r = Yield to Maturity
P = Principal Amount

Price is simply a function of the cash flows, the coupon rate, and the yield to maturity (YTM). First, if these bonds trade at par, they should be priced exactly the same (a spread of 0). If they were originally priced at a premium (coupon > YTM), the bond with the longer maturity would have a higher price. Conversely, if they were originally priced at a discount (coupon < YTM), the bond with the shorter maturity would have the higher price. In either case, the spread should be easily quantifiable.

While the above is mostly true in investment grade securities, this study observes that the spread widens and becomes more volatility as the company moves deeper into distress. Furthermore, the price



discrepancy continues after the bond has defaulted. What could explain this inconsistency? First, when a company is moving towards distress, one can argue that the bond with the shorter maturity will trade at a higher price. For example, if it is the year 2005 and a company is in distress, a bondholder would pay a premium for a more immediate redemption of his initial investment because the chances of a company defaulting increases with time (or solvency decreases).

However, this does not explain price discrepancies for sets of bonds with longer maturities. For example, consider a distressed company in the current year with a pair of bonds: one maturing in 10 years and another maturing in 11. An investor should be fairly indifferent between the risk of default of either security. The probability of a distressed company being solvent 10 years from now should be the same as the probability that is will be solvent in 11. This is also supported by the standard inverse exponential yield curve, which shows that yields increase only marginally as maturity increases for longer maturity bonds [Figure 1]. With the same logic, shifts in the yield curve as well as interest rate movements should affect both securities equally.

This study will investigate spreads between such a pair of securities during two time periods: Distress and post default. In analyzing the spreads, the study will test for abnormalities in the size of the spread and consider whether such discrepancies present a significant trading opportunity. In addition, it will attempt to analyze whether it is logistically feasible to execute such a trade. If spreads do uncharacteristically increase during these time periods, what market inefficiencies are responsible for creating this distortion? If a sufficient number of such opportunities do not exist, the study would suggest that in spite of minor differences, markets are

efficient at pricing such securities. Can the strategy be applied universally, or is it more time and industry specific?

Finally, this study hopes to incorporate the effects of distressed debt trading costs. Distressed and especially defaulted bonds are much more illiquid than investment grade bonds. Perhaps large bid/ask spreads are so prohibitive that this form of arbitrage is not profitable in the long run.

2. Background & Literature Review

While literature regarding this form of capital structure arbitrage is difficult to find, there have been several studies regarding more traditional forms of this strategy. Formal studies of capital structure arbitrage began when Robert Merton devised his equity based model valuing debt products [Merton 1974]. Commercial banks have used such models extensively to help manage loan portfolios. The models serve as a warning system: if a stock drops to a certain level, perhaps this indicates that it is a good time to sell that company's bonds (or buy insurance in the form of a credit default swap).

However, as evidenced by Long Term Capital Management, trading strategies that rely solely on modeling are likely to fail. Moreover, empirical evidence shows that the correlation between debt and equity is not consistently reliably. David Modest, a former partner of LTCM, states the correlation in on a debt-equity trade is 5% to 15%. Furthermore, Currie and Morris [2002], quotes traders saying that the average correlation between CDS spread and equity price is also 5 -15 %.

Yu [2004] studies the profitability and risk of capital structure arbitrage in relation to credit default swaps (CDS). More specifically, this strategy seeks to exploit market inefficiencies between a company's equity and its default swap (CDS) spread. A CDS is a

contract that insures against default on a particular bond. The buyer of a CDS is responsible for a periodic premium payment to the seller. Should default ever take place, the seller is responsible for paying the face value of the bonds to the buyer.

This strategy is based upon a model that is typically some version of Merton's (1974). It attempts to predict spreads based on a company's debt structure and its market value of equities. An opportunity arises when the market spread is larger than the spread predicted by the model. In this case, there are two possibilities. In the first case, the arbitrageur may believe that the market has fairly valued the equity while the CDS's are overvalued. In the second case, the CDS's could be fairly valued while the company's equity is overvalued. The arbitrageur would short CDS in the first case when he believes the predicted spread to be incorrect, and would short equity in the second case when he believes the market spread to be in error. Most cases, the arbitrageur is unsure and shorts both and profits when the spreads converge.

Certainly, the model's results could prove incorrect if in reality neither the CDS nor the equity is mispriced. When the spreads diverge, there is a probability of a loss if the two securities do not adequately hedge each other. Therefore, it is difficult to predict statistically how spreads will move. If spreads do converge as expected, the exact source of profit is still in question. Are profits actually due to the accuracy of the model or simply because the strategy constructs a more obscure case of statistical arbitrage.

Professor Yu has shown that the majority of losses arise when the arbitrageur shorts CDS and is victimized when the market spread subsequently skyrockets. At this point, hedging becomes ineffective, CDS trading stops, and the arbitrageur is forced to liquidate. This can lead up to a monthly loss of as high as 33 percent. A second finding is that returns from this strategy

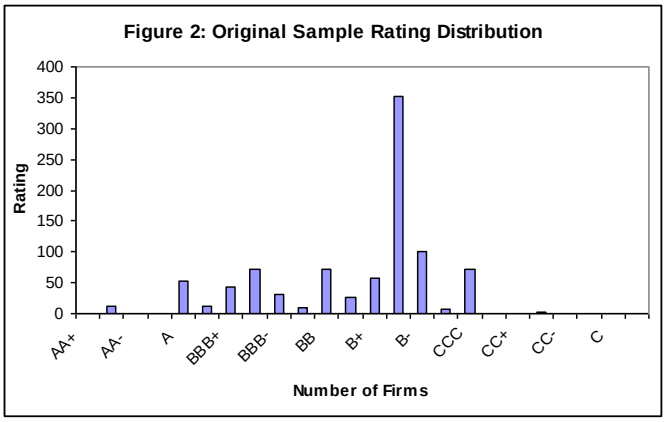
are positively correlated to fixed income and arbitrage indexes. Caveats in this study include a small sample period – 40 months between 2001 and 2004, and the absence of trading costs.

This study hopes to provide further insight into capital structure arbitrage by exploring a niche trading strategy. Unlike debt-equity trades, the pairs of bonds in this strategy have very high expected correlations. The study seeks to identify a consistent convergence-type strategy that is more reliable than bond / CDS trades and less volatile than debt-equity strategies.

3. Data and Methodology

Data

The bond sample is comprised of 25 firms (with 58 bond issues) that defaulted between January 1987 and December 2004. For each bond, there is information on the seniority, coupon, maturity date, amount outstanding, default date, original rating, default price, and prices before and after default. There is also limited data on trading costs.



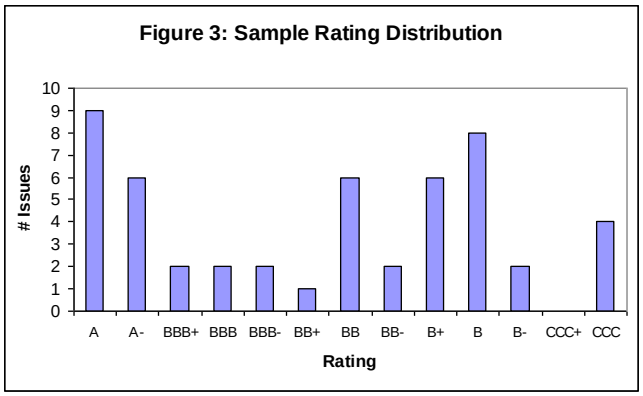
Rating	# Firms	Rating	# Firms	Rating	# Firms
AA+	0	BBB+	42	CCC+	8
AA	11	BBB	73	CCC	72
AA-	0	BBB-	32	CCC-	1
A+	1	BB+	9	CC+	0
A	53	BB	72	CC	2
A-	13	BB-	26	CC-	0
		B+	58	C+	0
		B	352	C	1
		B-	101	C-	0

Table 2

Bond Data sources include: bond databases from Professor Edward Altman; databases from Concordia Capital; the Merrill Lynch High Yield Credit Master Database; and Datastream. Bloomberg was used for pricing data for a small number of issues that could not be found though the above sources. Trading cost information was supplied by Allan Brown of Concordia Capital.

An advantage of the original data set is that it accounts for survivorship bias. The original sample size consisted of 1196 bonds that defaulted between January 1987 and December 2004. Of these issues, 800 (66.89%) were senior and 396 (33.11%) were subordinated. For this original sample, Table 2 shows the number of firms with each Bond Rating and Figure 2 shows a graph of the distribution. A significant portion of the defaults were rated from the B+ to B- range. This sample also had a mean default price of $36.77 and median default price of $31.00.

To obtain the sample set for this study, I sorted the original sample for firms using a query that searched for pairs of issues. This query identified securities with identical issuer names, identical seniorities, identical coupons, and different maturities.



Rating	# Firms	Rating	# Firms
A	9	BB-	2
A-	6	B+	6
BBB+	2	B	8
BBB	2	B-	2
BBB-	2	CCC+	0
BB+	1	CCC	4
BB	6		

Table 3

An initial query resulted in 86 bond issues from 35 firms. However, 28 of these issues, from 14 individual firms, were in fact the same issue. This resulted in a final sample of 58 issues from 25 different firms. 4 of these firms had multiple pairs of issues that fell under this category. The Subordinated category was tied for the largest portion of this sample (10 Issues, 17.2%), with Senior Notes (10 Issues, 17.2%). Bond Ratings did not follow the original distribution. The B+ to B- range still led the sample with 16 issues, but they were followed by 15 issues in the A+ to A- range. The detailed ratings breakdown can be found in figure 3 and table 3.

The sample had a mean default price of $39.50 and a median default price of $33.94. The mean length of bankruptcy was 18.8 months and the median was 14.5 months. Please note that pre-packaged bankruptcies skew these figures downward. Bond prices before default were available on a daily basis but only for a portion of the prices post-default. Monthly price data was available for all issues. Table 4 shows a list of all issues used in this study and includes information on the issuer, seniority, coupon, maturity date, default date, and default price.

Caveats on Data

While the quantity of data collected is substantial, it is by no means fully comprehensive. Pricing information on high yield and defaulted debt securities is often very difficult to obtain. Many of the databases did not have prices for a particular issue listed. Perhaps this is because the bond had been de-listed. Furthermore, the price stream is not continuous. There are many dates without any prices listed, and several instances of a lack of price data for periods of longer than a week. Pricing data is generally more comprehensive for larger and more liquid issues.

Even in cases where data is readily available, its accuracy is still in question. Distressed and Defaulted bond pricing may vary across different sources, and there is no clear authoritative pricing source. It would be extremely difficult to reconcile pricing methods from different sources to arrive at a comparable database. Defaulted bond prices depend on the level of debt outstanding, the seniority of the issue, and the expected recovery rate. These variables give defaulted bond pricing a level of uncertainty that is more traditionally attributed to equities.

Much of the price information after bankruptcy is only given on a monthly basis. For several firms, there are less than 10 data points (10 months) available. This is due to prepackaged bankruptcies or broker/dealers cessation of price coverage for the issue.

Information on trading costs is also sparse. Because a large portion of issues are highly illiquid, bid-ask information is seldom available on a daily basis. These issues virtually never trade on a daily basis as well.

Company	Bond Issue	Coupon	Maturity Date	Default Date	Amt Out($mil)	D Price
Adelphia Communications	Senior Notes	10.25%	11/1/06	6/25/02	500	46.75
Adelphia Communications	Senior Notes	10.25%	6/15/11	6/25/02	1000	46.75
XO Communications, Inc.	Senior Notes	10.75%	11/15/08	12/1/01	500	17.00
XO Communications, Inc.	Senior Notes	10.75%	6/1/09	12/1/01	675	17.00
Century Communications	Senior Discount Notes	0.00%	3/15/03	6/10/02	444	36.00
Century Communications	Senior Discount Notes	0.00%	1/15/08	6/10/02	605	36.00
WestPoint Stevens Inc.	Senior Unsecured	7.88%	6/15/05	6/1/03	525	22.00
WestPoint Stevens Inc.	Senior Unsecured	7.88%	6/15/08	6/1/03	475	22.00
Federal Mogul Corporation	Notes	7.50%	7/1/04	10/1/01	250	12.00
Federal Mogul Corporation	Notes	7.50%	1/15/09	10/1/01	599	12.00
Enron Corp.		7.38%	5/15/06	12/1/01	500	18.50
Enron Corp.		7.38%	5/15/19	12/1/01	500	19.50
Adelphia Communications	Senior Discount Notes	9.88%	3/1/05	6/25/02	129	46.75
Adelphia Communications	Senior Discount Notes	9.88%	3/1/07	6/25/02	350	46.75
Trans World Airlines Inc	Junior Subordinated Debentures	12.00%	2001	2/1/91	328	11.00
Trans World Airlines Inc	Junior Subordinated Debentures	12.00%	2008	2/1/91	212	12.88
Saftey-Kleen	Guaranteed Senior Notes	9.25%	6/1/2008	5/18/00	325	11.00
Saftey-Kleen	Guaranteed Senior Notes	9.25%	5/15/2009	5/18/00	225	2.00
Kmart, Corp.	Senior Notes	8.38%	12/1/04	1/22/02	300	41.00
Kmart, Corp.	Senior Notes	8.38%	7/1/22	1/22/02	100	41.00
NRG Energy Inc.	Senior Unsecured	7.50%	6/15/07	5/14/03	250	43.50
NRG Energy Inc.	Senior Unsecured	7.50%	6/1/09	5/14/03	300	43.50
Mariner Health Group Inc	Senior Subordinated Notes	9.50%	4/1/2006	10/1/99	150	3.00
Mariner Health Group Inc	Senior Subordinated Notes	9.50%	11/1/2007	10/1/99	275	7.50
Finova Capital Corp	Notes	7.25%	4/1/2001	2/27/01	100	86.00
Finova Capital Corp	Notes	7.25%	7/12/2006	2/27/01	225	86.00
Loewen Group Inc	Senior Notes	8.25%	5/15/2003	6/2/99	125	59.25
Loewen Group Inc	Senior Notes	8.25%	11/1/2003	6/2/99	225	59.25
Dolphin Telecom, PLC	Senior Discount Notes	11.13%	6/1/08	7/27/01	222	1.00
Dolphin Telecom, PLC	Senior Discount Notes	11.13%	5/15/09	7/27/01	215	2.00
Columbia Gas System	SF Debentures	10.50%	2011	7/31/91	100	84.63
Columbia Gas System	SF Debentures	10.50%	2012	7/31/91	200	84.00
Telemundo Group Inc	Senior Notes Zero Coupon		1992		100	
Telemundo Group Inc	Senior Notes Zero Coupon		1993		101	
Finova Capital Corp	Notes	7.13%	5/1/2002	2/27/01	100	86.00
Finova Capital Corp	Notes	7.13%	5/17/2004	2/27/01	100	86.00
Finova Capital Corp	Notes	7.40%	5/6/2006	2/27/01	100	86.00
Finova Capital Corp	Notes	7.40%	6/1/2007	2/27/01	100	86.00
USG Corp	Senior Notes	8.00%	1996	1/15/91	100	52.50
USG Corp	Senior Notes	8.00%	1997	1/15/91	100	56.00
Town & Country	Senior Subordinated Notes	13.00%	1998	6/15/92	97	88.00
Town & Country	Senior Subordinated Notes	13.00%	5/31/1998	11/17/97	68	33.50
MCorp	Notes	11.50%	1989	10/1/88	50	30.00
MCorp	Notes	11.50%	1992	10/1/88	49	40.00
Nu-Med Inc	Senior Subordinated SF Debentures	13.50%	1999		24.3	
Nu-Med Inc	Senior Subordinated SF Debentures	13.50%	2005		35.6	
Columbia Gas System	SF Debentures	7.50%	1997	7/31/91	23.7	75.38
Columbia Gas System	SF Debentures	7.50%	1997	7/31/91	28.4	77.00
Columbia Gas System	SF Debentures	9.13%	1995	7/31/91	20.3	87.38
Columbia Gas System	SF Debentures	9.13%	1996	7/31/91	18.6	86.50
Sunshine Precious Metals	Silver Index	9.50%	1994	5/15/91	16.8	32.50
Sunshine Precious Metals	Silver Index	9.50%	1995	6/15/91	19.2	34.38
AMERCO	Senior Unsecured	8.04%	9/18/06	6/30/03	10.0	82.00
AMERCO	Senior Unsecured	8.04%	10/2/06	6/30/03	20.0	82.00
Financial Corp of America	SF Debentures	6.00%	1988	10/1/88	25.0	2.00
Financial Corp of America	SF Debentures	6.00%	2010	11/1/88	6.6	1.00
Texas Petrochemicals LP	Senior Subordinated	11.13%				
Texas Petrochemicals LP	Senior Subordinated	11.13%				

Table 4

Methodology

First, I paired each issue with its counterpart and measured the spread between them before and after bankruptcy. This was found through the following method:

$$\text{Spread} = P_A - P_B$$

Where: P_A = Price of the issue with the shorter maturity
P_B = Price of the issue with the longer maturity

After spreads had been calculated, I performed a time series analysis of the spreads. A possible trading opportunity arises when the spread widens to an uncharacteristically high level. This was obtained through two methods: analyzing the size of the spread relative to the average and median spread and using a regression of the two prices.

For consistency, all regressions were performed with the price of the issue with the shorter maturity as the independent variable, and the price of the issue with the longer maturity as the independent variable. Regressions will be done over a period of 120 days before default using the daily data. 120 observations should suffice to give a statistically significant result. In cases where data before default is insufficient or incomplete, post-default prices will be used. Regressions after the default date will use all available monthly data. A regression of one price stream to the other will show how much of the movement in one security is explained by movement in the other. A high R^2 statistic will show that this is indeed true. The regression will also show the points in the time series when the spread is out of line. For purposes of this study, I will regress the top 10 largest issues in terms of amounts outstanding. Larger issues have generally greater liquidity and thus provide a better chance for traders to execute this strategy should the opportunity arise.

A final output will show the following information: Issue identifiers, R-squared statistic, t-statistic, the spread associated with the largest residual, the lowest value from a "peak to trough" perspective, and the time it took for the spread to converge.

After these potential opportunities have been identified, subsequent time series analysis will determine whether the spread actually converges, and if it does, whether it does so in a timely manner. Finally, expected trading costs are netted out and potential net profit is obtained.

To model a potential trade, we will make the following assumptions. First, long the lower priced issue and short the higher priced issue. We will assume that the immediate proceeds from the short issue cannot be used to fund the long position.

4. Empirical Results

Aggregate Results: R-Squared, Spread, and Convergence

Table 5 shows the top ten pairs of issues with the R-squared from the regression, the t statistic, the spread at the largest residual value, the spread at the greatest point of convergence (from a peak to through perspective), and the time period it took for the spread to converge. Note that eight of the ten pairs used daily data for the regression while the remaining two used monthly data.

The results of the regression are no surprise. The r-squared statistic is extremely impressive. The average r-squared for the sample was 93.36% and the median was 97.89%. With respect to the 8 firms whose regression used daily data, the lowest r-squared was 89.1%. The highest r-squared was 99.53% for Adelphia Communications. In addition, the average and median t-statistics for the sample were 73.70 and 61.53 respectively. A high t-statistic shows that the regression in statistically significant. The high r-squared signifies that the price of the shorter maturity bond is an excellent predictor of the price of the longer maturity bond.

Furthermore, all ten sets of issues were extremely positively correlated. This indicates that both issues should move very closely to one another.

Company	Data Used	Coupon	Default Date	Maturities	R-Squared	T-Stat	Spread at Largest Residual	Greatest Convergence	Days to Converge
Adelphia Communications	Daily	10.25%	6/25/2002	2006 & 2011	99.5%	158.0	4.00	0.00	13
XO Communications, Inc.	Daily	10.75%	12/1/2001	2008 & 2009	98.8%	98.7	-4.00	0.00	6
WestPoint Stevens Inc.	Daily	7.88%	6/1/2003	2005 & 2008	98.8%	98.7	2.00	0.00	44
Federal Mogul Corporation	Daily	7.50%	10/1/2001	2004 & 2009	89.1%	31.0	7.00	2.00	24
Adelphia Communications	Daily	9.88%	6/25/2002	2005 & 2007	97.0%	61.5	11.75	0.00	20
Trans World Airlines Inc	Monthly	12.00%	2/1/1991	2001 & 2008	76.5%	10.2	4.50	0.00	5 Months
Saftey-Kleen	Daily	9.25%	5/18/2000	2008 & 2009	99.4%	138.9	20.00	2.50	14
Kmart, Corp.	Daily	8.38%	1/22/2002	2004 & 2022	89.8%	32.2	22.50	0.00	12
NRG Energy Inc.	Monthly	7.50%	5/14/2003	2007 & 2009	100.0%	NA	0.00	0.00	NA
Mariner Health Group Inc	Daily	9.50%	10/1/1999	2006 & 2007	90.7%	34.0	18.00	0.00	47

Table 5

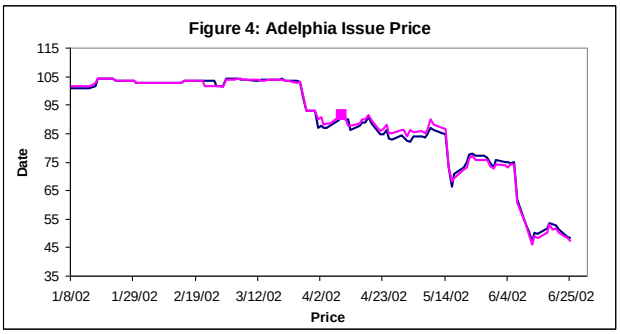
In terms of possible trades, nine of the ten pairs showed a spread that would converge back to zero. Five of these nine pairs showed spreads of $5.00 or greater, with a max of $22.50. The 8 issuers with daily data had an average convergence time of 26 days, and a median convergence time of 17 days. In all ten instances, the spread would converge to zero or very close to zero. Overall, the results of the study are consistent with the idea that pari passu bonds should trade at the same level at default.

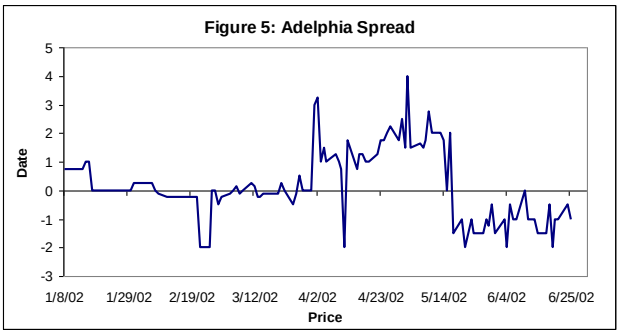
The monthly issues were split in terms of results. One issue had no variance whatsoever in the spread, which remained at zero throughout the period of study. It was the only pair that did not show a potential trading opportunity. The other set had a spread of $4.50 that converged to 0 in 5 months.

Case Analysis

Here are the results of the study in a more in depth, case by case basis.

Adelphia Communications: 10.25% due 2006 & 2011



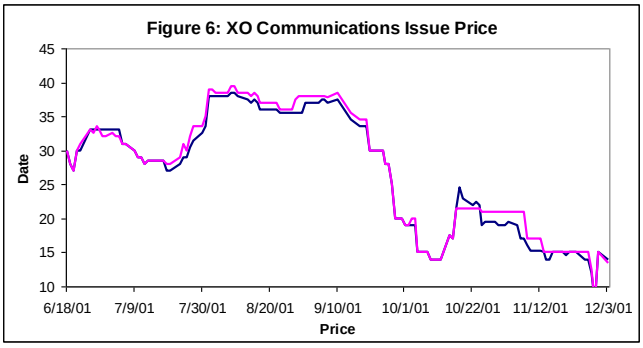


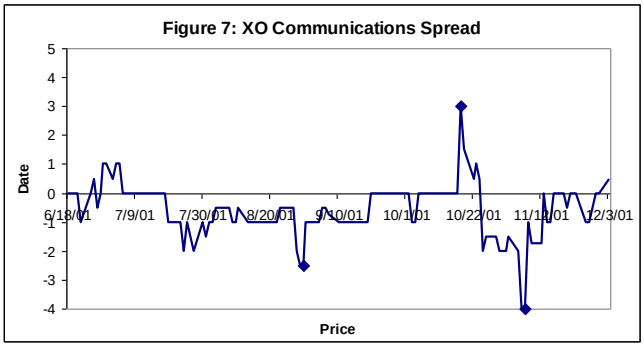
Adelphia Communications defaulted on 6/25/02. Figure 4 shows the historical prices for the two issues up until default. Figure 5 shows that the spread was widest during early April before the firm plunged into deep distress. Adelphia's issues were both rated B+ at issue.

This issue set had the highest r-squared and t-statistic out of all ten regressions, at 99.5% and 158 respectively. It took 13 days for the largest spread, $4.00, to converge to 0.

Note that aside from the largest spread of $4.00, there are other opportunities at spreads of $3.25 and -$2.00. These take 9 and 21 days to converge to 0 respectively. Adelphia issues remained at close to 0 spread post-default.

XO Communications: Inc: 10.75% due 2008 & 2009

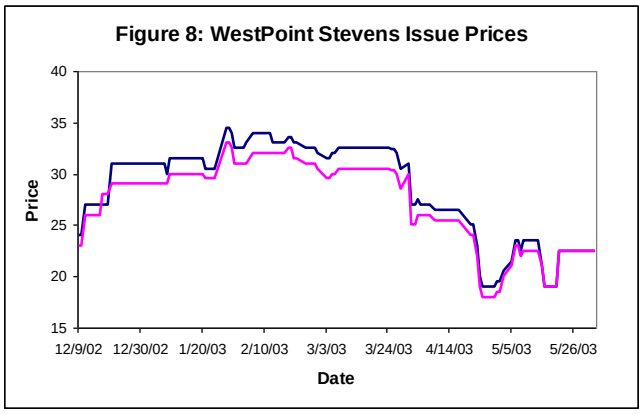


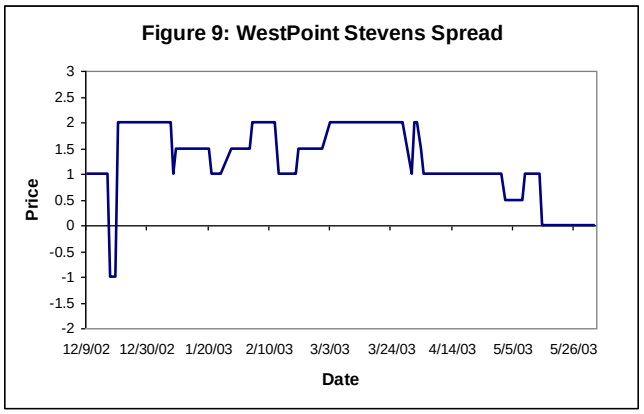


Xo communications defaulted on 12/1/01. Figures 6 and 7 show the historical prices for XO's issues and the corresponding spread respectively. XO's issues were both had a B original rating. The regression had an r-squared of 98.8% and a t-statistic of 98.7

I identified 3 points in the spread that presented a potential opportunity. The largest spread, $4.00, converged to 0 in six days. The other two points were at spreads of 3 and 2.5, and converged in and 6 and 21days respectively. Both of the largest spreads occurred when the firm was in deep distress. XO was only in default for a period of 7 months, and its spread remained at 0 throughout this time.

WestPoint Stevens Inc: 7.88% due 2005 & 2008

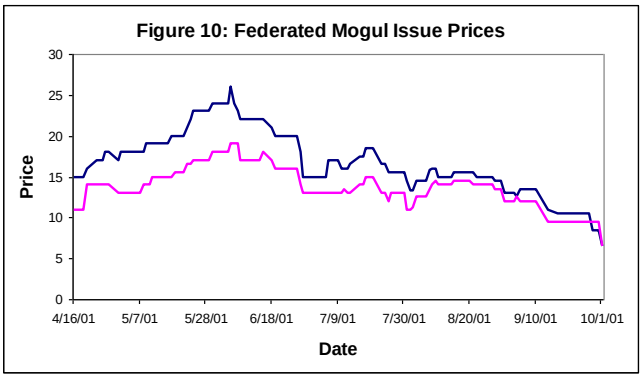


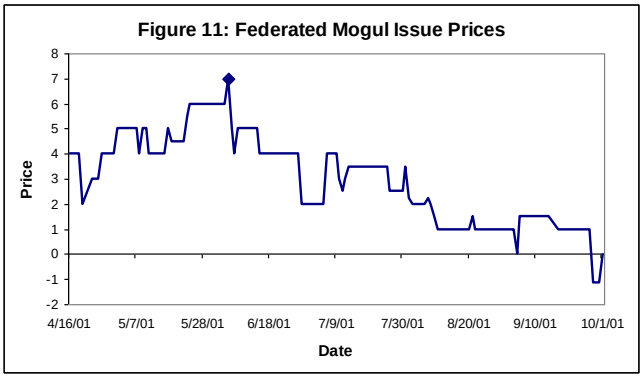


WestPoint Stevens Inc defaulted on 6/1/03. Figures 8 and 9 show the historical prices for WestPoint's issues and the corresponding spread respectively. WestPoint's issues both had a BB original rating. The regression had an r-squared of 98.8% and a t-statistic of 98.7.

WestPoints issues traded at a fairly constant spread of $2.00 for about 3 months before converging back to 0. The shortest time period of convergence (to 0) was 44 days. Throughout this time, the firm was already in deep distress. Post-default, WestPoint's spread remained at 0.

Federal Mogul Corporation: 7.50% due 2004 & 2009

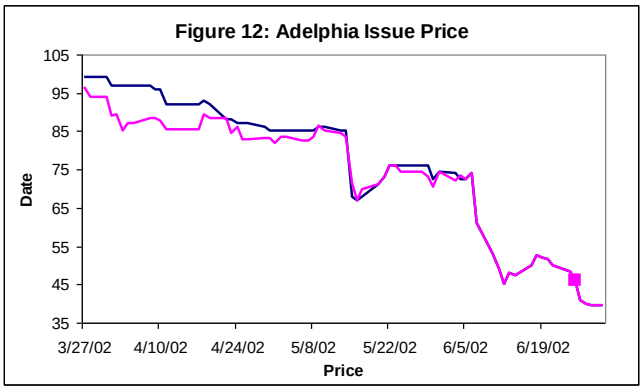


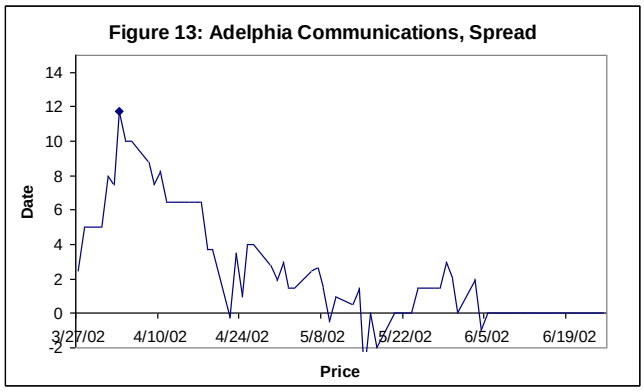


Federated Mogul Corporation defaulted on 10/1/01. Figures 10 and 11 show the historical prices for Federal Mogul's issues and the corresponding spread respectively. The firm's issues both had a original rating of BB. The regression had an r-squared of 89.1% and a t-statistic of 31.0.

As shown in figure 11, Federal Mogul's spread widened to $7.00 before slowly converging to 0 over 24 days. Post-default, the spread widened to $3.00 at one point before converging back to zero.

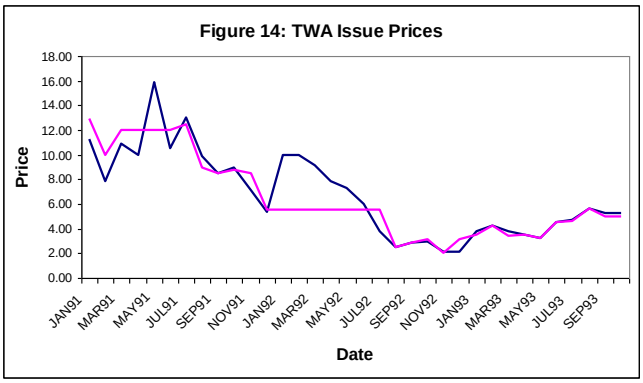
Adelphia Communications: 9.88% due 2005 & 2007

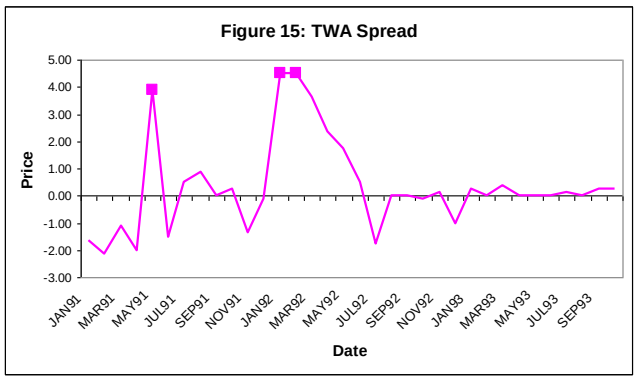




The second set of Adelphia issues had an r-squared of 97% and a t-statistic of 61.5. As shown in figure 13, Adelphia had a spread of $11.75 that converged to 0 in 20 days. Following this convergence, the spread climbed again to $4.00 before converging again to 0 in 30 days. The spread remained at 0 post-default.

Trans World Airlines: 12.00% due 2001 & 2008



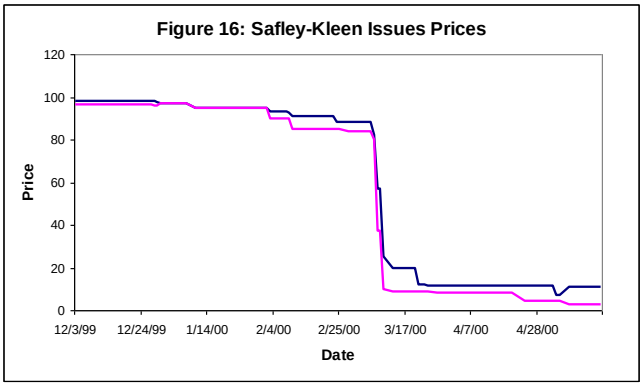


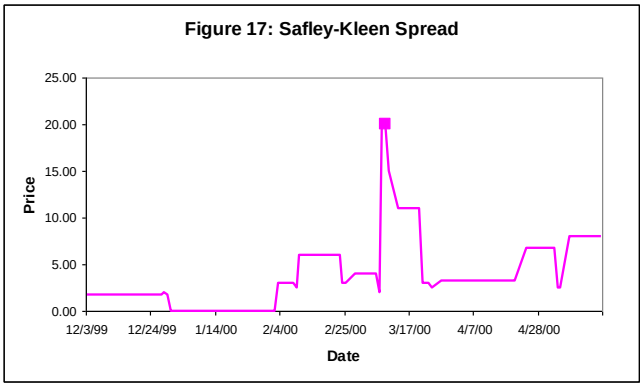
TWA defaulted on 2/1/91. Figures 14 and 15 show the historical prices for TWA's issues and the corresponding spread respectively. A lack of daily information before default constrained this study to analyzing post-default spreads using monthly data for this firm. TWA's

issues both had a CCC original rating. The regression had an r-squared of 76.5% and a t-statistic of 10.2.

As figure 15 shows, TWA's widest spread of $4.50 converged to 0 over 5 months. It's second largest spread of $3.88 converged to 0 in less that one month.

Safley-Kleen: 9.25% due 2008 & 2009

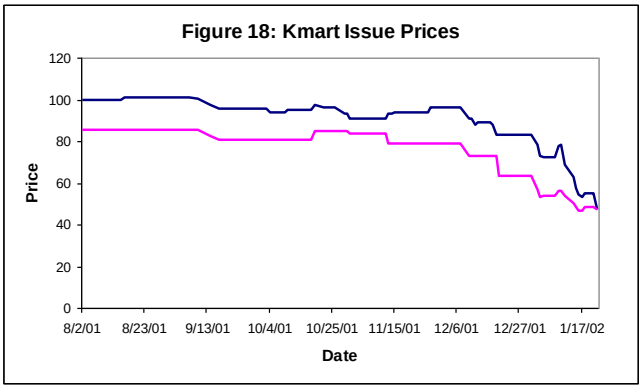


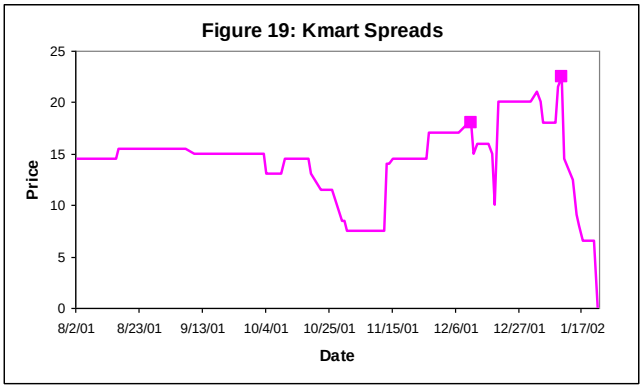


Safley-Kleen defaulted on 5/18/00. Figures 16 and 17 show the historical prices for Safley-Kleen's issues and the corresponding spread respectively. The firm's issues both had a B+ original rating. The regression had an r-squared of 99.4% and a t-statistic of 138.9.

Safley-Kleen's issues traded at a fairly constant spread before suddenly widening to a spread of $20.00. The spread quickly converged to $2.50 in 14 days. Throughout this time, the firm was going from distressed to deeply distressed. Post-default, WestPoint's spread remained at 0.

Kmart, Corp.: 8.38% due 2004 & 2022





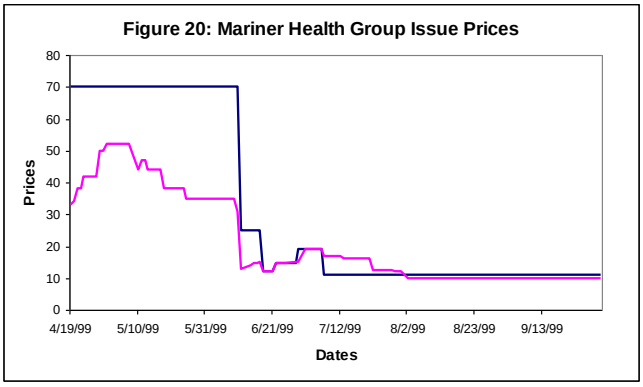
Kmart Corp. defaulted on 1/22/02. Figures 18 and 19 show the historical prices for Kmart's issues and the corresponding spread respectively. Kmart's issues both had a BB+ and an A original rating respectively. The regression had an r-squared of 89.8% and a t-statistic of 32.2.

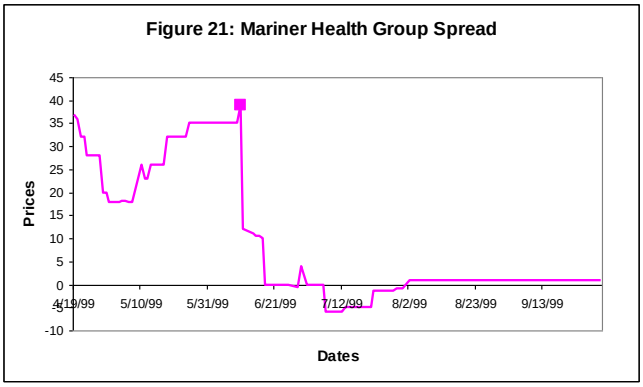
Kmart's spread remained constant at around $15 before jumping to $22.50 shortly before default. The spread converged to 0 in 12 days as the firm defaulted. Post-default, the spread widened to $10.25 before converging to 0 in less than a month.

NRG Energy 1nc.: 7.50% due 2007 & 2009

Reliable daily data pre-default was not available for NRG. Post default, NRG's spread remained at 0 over its 13 months of bankruptcy.

Mariner Health Group: 9,50% due 2006 & 2007





Mariner Health Group defaulted on 10/1/99. Figures 20 and 21 show the historical prices for Mariner's issues and the corresponding spread respectively. Mariner's issues both had a B rating at issuance. The regression had an r-squared of 90.7% and a t-statistic of 34.0.

Mariner's issue maturing in 2006 traded at a steady $70 before falling to $25 in one day. The largest residual indicates that, given the relative movement of the issue prices, the optimal trade should be constructed when the spread is at $18.00. This spread converged to 0 in 75 days.

Hypothetical Returns and Trading Costs

Distressed and defaulted securities are often highly illiquid. Interviews with traders suggest that the bid-ask spread is anywhere from 1% to 10%. For purposes of this study, industry experts recommended an average of 2%. Hypothetical net returns were calculated using the following formula:

% Net Return = [(S – C) / P_L] - TC

Where S = Spread when trade is constructed
C = Spread at point of closest convergence from a peak to trough perspective
P_L = Price of the issue that is longed when the trade is constructed
TC = Trading costs

The results for the 10 sample firms are shown in table 6. It appears that even at a fee of 10%, net profits are still possible

Company	Gross Return	Fee	Net Return	Fee	Net Return
Adelphia Communications	4.88%	2.00%	2.88%	10.00%	-5.12%
XO Communications, Inc.	23.53%	2.00%	21.53%	10.00%	13.53%
WestPoint Stevens Inc.	8.00%	2.00%	6.00%	10.00%	-2.00%
Federal Mogul Corporation	26.32%	2.00%	24.32%	10.00%	16.32%
Adelphia Communications	13.78%	2.00%	11.78%	10.00%	3.78%
Trans World Airlines Inc	81.82%	2.00%	79.82%	10.00%	71.82%
Saftey-Kleen	47.30%	2.00%	45.30%	10.00%	37.30%
Kmart, Corp.	40.18%	2.00%	38.18%	10.00%	30.18%
NRG Energy Inc.	0.00%	2.00%	-2.00%	10.00%	-10.00%
Mariner Health Group Inc	34.62%	2.00%	32.62%	10.00%	24.62%

Table 6

5. Summary & Conclusions

This study conducted a case by case analysis of the ten largest issues of bonds with equal coupon and seniority but different maturity. All 20 issues were above $150 million and 16 of these issues were above $250 million. With eight of the ten firms showing abnormally large spreads that converge to 0, the study shows that this could be a potentially lucrative strategy.

Furthermore, given the high certainly from the high r-squared in the regression, perhaps a reasonable amount of leverage could be used to magnify positive results.

To analyze spread convergence, I conducted time series analysis on price stream data. Specifically in regards to spreads, these ten cases show that spreads tend to generally converge to zero over time and as the firm moves towards default. The time it took spreads to converge ranged from under a week to several months. However, eight of the ten pairs converged in less than two months and six converged in under one month. These results support spread convergence in a timely manner.

Adjusting potential returns for trading costs shows that the strategy can still yield a positive net profit. Assuming a 2% average transaction cost, nine out of the ten nine of the ten pairs would give a positive return. Even in the extreme case of a 10% trading fee, six of the ten pairs still had extremely positive returns. However, a more detailed study of trading costs is needed since this study assumes a standard fee across all trades.

Future studies of this subject should investigate in greater detail the liquidity of the issues. A more through study of the bid-ask spread may reveal whether this type of trade is truly feasible. As always, reconciling actual prices with historic prices across different pricing sources will remain a challenge.

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