

Attention!
**Bankruptcy Shocks Bond Prices:
Impacts of the Credit Derivatives Market**

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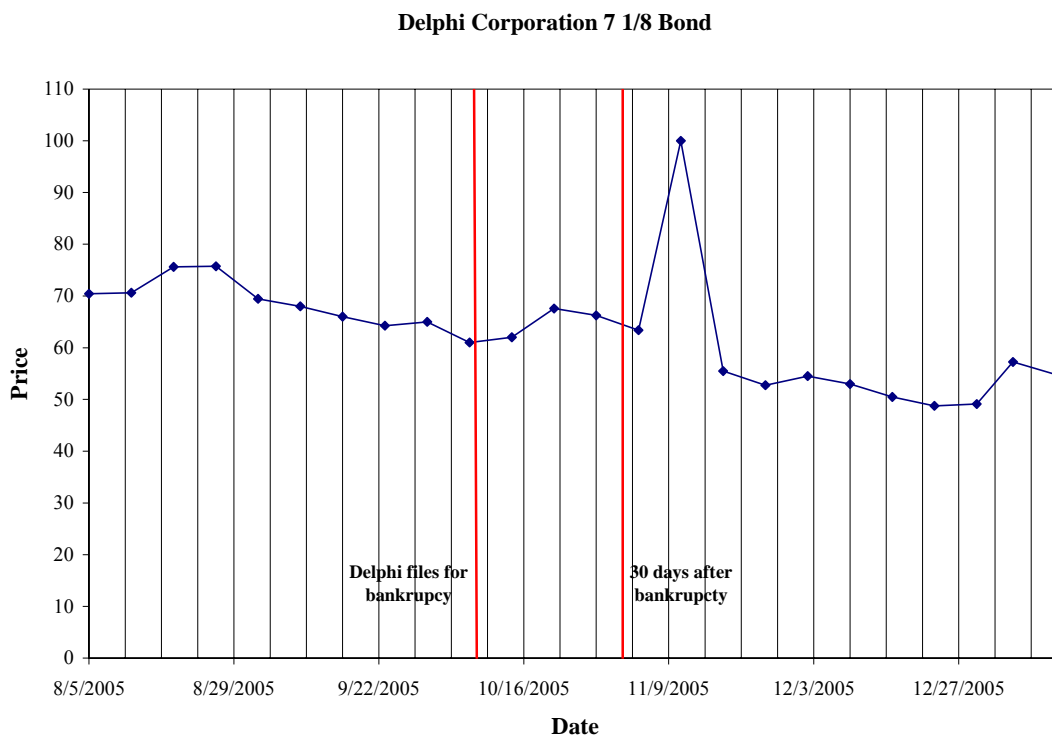
Abstract

This paper examines the impact of the credit default swap index on high yield bonds. Prior to the allowance of cash sum settlements by the International Swaps and Derivatives Association, when a credit event affected a particular company, the credit default swap contracts were settled by delivering the par valued bond. This paper explains bonds and credit derivatives and then analyzes the impact of the emergence of the credit default swap index as well as the allowance of cash sum settlements on junk bonds. The econometrics model includes economic variables that impact the high yield market place to test whether the credit default swap index affected the price, percent change in price, and volatility of the high yield index. Ultimately, the regression results show that the emergence of the credit default swap index and the allowance of cash sum settlements positively affected bond prices. The credit default swap index negatively affected both the percent change in price of high yield bonds and the standard deviation of the percent change in price of high yield bonds. Although the data set is small, and in particular, only two years of monthly data exist after the emergence of the credit default swap index, the results suggest that the credit default swap index may have had an affect on the high yield market.

I. Introduction

Delphi Corporation filed for bankruptcy on October 8th, 2005, prompting the company's bonds to be downgraded to junk status.¹ Oddly enough, the price of Delphi's bonds raised the bond price to par value, and drove down the yield to maturity. The price fluctuations of Delphi's 7 1/8 bond around the time of bankruptcy are seen in Figure (1).

Figure 1



The likely reason for this seemingly absurd spike in bond price has to do with the existence of derivatives called credit default swaps.

Credit default swap contracts provide insurance for bondholders. They essentially provide compensation to the bondholder to offset losses on a defaulted bond. Since their widespread use in this decade, many questions have developed over their effect on

¹ Rating changed by Standard and Poor's Investment Service

markets. Aside from explaining how credit default swap contracts can lead to perverse market reactions like Delphi's, this thesis seeks to discover the impact of credit default swap contracts on the price, return, and volatility of bonds. In addition to exploring these issues, this thesis will detail the structure of credit default swap contracts and explain the pricing as well as the bond ratings used by Standard and Poor's and Moody's rating agencies.

II. Bonds

Corporate Bonds

Two financial securities that are commonly traded today are bonds and stocks. The major difference between these two financial assets is that stockholders actually own a fraction of the company they are investing in, while bondholders are instead lending money to a company. In addition, the ownership rights that a stockholder has in a company, such as voting rights, extends until the particular stock is sold to a new party. A bond, however, is only issued for a finite period of time and eventually dissolves when all payments are made at the maturity date.

A corporate bond is a debt security that allows companies to borrow money from a lender, known as the bondholder, which may be an institution. Mishkin (2006) provides a review of the structure of bond contracts and the bond market. Bonds are usually sold to the borrower at a particular price called par value. The par value of a bond is usually equivalent to the face value of the bond. The face value is the large lump sum paid to the bondholder at the maturity date. The maturity is the date at which the bond contract expires and the issuer must repay the face value of the bond to the

bondholder. Short term bonds can be categorized as less than one year or sometimes less than three years. Intermediate bonds range from one or three years up until ten years, and long term bonds have a maturity greater than ten years.

According to Norris (1992), the coupon rate of a bond is an interest payment that is periodically made by the issuer throughout the maturity of the bond. These interest payments are often times fixed, but may also float against another rate such as LIBOR.² Coupon frequency can vary for different bonds. However, the most common frequency is semi-annually.

Bondholders always have the option to sell the bond before the maturity date. When a bond is sold to another party before maturity, the interest payments and face value are automatically transferred to the new holder. The price at which the bond holder can sell the bond at varies with the market. The price of a corporate bond is usually quoted as a percentage of the par value. For example, if a bond is quoted at 94.7, then a \$1000 face value bond has a price of \$947. Another important characteristic of bonds is the yield to maturity. The yield to maturity of a bond is the return of the bond if every interest payment is made on time. Thus yield compensates the bond holder for the time value of money, expected inflation and other factors such as risk and liquidity. As bond risk rises, investors will demand compensation in the form of more yield.

Bond Ratings

The risk of a bond is one of the most important characteristics for investors. Bond ratings have long been used by financial economists to assess risk. Bond ratings are especially important because they help investors determine the potential financial health

² The LIBOR rate is the London Interbank Offered Rate, and is the rate at which London banks can lend money to each other.

of a company. Investors use ratings to make portfolio decisions. The two main rating agencies are Standard and Poor's Investment Service and Moody's Investors Service. Rating agencies provide easy to understand measures of default risk. There are currently one hundred rating agencies in the world. The largest and most widely used in the United States are Fitch Ratings, Standard and Poor's, and Moody's Investors Service. Rating agencies are always adjusting the bond classifications in response to new information.

Sherwood (1976) examines rating reclassifications by bond rating agencies. Because bonds are debt obligations, rating agencies categorize bonds based on the likelihood the issuer will be able to pay interest and the principal amount over the entire maturity of the bond (Sherwood 1976). A downgrade in a rating may occur when a credit event affects a particular company. A "credit event" is typically defined by debt default or bankruptcy, prompting a payoff on a credit derivative.³ When a company fails to pay the coupon interest rates on the outstanding debt or makes late payments, a credit event is generated. Because a firm in default or bankruptcy is unlikely to pay the principal at par value or the coupon payments on time, the bond must be discounted for anyone to buy it, hence driving the price down and the yield higher. Because the possibility of a credit event is a risk associated with a bond, bondholders often invest in credit derivatives.

Both Standard and Poor's and Moody's use an alphabetical hierarchy to describe the financial wealth of various companies. The general rating classification used by both agencies ranges from A all the way down to D, with each having further refined categories within. The highest rating classification that can be given by Standard and Poor's is AAA, implying that the company has a very strong capability of meeting the financial obligations, and the bonds are considered a safe investment (Sherwood 1976).

³ Debt defaults for companies include missed filings with the Securities and Exchange Commission.

For this rating agency, the classification then begin to decline to AA, A, BBB, BB, B, CCC, CC, C, and last D, which is default (Standard and Poor's). Moody's Investors Service uses a similar scale that includes Aaa, Aa, A, Baa, Ba, B, Caa, Ca, C.

The entire rating classification can be split into two primary subcategories called "investment grade" bonds and "junk" bonds. The separation between investment grade bonds and junk bonds lies in the BB category. Bonds classified as BB or below are considered to be junk bonds. Junk bonds are also called "below investment grade" or "high yield" bonds. Investment grade bonds are considered to have very low risk associated with them. Because there is low risk, there is also a low return on these bonds. On the other hand, junk bonds have a high risk factor, and therefore pay the very high returns that give them their nickname. Companies with junk status are often going bankrupt or being bought out. Bonds with a rating of BB to C are currently continuing to make interest payments, but during a period of economic stress, may be less likely to meet their financial obligations (Sherwood 1976)

Although Moody's and Standard and Poor's use the alphabetical hierarchy, the rating agencies differ in their defined subcategories. Moody's uses 1's, 2's, and 3's as superscripts to further identify the credit outlook within a letter category while Standard and Poor's uses positive and negative symbols.⁴ For example, the classification from Moody's $Aa^1 = AA^+$ in Standard and Poor's, the classification $Aa^2 = AA$, and the classification $Aa^3 = AA^-$. Standard and Poor's reassesses its ratings at least once a year but ratings can change at any time after any relevant news of events.⁵

⁴ The superscript 1 represents a higher and safer rating than 2 and 3.

⁵ Information gathered from website

Research on the Impact of Bond Ratings on Bond Prices

Katz (1974) shows the impact on the price of a bond that experienced a downgrade in a credit rating. This paper uses a regression model to estimate the yield to maturity of electric utility bonds that underwent a change in the rating classification. This expected yield to maturity is compared to the actual yield to maturity to determine whether the bond market anticipated a price change prior to a rating reclassification.

This study examines 66 utility companies to construct a set of similar firms. Furthermore, the companies are restricted to those initially classified in the investment grade rating categories by Standard and Poor's. The dependent variable Y_t is the yield to maturity of the bond. The explanatory variables include each bond's maturity (M), float (which is the dollar value of a particular bond outstanding) (F), and coupon rate, (CR). In addition, a squared maturity term (M^2) is included to capture yield curve characteristics. The following econometrics model is estimated for all 66 firms:

$$(1) \quad Y_t = a + bM_t + cM_t^2 + dF_t + eCR_t + e$$

Maturity and coupon rate are found to be significant determinants of the yield to maturity. Float is found to be an insignificant determinant of the yield to maturity.⁶

To determine whether the market predicted bond reclassifications, price adjustments are compared twelve months prior to the reclassification, in the month of reclassification, and five months after the reclassification of the bond. It is shown that twelve months prior to the reclassification of the bond, there is no price adjustment.

⁶ Because this particular result is in contradiction with Fisher's (1969) finding, this paper closely examines float across the different rating classifications.

During the month that the bond is reclassified, there is a very small price adjustment, and during the six to ten weeks after the rating change, the price of the bond fully adjusts.⁷ Because the regression determines that bond prices do not change until after the rating reclassification occurs, and therefore there is no anticipation of a change in a bond rating, Katz (1974) concludes the bond market is inefficient.

Grier and Katz (1976) describe tests for the weak, semi-strong, and strong forms of the efficient market hypothesis. The efficient market hypothesis states that all relevant and public information is reflected in the prices of securities (Mishkin 2006). The weak test examines only whether fluctuations in bond prices are reflected in future bond prices. The semi-strong test considers whether changes in bond prices reflect all public information, and the strong test determines whether changes in bond prices reflect all information, including insider news. Mishkin (2006) describes the strong form of the efficient markets hypothesis as one in which prices indicate the correct fundamental value of the security. Because this paper looks at bonds that were downgraded by Standard and Poor's, it distinguishes public rating information from the private information about a company used to determine a credit rating.

Grier and Katz (1976) collect data on industrial bonds and utility bond, which explains a downgrade in credit rating. To determine the impact of bond rating changes on bond price, two similar corporate bonds are compared. The first bond suffers a decrease in the credit rating. The second bond is from the same industry that maintained the rating classification of the first bond prior to the downgrade. The bonds have equivalent maturities and nominal yields.

⁷ In the equity market, adjustments in a company's financial statements are highly anticipated prior to the actual changes (Katz, 1974).

The empirical model tests whether new public information has an effect on bond prices at the time of the rating change, before, or after. The model used to show the price change is seen in the following equation:

$$(2) \bar{P}_t = \frac{\sum_{i=1}^n P_{it}}{n}$$

where $\sum_{i=1}^n P_{it}$ represents the summation of all bonds that were downgraded between the base period and t months from the base period, n is the number of bonds, and \bar{P}_t represents the average price of the bonds in months t relative to the base period. The results show that 80% of the price decrease from a rating reclassification occurs in the month of and in the three months after the actual credit rating downgrade occurs. The paper ultimately concludes that the rating change did not immediately affect the price of a bond, but that the price gradually adjusts to the new rating. This may be surprising because the efficient markets hypothesis states that outside events are inherent in bond prices.

Hand, Holthausen, and Leftwich (1992) extend Katz (1974). In a similar approach, this paper examines the impact on bond prices from a rating reclassification by Standard and Poor's or Moody's. However, the methods in this paper are more comprehensive because market reactions are assessed for not only included rating reclassifications, but also the published warnings about a potential rating change. The warnings of a potential credit rating change are originally encompassed in a list by Standard and Poor's called the Credit Watch List in 1981. The designated warnings for a

rating change are categorized as “indicated upgrades”, “indicated downgrades,” or “developing.”

The paper uses data consisting of companies that are additions to the Credit Watch List and 1,100 announcements of a rating reclassification. The data are acquired from the “Taxable Corporate Securities – Ratings Reviewed and Revised” bond survey by Moody’s Investors Service. To determine whether a change in bond prices can be anticipated, this paper begins by comparing the yield to maturity prior to the reclassification or addition to the watch list with the equivalent yield to maturity of bonds with the same classification. For the yields to maturity, a price-based expectations model is used to improve the chances of identifying an announcement of a rating change or addition to the watch list.

Excess bond returns are measured using the “window-spanning method.” This method gives an aggregate measure of the transaction bond prices for a smaller window of time. Then the window-spanning method calculates the “raw return” on the bond which does not include accrued interest over time. To estimate the “excess bond returns” needed in this paper, the return on a risk-free bond is subtracted from the raw return. The excess bond return is equivalent to the risk premium. Based on the excess bond returns, this paper calculates a simple t-statistic to determine whether the excess bond return or change in excess return is different than zero.

In general, an addition to Standard and Poor’s Credit Watch List does not significantly affect excess bond returns. However, to account for expectations, the sample is further restricted to cases where additions to the list were unexpected because the outlook on the company is not changed prior to the rating reclassification. The model

shows that the negative return on a bond of -1.39% is linked to unexpected downgrades, and the positive return on a bond of 2.25% is connected to unexpected upgrades. In addition, in the sample of firms with actual changes in a credit rating, there is a negative return on a bond of -1.27% associated with downgrades. Overall, there are statistically significant excess bond returns associated with a credit rating decline within this category. Excess bond returns are statistically more significant for junk bonds than for investment grade bonds between 1981 and 1983.

III. Credit Derivatives

The Delphi Corporation example shows that a downgrade in a credit rating can lead to a significant increase in the price of the bond. In this particular example, the fall in the yield to maturity occurs because of the need to settle the credit derivative contracts with par valued bonds, thus increasing the demand for the bond. According to the International Swaps and Derivatives Association (2007), credit default contracts are usually initiated by a phone call. The two parties make agreements on the terms of the contract including any collateral and the oral agreement is binding for both parties. After the oral agreement, one party composes a letter that includes the economic terms of the contract established in the oral agreement. The letter is sent to the other member of the contract for a formal signature. Because the initial signed agreement does not contain detailed contract information such as the covenants and default outcomes, a formal contract called the master swap agreement is formed by ISDA.

According to the definitions of derivatives from ISDA (2007), a credit derivative is a security that shifts the risk of an underlying asset from one party to another.

Derivatives that are traded are grouped into two categories, over the counter derivatives and exchange-traded derivatives. Over the counter markets exist when buyers and sellers from different locations accept the price and sell to anyone who arrives (Mishkin 2006). Credit default swaps are traded in over the counter markets. Mishkin (2006) describes organized exchanges as a common place where buyers and sellers meet to trade with each other. Treasury futures are traded on organized exchanges. Hull (2004) recognizes credit default swaps as the most widely-used security in the credit derivatives market. Credit default swap contracts are a relatively liquid financial security. Liquidity is the means by which an investor can easily turn an asset into cash.

Chan-Lau (2003) provides a review of credit default swaps. In a credit default swap contract, the “buyer of protection” makes quarterly payments to the “seller of protection” until the bond matures or until a credit event occurs. Usually when a credit event occurs, the company becomes unable to pay the coupon payments as well as the principal amounts. According to Andritzky (2005), if the seller of protection in a credit default swap contract believes the corresponding bond to be an especially risky investment, then the seller may charge the buyer a premium in addition to the quarterly payments at the establishment of the contract.

If a credit event occurs before the contract expires, then the buyer of protection receives compensation equivalent to the par value of the defaulted bond. Until 2005, the buyer of protection in the credit default swap contract would receive the cash settlement payment in exchange for delivering the bond to the seller of protection. In this way, the bond holder is guaranteed par value. The gain from the credit default swap eliminates the financial loss for the bondholder from the company’s default. Interestingly, a bond

holder might prefer a default to an extended period of default worries. This may explain why some bond holder's try to force a declaration of default. In fact, the credit default swap is like a put option with the strike price at par value.

Prior to 2005 a CDS contract could only be settled through the deliverance of the actual defaulted bond. Andritzky (2005) explains this cheapest-to-deliver bond to be the deliverance of the least expensive bond to the seller of protection within thirty business days. Groups of bonds are not covered by a single credit default swap contract. If a bondholder wanted insurance on the possibility of default then that particular investor needed to buy the specific credit default swap for the bond as well. As we saw in the case of Delphi, the physical deliverance requirement created unusual spikes in the market. Because the underlying bond does not have to be held by the buyer of protection, investors can more freely speculate and hedge on defaults. If the buyer of protection in the credit default swap contract does not hold the particular bond, the buyer was required to buy the bond within the thirty day period. As a result, a default sometimes lead to heavy trading activity of the defaulted bonds, and even an increase in price. This is explained in more detail below.

Credit default swaps are similar to put options. The value of a credit default swap is based on the default probability, in addition to the price of the underlying security, so the pricing is different from the well-known Black-Scholes pricing model for options. Because credit default swaps are priced individually by the seller of protection, the prices are difficult to predict. Chan-Lau (2003) details credit default swap pricing. The credit default swap "spread" indicates the risk level associated with the bond. Hull (2004) describes the credit default swap spread as reflecting the rate of payments made to the

seller of insurance. The spread determines the annual amount that the buyer pays to the seller. The credit default swap spread is measured in basis points (1bp = .01%) For example, if the principal amount is \$5 million with a credit default swap spread of 100 bp, then the periodic payments made equal to $.01 \times \$5M = \$50,000$.

Hull (2004) explains how credit default swap spreads differ from bond prices. Like bonds, the credit default swap prices have bid and ask quotes from traders. A quote is the obligation of a firm to trade at least \$10 million (Hull, 2005). Once a quote is posted, the trader is committed to that particular price. However, bond prices only include suggested quotes, and therefore the trader is not committed to a particular price. Hull (2004) describes one reason credit default swap derivatives may appeal more to an investor: there is no adjustment needed to interpret the spread. Corporate bonds are compared to the risk-free rate to create a spread that is meaningful to traders. The credit default swap spread is negatively related to the rating given by the rating agency. The lower the credit default swap spread, the higher the credit rating. A company rated in the investment grade category will have a low credit default swap spread because the company is not likely to experience financial trouble.

Andritzky (2005) explains that credit default swaps trade in an unorganized over the counter market. The possibility of default and the expected recovery from the loss are key factors in providing a formal credit default swap pricing model. This paper uses an equation for the cash flows in credit default swap contracts. The value of this payment stream, referred to in the industry as “premium leg” is seen in equation one as $g(c,t)$.

$$g(c,t) = \frac{c}{4} \sum_{i=1}^N \exp\left(-\int_0^t r(u) + \lambda(u) du\right)$$

The variable r is the continuous risk-free rate, and λ is risk of the credit event. Andritzky (2005) provides a mathematical equation for the present value of the contract for the buyer of a credit default swap. For the most part, the pricing of credit default swaps is determined by the seller of protection.

JPMorgan (2005) gives background information on basic credit derivatives to further understand the impact of credit swaps and bond yields. For the holder of the “protection” (short) side of the contract, credit derivatives reduce or eliminate the default risk related to a bond. However, on the other (long) side of the credit default swap contract is a person or institution that has sold the protection. JPMorgan (2005) explains that the “buyer” of the credit derivative swap is actually buying protection on a risky bond. These contracts are marketable with exchanges made between individual parties. Interestingly, the buyer of protection is not required to hold the insured bond; parties may use credit default swap contracts merely to speculate.

Investors use the credit default swap as a more liquid alternative to bonds. Before the credit default swap index existed, when investors pulled their money out of junk bond mutual funds, the mutual funds were forced to sell high yield bonds to raise the cash. When the credit default swap index emerged in the market place, mutual fund managers used this index to manage their liquidity. Because the high yield index is less liquid than the credit default swap index, it can be difficult to buy back a particular bond at the most convenient opportunities. Unlike the high yield index, the credit default swap index can be traded by any investor an unlimited amount of times because any investor can simply create more contracts. There is no limit to the volume in the credit default swap index.

Money managers might buy and sell the credit default swap index as opposed to the high yield index or bonds in the index in order to manage the liquidity in a given portfolio. Because the credit default swap index is more liquid than the high yield index, I expect the volatility of the high yield index to decrease after the emergence of the credit default swap index. After the introduction of the credit default swap index into the market place, the high yield index might trade at a higher level than before because accounts are using the credit default swap index to move liquidity around instead of individual bonds. The selling of the credit default swap index decreases the value of credit default swaps and might in turn increase the value of bonds. In theory, because the high yield market has another competitor, the demand for high yield bonds should not increase after 2004, and thus the price should not increase. Because less pricing pressure is evident in individual high yield bonds this is also reflected in the high yield index.

As noted earlier, prior to 2005, when a credit event occurred, the seller of protection was obligated to purchase the bond at par value.⁸ More recently, credit default swap buyers have been able to opt for a cash sum settlements to avoid outcomes similar to Delphi Corporation. In a credit default swap contract, the seller of protection receives a period fee called coupon payments from the buyer of protection over the course of the bond's existence. The payments vary over time and may be based on market conditions. The coupon payments for credit derivative swaps are paid quarterly, unlike most bond coupon payments, which are paid semi-annually. Because the swaps are tradable, the payments are not always made to the original issuer of the protection.

The term "basis" is used to make a comparison between bonds and credit default swaps. Basis is equal to the credit default swap spread minus the corresponding bond

⁸ Recall a credit event is debt default, bankruptcy, or missed filings with the SEC.

spread. According to Choudry (2006),” the basis is not a spread on a particular financial security. The basis is a comparison between where the credit default swap trades and where the underlying bond trades. For example, if the credit default swap is trading at 2.5% points above LIBOR, at 250 basis points, and if the corresponding bond trades at 300 basis points, then there is negative basis of 50 basis points (250 basis points for the credit default swap – 300 basis points for the corporate bond). Negative basis occurs when the cash bond spread exceeds the credit default swap spread.

According to Chan-Lau (2003), the basis can be categorized as either positive or negative depending on whether the credit default swap spread lies above or below the bond spread. If the difference is negative, then the bond’s spread is larger than the credit default swap spread. A negative basis implies that the bond spread is wider than the credit default swap spread. Bond spreads tend to rise or fall when there is selling pressure in the bond market. Bond spreads may also change if there is low credit risk and the bond is callable.⁹ If the basis is positive, then the credit default swap spread is larger. Choudry (2006) explains that when an investor buys a corporate bond and also purchases protection on the bond, negative basis occurs when the credit default swap spread is relatively low and the underlying bond spread is relatively high. When negative basis exists, the corporate bond is viewed as cheap. Negative basis may imply that the bond is callable. A callable bond is generally cheaper, and there is no call option for the credit default swap. Choudry (2006) describes positive basis as occurring when an investor sells a corporate bond and then sells protection on the same company. Positive basis occurs when the credit default swap spread is high and the corporate bond spread is low.

⁹ The callable option value allows the bond to trade cheaper.

Chan-Lau (2003) described the widening of the basis to occur when either the credit default swap spread expands or the bond spread tightens. The cheapest-to-deliver condition allowed the buyer of protection to deliver the most inexpensive bond to the seller of protection that is covered by the CDS. When a credit default swap contract had the cheapest-to-deliver condition, the seller often charged a premium for this additional risk, ultimately widening the spread of the credit default swap.

The widening of the credit default swap spread can also stem from short-selling the credit default swap when the seller of the bond begins to default on payments.¹⁰ Investors short sell the market when they anticipate a decline in prices. When multiple parties short-sell a bond, the demand for that particular financial security increases, thus driving up the demand for protection in the credit default market. A widening of the basis may also occur when the bond price falls below the par value. For a bond selling below par, the seller of protection will charge a premium because she is obligated to repay the difference in the bond price and par value.

Chan-Lau (2003) explains the tightening of bond spreads to occur when the credit rating improved because the particular bond was associated with less risk. The spread squeezes when the economy is expanding because default risk falls in times of prosperity. A bond spread may also tighten if a better quality company makes a bid for that particular company. When the credit default spread is wider than the bond spread, there is “positive basis,” and the opposite occurs when there is a negative basis

A credit default spread may be wider than the underlying corporate bond spread because corporate bonds have restrictive covenants in their contracts unlike credit default

¹⁰ An investor short sells the market by borrowing a security and selling it to another investor. At a certain date, the seller must buy back the security and return it to the owner. If the price has fallen in the intervening period, the short-seller makes a profit.

swaps. Restrictive covenants are included in the bond indenture. The indenture is the contract associated with a particular bond that describes the responsibilities of both parties (Mishkin 2006). Corporate bond covenants may protect investors against the possibility of a leveraged buyout and other events that may increase bond risk. Usually, the more restrictions in the bond indenture, the lower the risk. Thus, when a bond contract has covenants, the credit default swap spread is typically tighter than bond spread.

ISDA monitors and regulates the derivatives market. According to Neal (1996), credit default swap contracts have stimulated much of the positive growth in the derivatives market over the past few years. Prior to January 13th 2005, the credit default swap contract required the buyer of protection to deliver the par bond to the buyer of protection in the event of a credit event. In the case of Delphi Corporation, the demand for these par value bonds increased substantially because the seller of protection was forced to return them to the buyer of protection. This resulted in the price of the bond rising even though the company had filed for bankruptcy. In 2005, the International Swaps and Derivatives Association permitted cash sum settlements for the credit default swap contracts to avoid this unusual situation in the future.

Case Studies

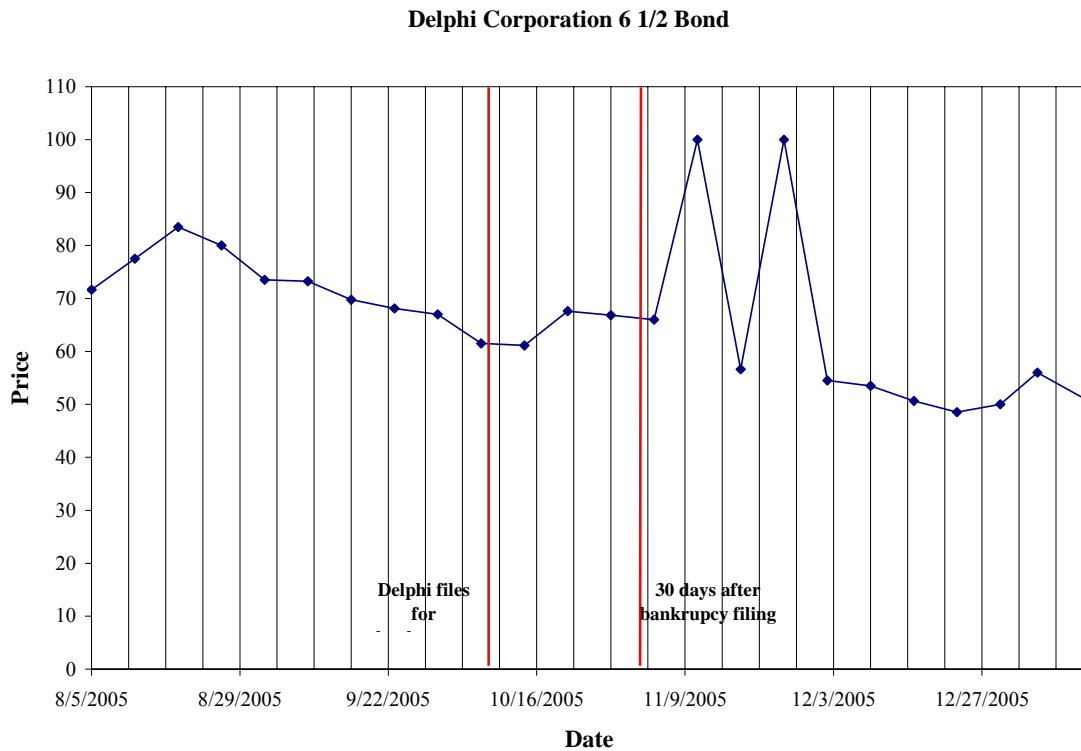
As noted earlier, Delphi Corporation filed for bankruptcy on October 8th 2005, triggering a credit event. Delphi Corporation had been part of General Motors until 1999, when it branched off to form its own independent auto parts provider company. Delphi supplies electronic parts of automobiles and other electronic components (Delphi Corporation). In the year prior to the bankruptcy in 2005, Delphi's revenue grew 2% to

\$28.7 billion in the year 2004. Because General Motors accounted for 50% of Delphi's total net sales, General Motors has been Delphi's most important customer since it became independent. In 2005, Delphi was striving to expand the client list so that the company would not have to depend so heavily on General Motors (Delphi Corporation). However, this was a time when auto sales decreased due to the cost of auto parts increasing dramatically, hurting both Delphi and General Motors revenue.

When Delphi Corporation declared bankruptcy in 2005, there was a call to settle the credit default swap contracts.¹¹ However, at this time the International Swaps and Derivatives Association did not allow the particular contracts associated with Delphi Corporation to be settled with cash. Each investor who bought insurance on the Delphi bonds needed to settle the contracts by delivering the actual par valued bond to the seller of protection. The need to settle the credit default swap contracts lead to an increase in the demand of Delphi's bonds even though the company had filed for bankruptcy. The price of Delphi's 6 ½ bond before and after the bankruptcy filing are seen in Figure

¹¹ Under the bankruptcy laws, Delphi filed for Chapter eleven which does not imply complete liquidation of the company. Under Chapter eleven, the reorganization of the company is permitted.

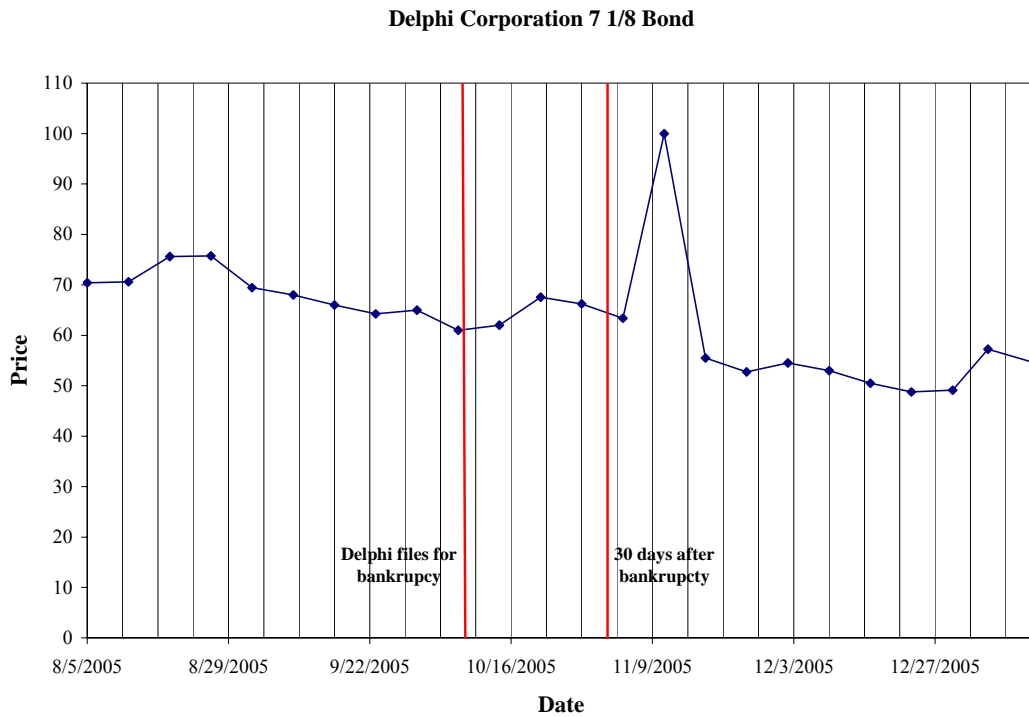
Figure 2



This was an unusual situation because usually when a corporation files for bankruptcy, the price of the bond decreases immediately because it is valued for less. Because the credit default contracts had to be settled within thirty days after default, the price shock occurred over 30 days after the announcement of Chapter 11 bankruptcy.

In July, just prior to the announcement of bankruptcy, the trading volume of Delphi's 6 1/2 bonds also heavily increased. The two spikes show that the price of Delphi's 6 1/2 bonds increased to 100, otherwise known as par, and then immediately drops down to the fifties. Delphi's 7 1/8 bonds experienced a similar shock to the bond price, as seen before in Figure 1. This graph is also seen in Figure 3.

Figure 3

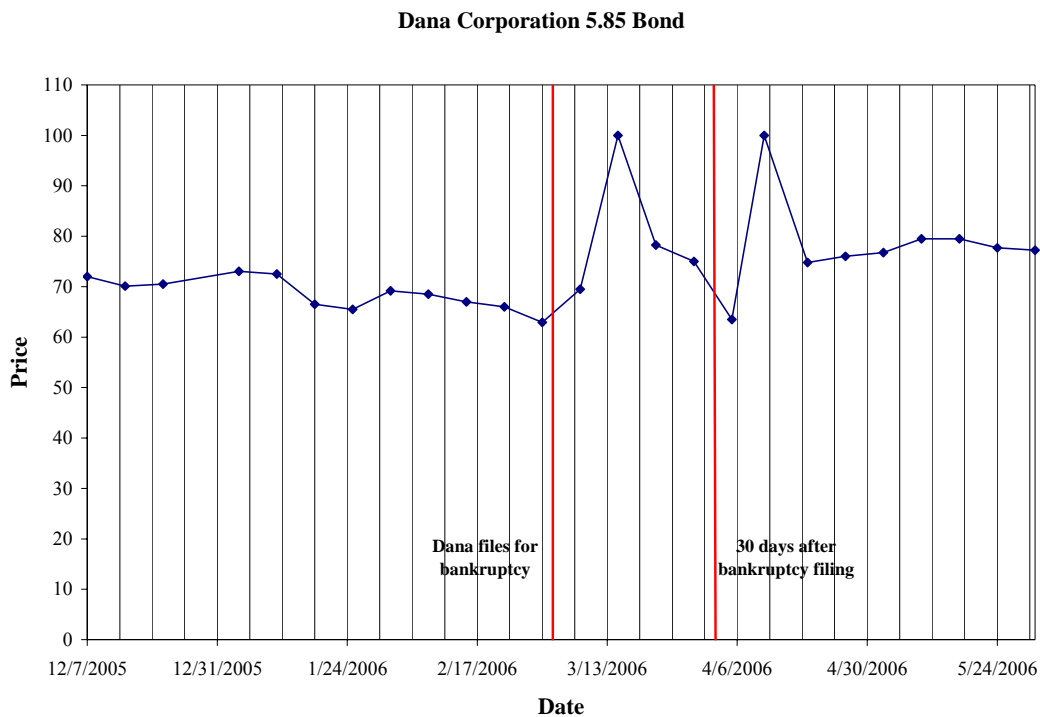


The increase in the price of Delphi's 7 1/8 bond also occurred around November 13th, 2005, almost thirty days after the bankruptcy announcement. Prior to the filing of Chapter eleven bankruptcy, this bond was also trading around the mid sixties. The shock increased the price to par as well, and then decreased to the fifties. That is, the market predicted Delphi's financial trouble. The amount of trades increased because investors who purchased insurance on the bond knew they needed to deliver the bond as compensation to the seller of protection.

Dana Corporation's corporate bonds experienced similar price shocks in 2006. According to the ISDA protocol for Dana Corporation, the company filed for bankruptcy on March 3, 2006, which occurred after the new rules for settling credit default swap contracts. Like Delphi Corporation, Dana is also an auto parts supplier (Dana Corporation). As in the Delphi case, when this company filed for bankruptcy, there was a

need to settle the credit default swap contracts with par bonds, leading to an increase in the demand for the bonds, thus driving up the price. The price shock to Dana Corporation's bond prices is seen in Figure 4.

Figure 4



The similar shock to bond prices affected both Dura Corporation and Calpine Corporation. According to the ISDA protocols, Dura Corporation filed for bankruptcy on October 30, 2006, and Calpine filed for bankruptcy on December 20th, 2005. Both companies filed for bankruptcy after the International Swaps and Derivatives Association changed the settlement options. However, the bonds for both companies experienced similar shocks to the bond prices because of previous requirement to deliver the par bond.

Based on the price shocks seen in the previous graphs, the credit default swap market certainly had an impact on bond prices when cash sum settlements were prohibited in specific contracts. Although the credit default swaps are relatively new, the

following sections attempt to determine the impact of credit default swaps on prices, change in prices, and volatility.

III. Methods

This paper attempts to determine the impact of the emergence of credit default swaps on the price, change in price, and volatility of high yield bonds. The previous graphs show a fluctuation in bond prices and a change in volatility around the time that the International Swaps and Derivatives Association allowed the cash sum settlement option in credit default swap contracts. Although there are only a few examples of a price increase after a company files for bankruptcy, it would be interesting to see if the emergence of the credit default swap index and the allowance of cash sum settlements affected the high yield market in general. To determine the impact of credit default swap contracts on the bond market as a whole, the high yield bond index is used to measure bond prices. Because quarterly data for credit default swap contracts is unavailable, a dummy variable is used to indicate the creation of the credit default swap index. The credit default swap index is called the CDX Index. The index contains one-hundred individual credit default swap contracts and officially entered the market place in 2004.

Monthly CDX and HY Index data were collected starting from January 1st, 1997 to September 1st, 2007. Control variables include the federal fund rate, the percent change in gross domestic product in chained 2000 dollars, the percent change in the Dow Jones Industrial Average, and the inflation rate minus food and energy. An additional dummy variable captures the introduction of cash sum settlements into the credit default swap contracts by the International Swaps and Derivatives Association in 2005.

To determine the impact of the credit default swap index on the high yield index, the independent variables were regressed for three transformations of the high yield index: the value of the high yield index, the percent change in the high yield index, and the standard deviation of the high yield index. The federal fund rate data and the consumer price index came from the FRED database (Economic Data). From the consumer price index, both inflation and inflation minus food and energy were calculated. The gross domestic product in chained 2000 dollars came from the Bureau of Economic Analysis. The Dow Jones Industrial Average and the S&P500 prices came from Yahoo.Finance. From the gross domestic product prices, the Dow Jones Industrial average prices, and the S&P500 prices, the percent changes were calculated. All the variables measured in percentage terms equate 1% with .01. The value of the high yield index came from Credit Suisse's High Yield Database. The actual federal fund rate is used.

The average value for the price of the high yield index is \$96.82, and the standard deviation of the price is 32.08. This can be seen below Table 2. The average value of the percent change in prices for the high yield index is .58%. This implies that the average price movement from 1997 to 2007 was .58%, and the standard deviation was 1.87%. Overall, the change in prices was not drastically large. The average value of the standard deviation of the returns of the high yield index is .33. Because the standard deviation was calculated for the percent change in the high yield index, a standard deviation of .33 implies that there was a .33% movement around the mean. Equation (3) specifies the regression model on the percent change of the high yield index

$$(3) \quad perHY = B_0 + B_1CSS + B_2CDX + B_3FFR + B_4GDP + B_5DJIAe + B_6INFL$$

where *CSS* represents the dummy variable for cash sum settlements, *CDX* as the emergence of the credit default swap index, *FFR* as the federal fund rate, *GDP* as the percent change in gross domestic product in chained 2000 dollars, *DJIA* as the percent change in the Dow Jones Industrial Average, and *INFL* as inflation minus food and energy. The percent change in the high yield index, (*perHY*), was calculated from the previous month. The percent change in the high yield index is the percent change in the price of the high yield bonds.

The independent variables were also regressed on the value of the high yield index to determine whether the emergence of the credit default swap index affected the actual price of the index for high yield bonds. The econometrics model is presented in the following equation:

$$(4) \quad \text{valuehyindex} = B_0 + B_1\text{cashsumsett} + B_2\text{cdx} + B_3\text{fedfundrate} + B_4\text{gdpper2000} + B_5\text{djiaperchange} + B_6\text{inflationmfe}$$

I would expect the coefficient of the credit default swap index to be positive. When the credit default swap index entered the market place, many investors traded the CDX Index instead of high yield bonds because corporate junk bonds are relatively illiquid. The emergence of the credit default swap index provided investors with an alternative investment method. This may have put more of a premium in the market for high yield bonds because the liquidity in the market place may have been managed by investors using the credit default swap index. For example, if an investor decided to pull \$100 M out of a mutual fund, the mutual fund has a few options to raise the cash. The fund manager could sell ten bonds for \$10 M, ultimately pushing the high yield index lower, and thus bond prices lower. However, instead of selling bonds, the fund manager could

sell the credit default swap index. If the credit derivatives market appealed more to investors, than the mutual fund managers might sell the credit default swap index. Selling the credit default swap index decreases the price of the credit default swap contracts decrease, and therefore would not negatively affect bond prices. However, after the emergence of the credit default swap index, the demand for bonds may have decreased, because investors were investing more in the credit default swap index. The decrease in demand for bonds could in turn decrease the price. The other issue is that because credit default swap contracts provide bonds with insurance, the credit default swap index should decrease the risk of bonds, ultimately decreasing bond prices.

The independent variables were also regressed on the standard deviation of the high yield index. The standard deviation of returns was calculated using the standard deviation formula in Excel with the data on the percent change in the high yield index. The regression is seen in the following equation.

$$(5) \quad stdevhyindex = B_0 + B_1cashsumsett + B_2cdx + B_3fedfundrate + B_4gdpper2000 + B_5djiaperchange + B_6inflationmfe$$

I would expect the coefficient on the credit default swap index to be negative. A negative coefficient would imply that when the credit default swap index emerged in 2004, the volatility of the high yield index decreased. This would be expected if more investors and mutual fund managers were using the credit default swap index to manage liquidity rather than high yield bonds.

Both regressions for the value of the high yield index as well as the standard deviation of the high yield index needed to be corrected for serial correlation. According to Woolbridge (2000), serial correlation exists when the error terms of a regression are correlated across time, implying that an error term at a specific point in time helps predict

future error terms. This causes regression results to be inefficient. The Durbin-Watson statistic, shown in the regression results, is an indicator for serial correlation. Woolbridge (2000) suggests a Durbin-Watson test to determine whether serial correlation exists in a regression; without serial correlation, the Durbin-Watson statistic is approximately equal to $2(1 - \hat{\rho})$. Woolbridge (2000) lets the null hypothesis for the Durbin-Watson test be $H_0: \rho=0$. When rho equals zero, the Durbin-Watson statistic is around 2 (from the previous equation). When the rho value is greater than zero, the Durbin-Watson statistic is negative. According to Stanford University's critical values for the Durbin-Watson Test, for 129 observations with 7 slopes including the intercept, the lower bound is 1.61651, and the upper bound is 1.81073. The null hypothesis that no serial correlation exists in the regression can be rejected if the Durbin-Watson statistic is less than 1.61561. Woolbridge (2000) explains that if the Durbin-Watson Test statistic is between 1.61651 and 1.81073, then the test is inconclusive. If the Durbin-Watson Statistic exceeds the upper bound, then we fail to reject the null hypothesis. Without correcting for serial correlation, the Durbin-Watson statistics for the value of the high yield index and the standard deviation of the high yield index were significantly less than 2.

To correct for serial correlation, Woolbridge (2000) suggests the Feasible General Least Squares Estimation. This method requires running a regression of u_t on u_{t-1} (Woolbridge). The coefficient on u_{t-1} is equivalent to the ρ value. The independent and dependent variables are corrected by subtracting the lag of the particular variable multiplied by the rho value. The correction for the variables is seen in the following equation:

$$(5) \bar{X}_t = X_t - (p * X_{t-1})$$

where \bar{X}_t is the corrected value for X. An econometrics model is then formed from the new variables corrected by the General Least Squares Feasible Estimation.

IV. Results

The regression results for the percent change in the high yield index are seen in Table 1. The R^2 value in this regression implies that the independent variables are explaining 5.94% of the variation in the percent changes in the high yield index. For a financial econometrics model, a high R^2 is not expected because it would imply that the variables in the regression could accurately predict the price of the index for high yield bonds. However, because of the efficient markets hypothesis, all relevant and public information is already inherent in the price of securities and can therefore not be predicted, especially at the monthly frequency of these data. The coefficient on the credit default swap index is -.81 which means that when the credit default swap index emerged in the market place, the percent change in prices of high yield bonds decreased by -.81% points. When the International Swaps and Derivatives Association introduced cash sum settlements into credit default swap contracts, the return of high yield bonds increased by 1.01% points. The federal funds rate is the only statistically significant variable in the regression at the 5% level of significance. For a hypothesis that the coefficient on the credit default swap index equals zero, ($H_0: B_2=0$), the t-statistic is -1.26. Based on this result, the null hypothesis that $B_2=0$ is rejected at only the 80% confidence level.

Therefore the emergence of the credit default swap index may have affected the return of

the high yield index. A hypothesis for cash sum settlements equaling zero ($B_1=0$) calculates a t-statistic equal to 1.39. Based on this result, the null hypothesis that $B_1=0$ is also rejected at only the 80% confidence interval. Therefore, the allowance of cash sum settlements in credit default swap contracts may have positively affected the high yield index. The Durbin-Watson statistic for this regression is 1.86, so there was no need to correct for serial correlation.

The second, third, and fourth regressions for the percent change in the high yield index include alternatives to the variables in the first regression. For example, the second and fourth regressions include the percent change in the S&P 500 in replace of the percent change in the Dow Jones Industrial Average. Regression three includes the lag of gross domestic product in chained 2000 dollars instead of gross domestic product growth as well as core inflation, which is inflation minus food and energy. For the most part, the coefficients remain the same sign and around the same value throughout the four regressions.

The regression for the value of the high yield index is seen in Table (2). Because the regression was corrected for serial correlation, the Durbin-Watson statistic increased to .872. The R^2 equals .513 implying that the independent variables explain 51.3% of the variation in the value of the high yield index. The coefficient on the credit default swap index is 88.83 so the emergence of the credit default swap index into the market place increased the price of the high yield index by \$88.83. This number seems excessively high because the average price of the high yield index is 96.82. An additional \$88.83 because of the emergence of the credit default swap index seems unlikely. For a hypothesis that $B_2=0$, the t-statistic on the variable for the credit default swap index

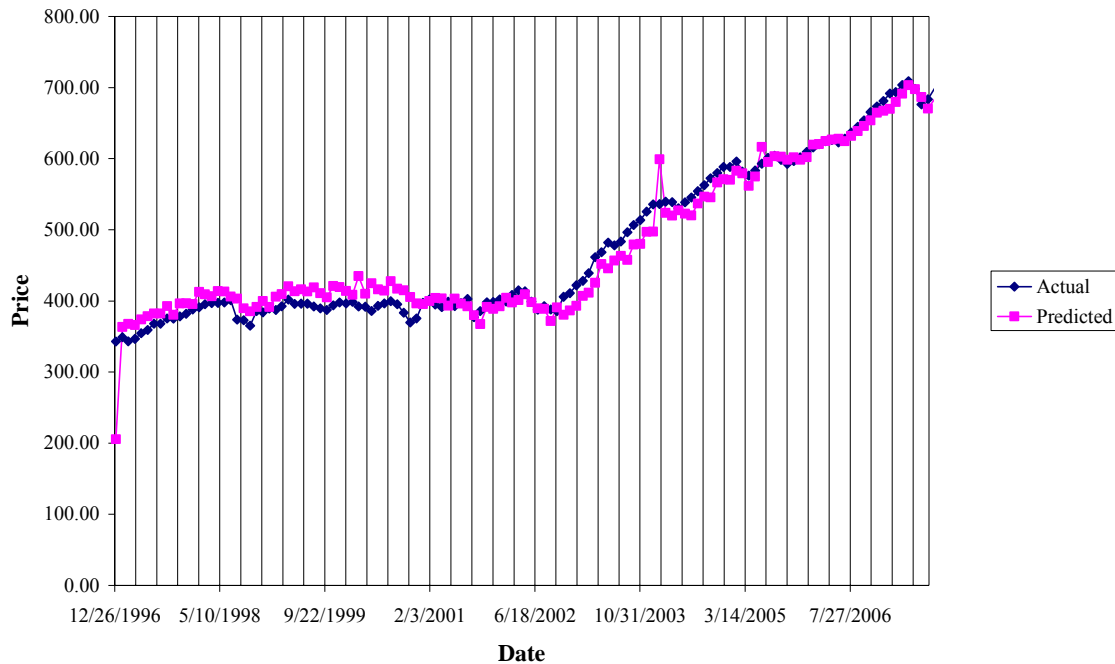
equals 4.73 which exceeds the critical value at 1.96. Therefore, at above the 95% confidence level, the null that $B_2=0$ can be rejected. The coefficient on cash sum settlements is 49.6 so the emergence of the credit default swap index increased the price of the high yield index by \$49.6. This number is extremely high and seems unreasonable. The t-statistic is 2.49, so I can reject the hypothesis that $B_1=0$, and thus the allowance of cash sum settlements in credit default swap contracts negatively affected the value of the high yield index.

The regression for the standard deviation of returns is seen in Table 3. The coefficient on the credit default swap index is -0.331 so the emergence of the credit default swap index into the marketplace decreased the variance around the mean of the high yield index by .33. The coefficient on cash sum settlements is -0.0985, so the allowance of cash sum settlements in credit default swap contracts decreased the variance around the mean of the high yield index by .0985. The introduction of the credit default swap index and cash sum settlements decreased the volatility of the high yield index. The R^2 of the regression is .159 so the independent variables explain 15.9% of the variation in the high yield index. Again, the low R^2 value shows the significance of the Efficient Markets Hypothesis and the inability to predict bond prices.

Because bond prices are unpredictable and random, it is difficult for anyone to be over 90% confident about the effect of an independent variable on the high yield market. Overall, the credit default swap index and the allowance of cash sum settlements by the International Swaps and Derivatives Association affected the value, return, and volatility of the high yield index. A plot of the actual value of the high yield index and the predicted value of the high yield index appears in Figure (5) below.

Figure 5

Actual vs. Predicted Prices of the High Yield Index



This graph shows that the predicted values closely estimate the actual values. There is, however, a spike in both the predicted and actual bond price in February of 2004. In general, from 1996 to 2007, prices in the high yield market have increased. From the graph, starting in 2002, the bond prices seemed to more drastically rise as the slope of the actual and predicted prices increased.

V. Conclusions

The Delphi Corporation example shows that a spike in bond prices occurred because of the need to settle credit default swap contracts. This unusual increase in price initially stems from credit events affecting the financial health of a particular company; this ultimately caused settlement issues in the credit derivatives market because the International Swaps and Derivatives Association required the deliverance of par valued

bonds as compensation to the buyer of protection. The regression results show that the emergence of the credit default swap index as well as the allowance of cash sum settlements affected the price of high yield bonds, and ultimately the high yield market.

However, this trend could be attributed to other factors affecting the market between 1997 and 2007. The economy experienced negative percent change in GDP growth in chained 2000 dollars during the third quarter of 2000, the first quarter of 2001, and the third quarter of 2001. While a recession is technically measured by two consecutive quarters of negative real GDP growth, these three quarters of negative growth, though not consecutive, had a recession-like affect on the market. The attacks of September 11, 2001 worked to further slow down the economy. For example, the attacks on the United States led Americans to cut back expenditures on airplane travel out of fear, and other sectors of the economy were further impacted. However, the percent change in real GDP growth turned positive in the fourth quarter of 2001. Another factor that affected markets during this period was the Sarbanes-Oxley Act. Passed in 2002, the act stressed accounting conservatism in the aftermath of the Enron scandal. Because of the new time consuming regulations, many companies were unable to file financial statements on time. The Sarbanes-Oxley Act also had an impact on the leveraged buyouts in the market. Since some private companies were not affected by the new act, many public companies wanted to turn private to avoid the new regulations for filing financial statements. This ultimately increased the amount of leveraged buyouts in the market, putting more leverage on companies that were going private. The Iraq War in 2003 also may have impacted the market during this time. During a major war, foreigners tend to put their money in the safest currency, the US dollar. The foreign

investments in the United States brought more buyers into the American markets. These worldwide impacts certainly had an affect on the market. Therefore, the bond fluctuations during this time were probably not only attributed to the emergence of the credit default swap index and the allowance of cash sum settlements. However, despite these outside factors, the results of this paper imply that the emergence of the credit default index has had an important impact on the market.

Table 1

Dependent Variable: Percent Change of High Yield Index		* Indicates Significance at 5% Level			
	(1)	(2)	(3)	(4)	
C	1.26 (1.76)	1.58 *(3.24)	1.05 (1.60)	1.59 *(3.36)	
Cash Sum Settlements	1.01 (1.39)	0.70 (1.14)	1.18 (1.62)	0.66 (1.05)	
CDX	-0.81 (-1.26)	-0.498 (-.98)	-0.96 (-1.49)	-0.477 (-.92)	
% Change DJIA	0.0 (.52)		0.0074 (.73)		
% Change S&P 500		0.22 (6.8)		0.23 *(6.74)	
GDP Growth	0.19 (1.17)	0.0048 (.04)			
GDP Lagged Growth			0.26 (1.57)	-0.013 (-.10)	
Inflation Core			-0.78 (-1.17)		
Inflation Minus Food and Energy	-1.60 (-.76)	-1.116 (-.62)		-1.09 (-.61)	
Federal Funds Rate	-0.29 *(-2.29)	-0.24 *(-2.30)	-0.35 *(-2.79)	-0.23 *(-2.15)	
R-squared	0.059				
Adjusted R-squared	0.013				
F-statistic	1.286				
Durbin-Watson stat	1.860				

Summary Statistics

	% Change High Yield Index	Cash Sum Settlements	CDX	% Change DJIA	GDP Growth	Inflation Minus Food and Energy	Federal Fund Rate
Mean	0.58	0.22	0.34	55.36	2.79	0.18	3.92
Median	0.93	0.00	0.00	60.31	3.01	0.17	4.76
Maximum	5.88	1.00	1.00	115.49	4.85	0.38	6.54
Minimum	-6.79	0.00	0.00	2.10	-0.17	0.00	0.98
Std. Dev.	1.87	0.41	0.48	23.18	1.27	0.08	1.83

Table 2

Dependent Variable: Value of High Yield Index

	(1)	(2)	(3)	(4)
C	56.40 (11.71)	54.29 (15.44)	66.06 (23.09)	79.29 (23.03)
Cash Sum Settlements	49.6 (2.49)	55.17 (2.79)	64.93 (5.61)	78.90 (5.97)
CDX	88.83 (4.73)	88.92 (4.77)	65.97 (5.98)	83.87 (6.78)
% Change DJIA	0.84 (2.82)		1.06 (6.24)	
% Change S&P 500		0.56 (1.58)		0.34 (1.42)
GDP Growth	4.07 (1.44)	3.23 (1.17)		
GDP Lagged Growth			-0.67 (-.46)	-0.96 (-.56)
Inflation Core			2.39 (.60)	
Inflation Minus Food and Energy	17.70 (.92)	21.54 (1.67)		6.13 (.50)
Federal Funds Rate	23.85 (5.93)	28.92 (7.07)	-7.29 (-2.08)	-6.057 (-1.57)
R-squared	0.513			
Adjusted R-squared	0.489			
F-statistic	21.399			
Durbin-Watson stat	0.872			
Rho Value	0.805			

Note that the summary statistics changed because the variables were corrected for Feasible General Least Squares.

Summary Statistics

	Value High Yield Index	Cash Sum Settlements	CDX	% Change DJIA	GDP Growth	Inflation Minus Food and Energy	Federal Fund Rate
Mean	96.82	0.05	0.07	11.50	0.56	0.04	0.79
Median	85.70	0.00	0.00	11.24	0.56	0.03	0.90
Maximum	343.10	1.00	1.00	29.21	3.69	0.30	5.25
Minimum	50.87	0.00	0.00	-13.49	-1.21	-0.21	-0.07
Std. Dev.	32.08	0.12	0.12	7.36	0.78	0.11	0.55

Table (3)

Dependent Variable: Standard Deviation of Returns in High Yield Index				
	(1)	(2)	(3)	(4)
C	0.47 (8.84)	0.355 (8.49)	0.534 (9.08)	0.4289 (8.52)
Cash Sum Settlements	-0.0985 (-.45)	-0.1985 (-.89)	-0.074 (-.33)	-0.113 (-.51)
CDX	-0.331 (-1.59)	-0.408 (-1.94)	-0.344 (-1.65)	-0.409 (-1.99)
% Change DJIA	-0.0082 (-2.47)		-0.0067 (-2.03)	
% Change S&P 500		-0.0026 (-.65)		-0.0029 (-.738)
GDP Growth	0.00995 (.32)	0.02 (.63)		
GDP Lagged Growth			-0.045 (-1.56)	-0.0446 (-1.55)
Inflation Core			0.049 (.62)	
Inflation Minus Food and Energy	0.604 (2.84)	0.5497 (2.57)		0.5129 (2.51)
Federal Funds Rate	-0.05697 (-1.28)	-0.0516 (-1.12)	-0.138 (-2.37)	-0.157 (-2.43)
R-squared	0.159			
Adjusted R-squared	0.117			
F-statistic	3.830			
Durbin-Watson stat	1.546			
Rho	0.804			

Note that these values also changed because of the correction for Feasible General Least Squares.

Summary Statistics

	Standard Deviation of High Yield Index	Cash Sum Settlements	CDX	% Change DJIA	GDP Growth	Inflation Minus Food and Energy	Federal Fund Rate
Mean	0.33	0.05	0.07	11.57	0.56	0.04	0.80
Median	0.26	0.00	0.00	11.29	0.56	0.03	0.90
Maximum	1.74	1.00	1.00	29.34	3.69	0.30	5.25
Minimum	-0.36	0.00	0.00	-13.45	-1.21	-0.21	-0.07
Std. Dev.	0.27	0.12	0.12	7.38	0.78	0.11	0.56

References

- Allen & Overy. (2002). An Introduction to the Documentation of OTC Derivatives: Ten Themes. *International Swaps and Derivatives Association*. Retrieved Fall, 2007, from
<<http://www.isda.org/educat/pdf/ten-themes.pdf>>
- Andritzky, John, & Manmohan, Singh. (2005). The Pricing of Credit Default Swaps During Distress. *International Monetary Fund*. Retrieved Fall, 2007.
- Chan-Lau, Jorge A. (2003). Anticipating Credit Events Using Credit Default Swaps, with an Application to Sovereign Debt Crises. *International Monetary Fund*. Retrieved Fall, 2007.
- Choudry, Moorad. (2006). The Credit Default Swap Basis. *Bloomberg Press*.
- Corporate Communications. (2002). Understanding Credit Ratings. *Standard and Poor'*. Retrieved Fall, 2007, from
<<http://www2.standardandpoors.com/spf/pdf/media/UnderstandingRatings.PDF>>.
- Dotz, Niko. (2007). Time-Varying Contributions by the Corporate Bond and CDS Markets to Credit Risk Price Discovery. *Deutsche Bundesbank*. Retrieved Fall, 2007.
- Grier, Paul & Grier Katz. (1976). The Differential Effects of Bond Rating Changes Among Industrial and Public Utility Bonds by Maturity. *The Journal of Business*, 42(2), 226-239.
- Hand, Holthausen & Leftwich. (1992). The Effect of Bond Rating Agency Announcements on Bond and Stock Prices. *The Journal of Finance*.733-752.
- Hull, Predescu, and White. (2004). The Relationship Between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements. *Joseph L. Rotman School of Management*.
- JPMorgan. (2005). Credit Derivatives: An Updated Primer. *JPMorgan and Company: Credit Derivatives and Quantitative Research*.
- Katz, Steven. (1974). The Price and Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency. *The Journal of Finance*. 551-559.
- McGraw. (2006). Standard and Poors Corporate Ratings Definitions. *Standard and Poor's*. Retrieved Fall 2007, from
<<http://www2.standardandpoors.com/portal/site/sp/en/us/page.article/2,1,3,0,1148442391999.html>>.

- Mishkin, Frederic S & Eakins, Stanley G. (2006). *Financial Markets and Institutions*. New York: Pearson Addison Wesley.
- Neal, Robert S. (1996). Credit Derivatives: New Financial Instruments for Controlling Credit Risk. *Federal Reserve Bank of Kansas City Economic Review*, 81 (2).
- Norris, Kim. (1992). The Language of Bonds. *St. Petersburg Times, Business Section*, 4.
- Sherwood, Hugh C. (1976). *How Corporate and Municipal Debt is Rate; An Inside Look at Standard and Poor's Rating System*. New York: John Wiley and Sons.
- Southern Unit Trust (1998), "Mechanics of Bond Market and Role of Rating Agencies," *New Straits Times, Business Wise Moves*, 28.
- N.E. Savin, N.E and K.J. White. (1977) The Durbin-Watson Test for Serial Correlation with Extreme Sample Sizes or Many Regressors. *Econometrica*, 45, 1989-1996. < <http://www.stanford.edu/~clint/bench/dwcrit.htm>>
- Wooldbridge, Jeffrey M. (2000). *Introductory Econometrics*. Australia: South-Western College Publishing.