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Fighting “Fool’s Yield”: A Quantitative Solution to the Pitfalls of Passive High Yield Investing

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ABSTRACT

The purpose of this paper is to track the raw and risk-adjusted performance of a two-factor high yield corporate bond portfolio relative to its respective benchmarks and examine the return characteristics of distressed and high yield bonds. At the index level, CCC-rated and B-rated bonds underperform higher-rated bonds on both a raw and risk-adjusted basis. The high number of defaults in these two indexes offsets the higher yield. Essentially, the higher yield does not translate into higher returns. This is known as “fool’s yield.” However, this paper finds that passive investing in lower credit quality bonds can exhibit higher risk-adjusted and raw returns relative to BB and higher credit ratings by quantitatively tailoring the portfolio through two factors: price and time to maturity. A high yield bond portfolio that holds low-priced bonds exhibits a positive skewness of returns that offsets the losses from defaults, and the longer time to maturity lowers the number of defaults by creating for a longer runway for management to turn things around.

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Chapter 1

Introduction

Active and Passive Management

The rise of passive investing has taken the investment management industry and the financial markets by storm over the past few decades. Passive investing focuses on replicating an index, while active management involves strategically trading and selecting specific investments with the intent of outperforming the index. Up until the 1970s, there was no such thing as passive investing; active management was the only path to investing. However, the fees and frequent underperformance of active managers relative to the index has caused money to flow from active funds into passive investment vehicles, such as index funds and ETFs. This has especially been seen in equities. As of June 2024, 54% of institutional equity assets under management were passive strategies (PineBridge, 2025). This percentage has been steadily increasing over the past 20 years. As seen in Figure 1 below, almost all active equity managers underperform the index over a period of 20-years. Even when adjusted for risk, the percentage of active managers that underperform is extremely similar to Figure 1. Additionally, most of the active managers that outperform the index in a 5-year stretch do not outperform in the subsequent 5-year period.

Figure 1: Percentage of Active Equity Managers that Underperform Benchmark[1]

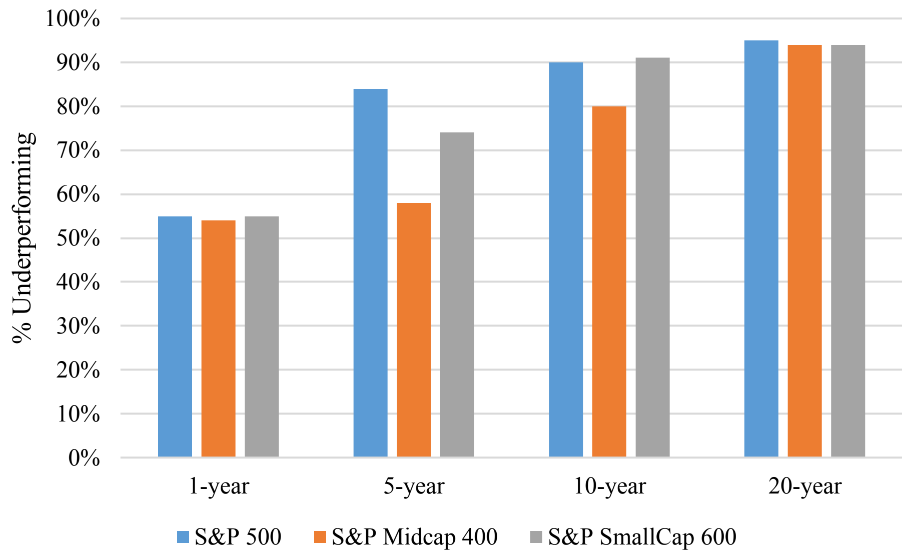


Table 1: Performance of Top Quartile Active Managers After 5 Years[2]

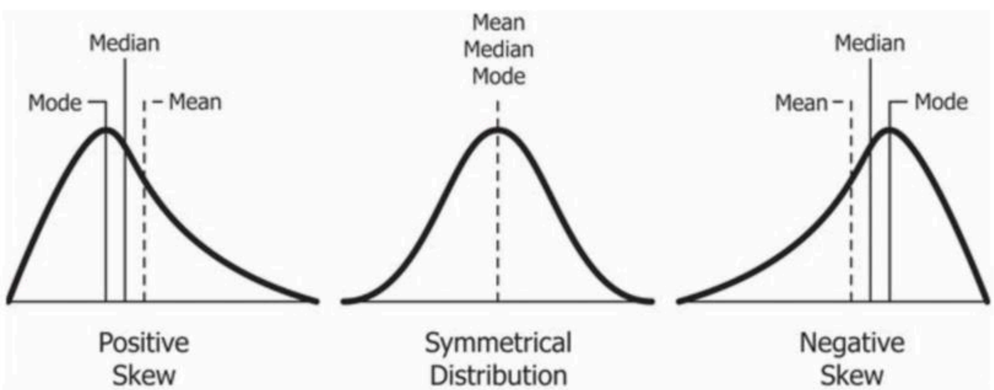
Fund Category	% Repeating in Top Quartile	% Moving to Bottom Quartile
Large Cap	27.1	5.0
Mid Cap	1.5	14.9
Small Cap	0.9	22.8

As the Table 1 suggests, most of the outperformance of active managers does not persist and is rather random. A large reason why active managers underperform is due to the skewness of stock returns (S&P, 2022). With a normal distribution of returns, the chance that a return is above or below the average is exactly 50%; the mean is equal to the median and returns lie symmetrically around the mean. However, stock returns exhibit positive skewness, meaning that

[1] Source: S&P
[2] Source: S&P

there are large positive outliers that pull the distribution to the right. This causes the mean return to be higher than the median. This is because stocks can return at the least -100% but can have unlimited gains. As an active manager, this makes outperforming the index extremely hard. In fact, the majority of individual stocks have lifetime buy-and-hold returns that are less than 1-month Treasury Bills, and when stated in lifetime dollar wealth creation, only the top-performing 4% of stocks are responsible for the entire net positive gain for the U.S. stock market since 1926 (Bessembinder, 2018). Essentially, if you do not own the few winners that drive the bulk of

Figure 2: Different Kinds of Distributions[3]



returns of the index, you will underperform. It is not enough to simply avoid losses. In equities, you must deliver outperformance because of the upside associated with the asset class.

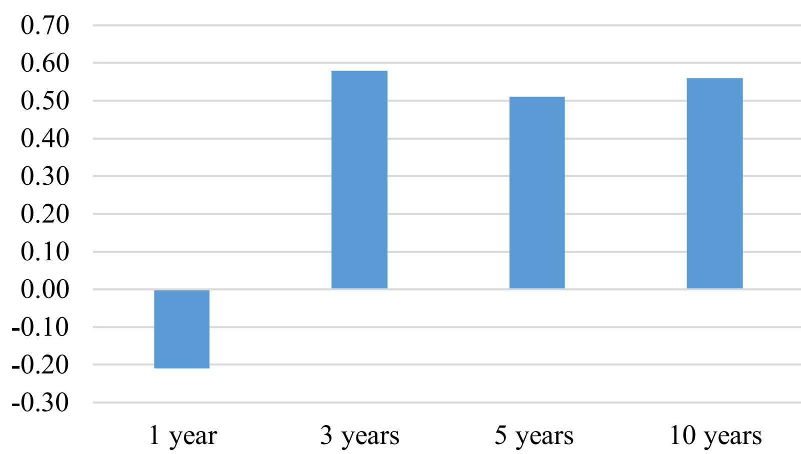
However, in fixed income, specifically corporate credit, active management still remains the preferred strategy over passive management. In the fixed income universe, only 15% of assets under management by institutional investors are passively managed (PineBridge, 2025). This is a stark contrast to equities. Unlike equities, credit exhibits negatively skewed returns, meaning that large negative outliers occur with higher frequency than large positive outliers.

[3] Source: Wikipedia

This is because bonds have a fixed nature. Bonds have an upside consisting of interest payments and a downside of -100%. Because the upside is fixed, the only variation in return is on the downside, causing the distribution of returns to be negatively skewed. This consistent, fixed stream of income is what bond investors are looking for. However, these consistent and predictable cash flows come at the expense of upside gains.

The negative skewness of this asset class makes passive investing in high yield bonds a dangerous investment strategy. Because the index in credit has the losers (i.e., the bonds that default or get downgraded), active managers in high yield credit often outperform by avoiding the losing bonds in the index. Unlike in equities, high yield managers are not solely focused on delivering outperformance; because of the distribution of returns in credit, simply avoiding losses is good enough to beat the index in most cases. In his article "The Loser's Game," Charlie Ellis compares the analysis of tennis in *Extraordinary Tennis for the Ordinary Tennis Player* by Simon Ramo with investing. In the book, Ramo classifies two games of tennis. The first is the game played by professionals and skilled amateurs, known as "the winner's game," and the second, "the loser's game," is played by everyone else. In professional tennis, the match goes to the player that outperforms his/her opponent by hitting the winning, well-placed shots that the opponent cannot return; points are won in professional tennis. In amateur tennis, the match goes to the player that makes the fewest number of mistakes. The winner of the loser's game keeps the ball in play until the opponent hits the ball into the net or out of play; points are not won but rather lost in amateur tennis. These two games of tennis can metaphorically be described as the difference between equity and credit investing, with the two being the winner's game and the loser's game, respectively. According to Benjamin Graham and David Dodd, this exclusion of bad bonds by active managers makes credit investing a negative art (Marks, 2018). As a result of this difference, active high yield managers almost always beat the index, unlike their equity counterparts. Also, active high yield managers offer a higher Sharpe ratio compared to the index over all periods (PineBridge, 2025).

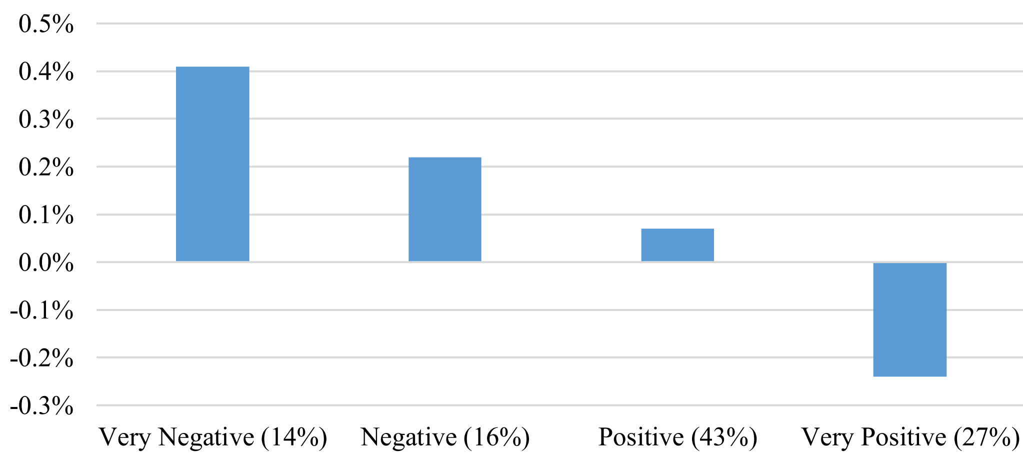
Figure 3: Active High Yield Excess Returns Over Different Periods[4]



However, active managers only tend to outperform in credit bear markets and tend to underperform in credit bull markets, as seen in Figure 4 (BlackRock, 2024). This is largely because active high yield managers position their portfolios to mitigate downside risks due to the asymmetric return profile of high yield credit and because credit investors are most concerned with not losing money. However, this extreme risk mitigation causes the underperformance in credit bull markets; by focusing mostly on reducing downside risk, active managers miss the upside in bull markets. One of the aims of this paper is to find a solution to this asymmetric downside in corporate credit.

[4] Source: PineBridge

Figure 4: Monthly Active Excess Returns by Credit Market Regime[5]



Factor Investing

Factors in the practice of investing are certain characteristics that explain much of the variation in a security's return. Factors in equities have been researched thoroughly, first coming to light by the works of Eugene Fama and Kenneth French in 1992. Fama and French found that a stock portfolio consisting of 3-factors: size, value, and market risk, had more accurate explanations for the variance of cross-sectional stock returns than the capital asset pricing model by Litner (1965) and Sharpe (1964) would suggest. In 2015, Fama and French researched a 5-factor model that included the three aforementioned factors along with the "investment" and "profitability" factors. All together, these five factors account for 71% to 94% of the variation in stock returns.

[5] Source: Blackrock. X-axis indicates credit market performance.

Factor investing works in equities because of the idiosyncratic risk and positive skewness of returns that the asset class exhibits. Quantitative, factor investing in fixed income is not typically used because of the asymmetrical returns of the asset class and because systematic interest rate risk is the main risk in credit. Factor investing in credit is only a slice of the market. Bloomberg estimates that $10 to $40 billion of ETFs are dedicated to credit factor investing, but this still pales in comparison to the estimated $300 billion in actively managed bond ETFs (Bloomberg, 2025). Due to the amount of systematic risk in credit, many investors question whether factor investing in credit is relevant (S&P, 2016). As mentioned above, in traditional fixed income, the downside potential exceeds the upside potential, as the upside is limited to interest and principal and the downside is a return of -100%. However, as credit quality decreases, the risk switches from interest rate risk to default risk, essentially switching from systematic risk to idiosyncratic risk. This proposes the idea that if you go down enough in credit quality (i.e., distressed bonds), equity-like, idiosyncratic risk could allow for a quantitative, factor-driven strategy. Fixed income investors are punished more severely for being wrong than equity investors due to these asymmetrical, negatively skewed returns and because credit investors are risk averse and prioritize a consistent, contractual stream of payments over the opportunity of extreme upside potential. Because these distressed bonds act more like equity than debt, my hypothesis is that a quantitative investing strategy could be utilized, and the returns of this portfolio would exhibit positive skewness, which is not seen in higher credit quality bonds. The combination of idiosyncratic risk and a positively skewed distribution of returns while keeping the contractual structure of fixed income could result in attractive returns that are uncorrelated with credit market returns due to the mitigated systematic risk and give credit investors exposure to equity-like returns and upside.

Fool's Yield

As you go down the credit rating spectrum, the need for active high yield managers increases. This is because at the CCC and B ratings, there are more defaults, which means returns are even more negatively skewed. As credit quality gets worse, investors demand higher yields to compensate for the increased default risk. However, the high number of defaults in these ratings classes offsets the higher yield that is offered. As a result, CCC and B rated indexes often underperform or fall in line with BB and higher rated indexes, even though they are riskier and experience higher volatility. This is known as "fool's yield" (Verdad Capital 2019). So, CCC and B-rated indexes have the lowest risk-adjusted returns in corporate credit.

CCC and B-rated indexes post poor results due to more defaults in the portfolio *in combination* with the negative skewness of the corporate credit asset class. My hypothesis is that passive investing in lower credit quality bonds can exhibit higher risk-adjusted and raw returns relative to ratings BB and above by quantitatively tailoring the portfolio to maximize positive skewness and minimize defaults through two factors: price and time to maturity. I think that a portfolio with lower price parameters will exhibit positive skewness due to the asymmetric price upside, which allows for both idiosyncratic and systematic risk factors to have greater torque to the upside; there is a clean runway for price appreciation in the event of company specific improvements or a rally in interest rates or credit spreads due to the positive convexity.

As for a lower default rate, I think that this can be achieved by structuring the portfolio to only invest in bonds with more than four years remaining until to maturity. The thought process here is that management's concern of a liquidity event and need of action is low due to the optionality that the extended time brings. The main reason that a company defaults on its debt obligations is because it cannot pay back the principal at the maturity date. Rarely will a company be forced into bankruptcy because they cannot pay the contractual interest payments. So, if a bond's maturity is years away and the company can adequately pay the semiannual interest payments, filing for bankruptcy does not make much sense, especially since most management teams' net worth is in the company's stock, so a bankruptcy would wipe out their entire equity position.

Also, I think that these bonds will exhibit higher risk-adjusted returns due to these bonds trading off of their recovery values, creating for a margin of safety on the downside. My hypothesis is that this factor portfolio will have a high risk-adjusted return and compensate investors with more than enough return for the risk taken, especially relative to the CCC or B-rated indexes. This is important because active high yield managers often underperform in bull markets due to the asymmetric nature of the asset class; they are so focused on mitigating the downside that they miss the upside. Again, because their job is to prevent the notion of fool's yield from happening.

This paper first analyzes the annual returns of this factor portfolio, and then I try to find the source of the portfolio's returns by doing portfolio-level, time-independent analysis of the price of a bond portfolio and the relationship with different metrics, such as volatility, skewness, risk-adjusted returns, and loss given default.

Chapter 2

Literature Review

Price Inefficiencies in Distressed Companies

Due to the asymmetric information involved in distressed credit through non-disclosure agreements, niche court hearings and little sell-side analyst coverage on distressed companies, the prices of the debtor's various securities within its capital structure can go against conventional wisdom. Martin Fridson and M. C. Garman (2007) study the difference in returns for non-investment grade (i.e., companies that have elevated risk of bankruptcy) senior and junior debt that have the same credit rating. Credit ratings are a letter scale that expresses the creditworthiness and safety of a debt investment.

Table 2: Credit Ratings by Rating Agency

S&P	Moody's	Fitch
	Investment Grade	
AAA	Aaa	AAA
AA	Aa	AA
A	A	A
BBB	Baa	BBB
	Non-investment Grade	
BB	Ba	BB
B	B	B
CCC	Caa	CCC
CC	Ca	CC
C	C	C
D	D	D

Credit ratings range from AAA to D, and non-investment grade companies have credit ratings that are below BBB. They conclude that senior debt with the same credit rating as junior debt has a higher yield. This appears to directly go against the absolute priority rule and was to the surprise of many investment professionals. Fridson and Garman (2007) find that ratings rationale is not created equally among the different priorities in debt rankings, and the trading prices reflect that. Essentially, this study shows that the market knows more about default and loss probabilities than the credit ratings suggest. However, this can cause extreme inefficiencies in price when most of the holders of debt are institutional investors with highly regulated compliance restrictions. This is interesting because pension funds, insurance companies, exchange-traded funds, and collateralized debt obligations (CDOs) structure their portfolios based on credit ratings, not market prices; often, these investors treat every rating the same, regardless if the bond is senior or junior. So, changes in these ratings can cause these investors to be forced sellers.

Fire sales by asset managers cause abnormal downward price pressure, as the forced asset sales by an asset manager because of its portfolio regulation creates a wave of selling (Falato et al., 2021). A study done by Falato et al. (2021) shows that large asset managers are under intense regulatory pressure to get rid of certain assets when they breach a compliance threshold (i.e., a downgrade to a rating outside of their investable universe). While this study does not particularly focus on fire sales in distressed companies, this study is important to keep in mind because it could be a telling sign that the distressed debt market is more inefficiently priced. Particularly, CDOs markdown a non-performing asset (i.e., a bond of a company in bankruptcy) to zero even if it is not trading at zero. Because companies do not have to make interest payments in bankruptcy, the CDOs view it as a complete loss, thus marking it down to zero on their books and selling it as soon as possible, causing fire sales in the market. No matter what the CDO thinks about the company or the bonds fundamentally, the bonds have to be sold because of its non-performing status or credit rating, a measure that is not always telling for the casual, time constrained investor, as observed from Fridson and Garman (1997). This research suggests that market participants in the distressed securities market do not always act rationally, and that strict investment mandates and parameters often trump individual intuition.

Individual Corporate Bond Return Characteristics

A bond is a loan from an investor to a company, government, school, etc. that requires the borrower to pay the lender interest payments (typically semiannual) and pays principal at the end of the bond's life, which is the maturity date. Typically, bonds are quoted as a percentage of the amount lent, or par, typically set at 100 cents on the dollar. Unlike stocks, bonds have a limited upside due to their fixed, finite nature; the most an investor can receive from a bond is par plus the interest payments while stocks have unlimited upside, as they are a residual claim on a company's cash flows after the debt has been paid off. This creates for asymmetric returns for both asset classes. Both assets have the same downside of being worth zero, but bonds will have a price potential that cannot roam far above 100 while stocks have an unlimited upside. This asymmetrical return profile means that bonds have a negatively skewed distribution of returns. This also means that bond investors do not benefit from improvements in company fundamentals to the same degree as equity investors.

As examined by Bai et al. (2016), individual corporate bond returns have an inverse relationship with skewness; the higher the skewness of past returns, the lower the expected returns. This is because investors favor positive skewness over negative skewness, all else being equal, so the expected return required from investors is lower. Additionally, Bai et al. (2016) find that bonds exhibit a positive relationship between volatility and returns, as well as with kurtosis and returns (although statistically and economically insignificant). The relationship between volatility and returns is consistent with practically every investment; the more risk an investor accepts, the higher the expected return. However, Bat et al. (2016) focus on mostly investment grade bonds, not distressed and high yield bonds specifically, and only examine bonds from an individual standpoint. The typical maturity profile in the study was around 13 years with a rating of A to BBB+. This paper will examine the portfolio-level return characteristics of high yield and distressed bonds specifically.

Factors in Corporate Bond Returns

Factors in the corporate bond market are far less studied, and specific factors are less widely accepted as they are in equities. Common corporate bond factors that have been studied include but are not limited to value, low-risk, momentum, size, and quality. The value factor has taken many different forms in fixed income factor research. Work done by Heckel et al. (2019), L'Hoir and Boulhabel (2010), Correia et al. (2012), Houweling and van Zundert (2017), and Israel et al. (2018) defined the value factor in fixed income as the credit spread. Using the credit spread isolates the issuer's creditworthiness from interest rate movements that would affect the return of the bond. Some other definitions of the value factor in corporate credit include the recovery rates and predicted default rates (Frieda and Richardson, 2016), a bond's excess spread relative to peers, and a bond's spread per unit of debt-to-earnings ratio (Dor et al., 2020). Heckel et al. (2019) also research factors such as quality, low-risk, and momentum. They define the quality factor as high EBITDA-to-interest expense ratios and high cash flow metrics and profitability metrics. The low-risk factor in their paper consists of companies with low leverage and a high distance to default, which is the number of standard deviations that the firm's asset value is away from default (Duan and Wang, 2012), and companies with low historical equity volatility and low market beta. The momentum factor was defined as bonds that have outperformed their peers in the medium term (6-to-12-month window), and bonds that have underperformed peers in the short term; they also included fundamental momentum, which is the volatility in a company's earnings forecasts. Houweling and van Zundert (2017) also researched low-risk, momentum, and size in addition to value. They defined low-risk as high-rated, short-dated bonds, momentum as a bond's past 6-month return, and size as an issuer's market value weight in the index. Bai et al. (2019) also introduce the downside volatility factor, which was defined as the value-at-risk of a bond portfolio.

All of the studies mentioned above find each factor to play a significant role in the variation of corporate bonds returns. Yet, each factor is often defined and used differently, and the number of research reports on corporate bond factors is extremely small, especially given how large the corporate bond market is. However, the existing literature primarily focuses on investment grade credit. This paper will contribute to the existing literature on corporate bond factors by examining a two-factor portfolio consisting of distressed and low-rated high yield corporate bonds.

Historical Performance of Distressed Securities

Bond Returns During Bankruptcy

Because of the elevated status of debt in a company's capital structure and due to the absolute priority rule, bonds have exhibited higher expected recoveries in bankruptcy than equity. Also, the recoveries for senior bonds exceed those of junior bonds by quite a large margin. Wei Wang (2011) conducted a study tracking the difference in returns of senior and junior bonds for companies that went bankrupt. The study compiles trading data during the bankruptcy, one month after, and two months after; the study also controls for size by eliminating any companies that have less than $100 million in debt. The results showed that senior bonds realized strong returns while junior bonds incurred loses shortly after bankruptcy. These results prove that senior bonds often are more insulated from losses given a bankruptcy than junior bonds. Wang claims that the reason for losses on the junior bonds is due to an initial overvaluation. During bankruptcy, the bankruptcy court and the company's creditors vote on how much debt the company can support going forward. This study shows that the incremental debt below the senior level on the capital structure is most likely to be overvalued, meaning that the company cannot support as much debt as voted on by the creditors and that there can be significant error in judgement. Wang finds that the recovery for junior bonds takes a 20% annualized loss on average, while senior bonds receive a 20% annualized return on average. This is a great example of the zero-sum nature of distressed credit. A higher recovery for senior bond holders means a lower recovery for junior bondholders. This study highlights that bonds still retain value when in default, as they have measurable recovery rates and can still be undervalued.

Stock Returns Following Bankruptcy

A study in 2007 done by Dawkins et al. followed the stock price fluctuations for companies that that filed for bankruptcy. From 1993-1997 for companies that were still listed on a major stock exchange following immediately following the bankruptcy, the price reverted to one-third of the drop upon the bankruptcy filing. However, the reversal in price was not seen from 2000-2003. This conclusion is congruent with a more recent study done by Jiang et al. (2020) on the stock returns of companies that emerged from Chapter 11 bankruptcy. The researchers showed that the stock returns of companies that emerged from bankruptcy exhibited excess returns over the benchmark up until the 2010s decade. This study concludes that the disappearance in outperformance is accredited to the more accurate valuations of firms that emerge from bankruptcy and to an increased number of institutional investors holding the shares. Historically, in the first 180 days after filing for bankruptcy, a company’s stock exhibited outsized returns, as the company posted better earnings reports with the new and improved unlevered balance sheet. Just like in research done by Dawkins et al. (2007), the positive equity returns start to disappear in the early 2000s. The study finds that the equal-weighted calendar time portfolio of post-reorganization stocks generated 7.20% over the benchmark, but much of the excess return dwindles down over time and ultimately reaches zero in the most recent decade. These reports highlight the importance of time in an investment strategy; excess returns can change or disappear altogether over time as more investors discover the strategy. These reports also show the increasing presence of institutional investors in the distressed marketplace. Thus, financial research must be conducted frequently.

The Role of Investors in the Distressed Market

The particular investors in a debtor's capital structure can have implications for the plan of reorganization in a bankruptcy, the speed at which the bankruptcy takes place, and the returns for the various securities in the capital structure. In the studies by Jiang et al. (2020) and Dawkins et al. (2007), both papers point towards institutional investors having significant pricing powers. In the report by Dawkins et al. (2007), most of the reversal in the stock price from the time of the bankruptcy filing is attributed to large institutional investors, such as insurance funds, pension funds, hedge funds, etc., pouring money into the emerged company. This is because large investors are more active in the bankruptcy process than smaller ones, causing larger capital flows into the company's shares as a result of rebalancing their portfolios.

Jiang et al. (2020) infers that the disappearance in the outsized returns of post-reorganizational stocks is attributed to institutional investors discovering the investment strategy and minimizing the inefficiency in pricing that was experienced beforehand. Additionally, the role of hedge funds in particular make bankruptcies faster, more efficient, and result in greater debt reduction. Hedge funds achieve this through better negotiation and contracting (Lim, 2015). The holders of the company's securities also have different desires, which creates for a zero-sum game; one investor's recovery is often another investor's loss.

Additionally, market-making investment banks that facilitate trades have arguably an equal share in the pricing of distressed securities. When dealers do not have enough inventory of corporate bonds, the prices on the bonds decrease dramatically, as buyers have to be compensated for not being able to sell easily (Goldberg et al., 2021). This is especially intriguing in the distressed securities market, as the buying and selling of these securities is not as liquid or easy as higher quality securities; since the overall market is relatively small, there is not much trading activity. This shows that factors outside of the core fundamentals of the company can have huge implications on the prices of stocks and bonds. While Goldberg et al. (2021) do not necessarily observe the price fluctuations due to liquidity constraints in the distressed market specifically, these findings would most likely occur in the distressed space to an even higher degree because of the smaller market size. These articles emphasize how important of a role the players in the distressed marketplace are for not only other investors but for the companies themselves.

Conclusion

The market for distressed securities is vastly complex due to the potential for inefficiencies, the importance of stakeholders, and the intense regulatory pressures. These different elements can have direct impacts on the prices of these securities. In addition, there are many factors in the returns of corporate bonds, ranging from but not limited to value, low-risk, momentum, size, downside volatility, and quality. However, there is a pressing need for more research surrounding corporate bond factors and the distressed securities market as a whole due to the limited number of preexisting research done on the matters. Timely research is crucial to the financial world, as things are constantly changing. As more money starts to flow into the distressed market, the research surrounding these dynamics will continue to grow.

Chapter 3

Data and Methodology

The portfolio constructed consists of bonds according to their price and time to maturity. These two factors came to mind because they could result in lower defaults and positive skewness, leading to outsized returns. The price factor aims to give the portfolio positive skewness, as low-priced bonds have high price upside potential because the call price and/or par is father away. I used the “Fixed Income Search” function on a Bloomberg terminal to acquire the list of bonds for the portfolio. Bloomberg only had yearly bond data stretching back to 2007, so I compiled bonds on a yearly basis from October 2007 to October 2023. My screening criteria includes bonds with the following:

- Maturity of 4 years or greater
- USD denominated debt
- Price of 100% of par or less
- Credit rating of B- or lower
- Non-convertible

Because distressed corporate bonds have such low liquidity to begin with, I tried to control for this lack of liquidity by only including bonds that have a tranche size outstanding of $100 million or greater, which is also done in previous distressed bond return studies (Wang, 2011). A larger tranche is likely to have higher liquidity and trading volume. Generally, corporate bonds are traded in blocks of $1 million, which would only be 1% of the smallest tranche size in the portfolio.

The portfolio rebalances annually in October of every year; this low rebalancing frequency helps with keeping the transaction costs low, as there is less turnover and buying/selling in the portfolio. I only included bonds with a credit rating of B- or lower because this ratings range is often where bonds are labeled “distressed.” Although there is not one standardized definition of distressed, bonds rated higher than B- are likely not distressed, and the focus of this portfolio is on low-rated high yield.

After all of the screening, I compiled a list of 9,298 bonds from 2007 to 2023. From there, I recorded the 1-year forward returns from the bonds in the year that they were listed, and I was able to pull relevant bond information, such as coupon, maturity date, options-adjusted duration, options-adjusted convexity, tranche size, and the date of default if it occurred. I used Bloomberg’s cumulative total return Excel function to record the returns, but for bonds that Bloomberg did not have return data for, I used FactSet to pull price data from the entry date to the exit date and calculated the returns manually in Excel. The formula used for calculating the return from the FactSet data:

$$Total\ Return = \left(\frac{P_1 - P_0}{P_0}\right) + \frac{C}{P_0}$$

Where:

P_0 = *Entry price*

P_1 = *Exit price*

C = *Annual coupon amount in dollars*

For bonds that defaulted during the holding period where FactSet data was used, I omitted the coupon return portion of the formula, as most bonds in bankruptcy do not pay interest payments. Because the coupon date could not be pulled from Bloomberg, I omitted the coupon return from the calculation for any bond that defaulted during the holding period, regardless if the default was past the first six months of the holding period. Typically, bonds pay interest payments every six months, but because of the voidable preference clause, interest payments made up to 90 days prior to bankruptcy can be voided and the payment returned to the debtor. This prevents creditors from receiving preferential payments from the debtor prior to bankruptcy, ensuring that cash remains available to be equitably distriubted among creditors.

However, certain bonds could not return any price data from either Bloomberg or FactSet. I tried other databases, such as the Wharton Research Data Services (WRDS) and S&P Capital IQ, but these databases have little to no data on the bonds that I screened; Bloomberg had the best data by a large margin. So, out of the 9,298 bonds pulled, only 4,893 (52.6%) of the bonds have recorded returns. I examined quite a number of the bonds that did not record price or return data and found that the cause was in most cases arbitrary. However, some bonds were called and therefore delisted before the exit date of the portfolio, so Bloomberg could not calculate a return. If anything, bond that is called which is trading at such a low price would result in a high return, as bonds are often called at or above 100 cents on the dollar. Out of the bonds that did not have price or return data, 4.4% of them defaulted, 2.4% of them were exchanged, and 35.1% of them were called. Most importantly, the majority of bonds that defaulted still recorded returns and prices were tracked through the bankruptcy, so survivorship bias seems to be largely mitigated but not entirely eliminated because the data for distressed credit is rather noisy.

Downside Volatility

Due to the asymmetric distribution of returns that the corporate credit exhibits, a case could be made for a skewness-adjusted measure of risk; upside returns should not be penalized as risk (as they are when standard deviation is expressed as risk). In order to appropriately capture risk, I included downside deviation as a measure of risk. This metric only penalizes volatility below a minimal acceptable return (MAR) as risk. For this portfolio and the benchmarks, I set the MAR at 7%, which is the long-term historical average return of the high yield index. So, any return recorded under 7% is treated as volatility. The calculation for downside deviation is as follows:

$$Downside\ Deviation = \sqrt{\frac{1}{N} \cdot \sum_{i=1}^{N} \min\,(0, R_i - MAR)^2}$$

Where:

N = Number of returns

R_i = i^{th} return

MAR = Minimal acceptable return

Sharpe and Sortino Ratios

In this paper, I examined the risk-adjusted returns of the portfolio and benchmarks by using the Sharpe and Sortino ratios. Both of these ratios capture a portfolio's excess return relative to its risk. The Sharpe ratio formula is as follows:

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

Where:

R_p = Return of portfolio

R_f = Risk-free rate

σ_p = Standard deviation of portfolio returns

The Sharpe ratio determines the excess return per unit of risk, in which risk is measured as the standard deviation of returns. This serves as a great metric for the investment management industry to analyze the performance of a manager or strategy. However, because it establishes standard deviation as risk, it treats upside gains and downside losses equally as risk. While this is a great framework when dealing with a symmetric distribution of returns, as mentioned in the introduction, corporate credit is a negatively skewed asset class and as found in this paper, low-priced distressed credit is positively skewed. So, solely comparing the Sharpe ratio for this portfolio against the indexes would not incorporate skewness into risk-adjusted returns. To adjust for the skewness[6], I included the Sortino ratio, which is:

$$Sortino\ Ratio = \frac{R_p - R_f}{\sigma_d}$$

Where:

R_p = Return of portfolio

R_f = Risk-free rate

σ_d = Downside deviation

The Sortino ratio is much like the Sharpe ratio, but it measures risk directionally; only returns below the minimal acceptable return are treated as risk. This ratio does not penalize extreme positive outliers, which is important for distressed credit. The thought process is that if low-priced bonds are trading off of their recovery value and therefore have little downside

[6] Skewness of bond returns was taken by using the SKEW function in Excel

deviation with lots of upside price potential, an extreme price movement upwards should not count as risk in the risk-adjusted performance calculation. This ratio adequately factors in skewness into the risk-adjusted returns. Since most credit investors are downside focused, measuring downside risk-adjusted returns is important and necessary.

For the risk-free rate, the number that I used was the contemporaneous 1-year Treasury Bill rate. So, for the annual portfolio performance measures of risk-adjusted returns, I subtracted the appropriate 1-year Treasury Bill rate from that year's portfolio return. For the time-independent portfolio-level analysis, I subtracted the appropriate 1-year Treasury Bill rate from each individual bond's return.

Beta

In the portfolio annual performance section, I find the beta of the factor portfolio relative to the high yield benchmark. Beta measures the overall market exposure of a portfolio. The higher the beta, the more reactive a portfolio is to market changes. A beta of 1 means a portfolio is expected to move exactly in line with the overall market. The formula for beta is:

$$Beta = \frac{Covariance(R_p, R_m)}{Variance(R_m)}$$

Where:

R_p = Return on portfolio

R_m = Return on market

Credit Rating

When conducting the portfolio-level analysis of the price factor, I used a numerical scale for credit rating. This was done by converting the given bond rating into a number via Excel formulas. The lower the number, the higher the credit rating. Not Rated (NR) bonds do not carry a rating from a rating agency. Rating agencies are paid by the borrower to assign them a credit rating. Some companies that would likely be rated CCC or lower might find that the rating would be of no benefit and choose to forgo it. Since NR bonds had the worst default statistics in my data, I assigned them the highest numerical value. In the portfolio annual performance section, I use the median rating of the bonds in the portfolio for the given year. This keeps the ordinal nature of the scale intact and prevents extreme numerical values from skewing the portfolio's rating. The rating scale used:

Table 3: Numerical Credit Rating Scale

Rating	Value
BB	1
B	2
CCC	3
CC	4
C	5
D	6
NR	7

Loss Given Default (LGD)

Loss given default shows the percentage loss on a bond that defaults. It is the inverse of a bond's recovery rate. In this paper, a negative LGD means a negative return after default, while a positive LGD indicates a positive return after default. I calculated LGD by recording the returns of bonds that defaulted during the 1-year holding period, which was done with a binary default dummy variable and Excel functions.

Yield to Maturity (YTM)

The yield to maturity of a bond represents the bond's annual percentage return if bought and held to maturity. While I was able to find the yield-to-worst, which is the lowest yield a bond can have given its call schedule and maturity date, for bonds in some years via a Bloomberg function, many years did not have this data. So, I calculated the YTM for each bond manually. The formula for YTM is:

$$YTM = \frac{C + \frac{FV - PV}{N}}{\frac{FV + PV}{2}}$$

Where:

C = Coupon amount in dollars

FV = Face value

PV = Current price of the bond

N = Number of periods until maturity

Modified Duration

Modified duration measures the percentage change in a bond's price given a 1% change in yield. Duration shows a bond's sensitivity to changes in interest rates, and it is quoted in years. A longer duration means a greater sensitivity to changes in yield or interest rates. Bonds that have a longer maturity, lower coupon, and lower yield have longer durations. To find a bond's modified duration, the Macaulay duration must be found first, which is the weighted average time until all of the bond’s cashflows are received. The formula for Macaulay duration is:

$$Macaulay\ Duration = \frac{\sum_{i=1}^{N} \frac{t\ x\ C}{(1+y)^t} + \frac{t\ x\ M}{(1+y)^t}}{P_0}$$

Where:

t = Time to maturity

C = Periodic coupon payment

y = Periodic yield

M = Maturity value

N = Number of periods

P_0 = Entry price

Then, the Modified duration can be found:

$$Modified\ Duration = \frac{Macaulay\ Duration}{(1 + \frac{YTM}{N})}$$

Where:

YTM = Yield to maturity

N = Number of periods

Log Returns

For the portfolio-level time-independent analysis, I recorded the log returns for each bond to examine the distribution of log returns. Taking the log returns is different from taking the simple return because it assumes a continuously compounding return. Log returns typically smooth outliers and make the distribution more normal, which is typically used for various risk models. However, because corporate credit is negatively skewed, this means the log returns impose symmetry into the distribution of returns. This normal distribution of corporate bond returns underestimates the downside risk and overestimates the upside potential. A normal distribution assumes the probability of a return above the mean and below the mean is the same, which is not case for corporate bonds in both investment grade and high yield. The formula for lognormal returns:

$$Log\ Return = \ln\left(\frac{P_1}{P_0}\right)$$

Where:

P_0 = *Entry price*

P_1 = *Exit price*

Chapter 4

Results and Data Analysis

So far, my findings have showed that a bond portfolio consisting of these two factors presents superior raw and risk-adjusted returns than both the CCC, B, and BB-rated indexes on average. Also, compared to the indexes, the factor portfolio has a positive skewness of returns and a higher upside-downside ratio. This means that this portfolio offers an asymmetric return profile to the upside, which is not seen in corporate credit nor with active high yield managers. Also, my findings that the raw and risk-adjusted underperformance of the CCC and B indexes fell at or below those of the BB index are consistent with Verdad's findings. The factor portfolio generally follows the direction of the benchmarks but has a greater return amplitude, meaning it has a higher beta. The portfolio's beta in relation to the high yield index is 2.02. However, the portfolio outperforms to a greater degree than it underperforms. This is likely due to the positive skewness and positive asymmetrical return profile; the positive skewness makes it so that downside returns are less severe than upside gains. So, the hypothesis that this portfolio delivers positive skewness can be accepted.

Table 4: Factor Portfolio Annual Performance

Year	Portfolio[7]	CCC	B	BB	BBHY
2007	-59.0	-34.8	-25.3	-17.7	-25.0
2008	69.7	37.2	31.4	32.0	39.1
2009	73.5	19.1	15.6	18.4	18.5
2010	9.0	0.8	3.7	3.9	3.2
2011	45.3	21.2	17.0	16.3	17.5
2012	31.2	12.9	7.6	5.3	7.6
2013	35.1	4.6	4.7	6.5	5.4
2014	-14.6	-6.6	-1.9	1.5	-1.4
2015	3.9	16.8	9.5	10.2	11.3
2016	3.5	12.5	7.8	7.0	8.3
2017	33.0	5.9	2.2	-0.5	1.6
2018	7.9	-3.3	7.9	11.1	7.6
2019	-18.6	-2.3	2.9	7.8	4.5
2020	110.8	16.9	8.3	7.9	9.5
2021	12.8	-16.0	-12.7	-13.1	-13.3
2022	4.3	10.1	8.3	5.9	7.5
2023	56.9	24.0	16.5	16.1	17.6

	Portfolio	CCC	B	BB	BBHY
Average Return	23.8	7.0	6.1	7.0	7.0
Volatility	40.2	16.8	12.3	11.4	13.6
Sharpe Ratio	0.52	0.24	0.25	0.35	0.29
Skew	0.21	-0.75	-0.71	-0.24	-0.14
Kurtosis	0.60	1.34	2.48	1.59	2.49
Downside Vol	17.99	12.60	9.61	8.09	9.58
Sortino Ratio	1.16	0.32	0.32	0.49	0.42
Correlation	-	0.76	0.69	0.63	0.68
R Squared	-	0.58	0.48	0.39	0.47

[7] Factor portfolio above has bond price parameters in place of 5 to 65. The years 2007, 2013, 2017, 2021 have bond price parameters in place of 5 to 75 to increase the number of bonds in those years.

Portfolio Statisitics

Year	# of bonds	Yield	Price	Rating	Skew	Default Rate
2007	37	18.4	62.7	CCC	0.74	21.6%
2008	299	35.6	38.4	CCC	0.87	25.8%
2009	106	36.0	37.7	CC	2.28	3.8%
2010	43	30.3	39.7	CC	0.12	7.0%
2011	49	26.3	48.5	CCC	1.49	12.2%
2012	33	23.9	53.3	CCC	0.40	18.2%
2013	31	34.0	43.5	CCC	-0.23	19.4%
2014	26	44.1	33.2	CC	0.69	34.6%
2015	55	39.1	34.1	CCC	0.91	52.7%
2016	31	30.0	44.3	CC	0.01	19.4%
2017	23	28.1	45.3	CCC	-0.36	13.0%
2018	23	17.6	51.5	CCC	0.33	13.0%
2019	44	19.5	50.2	CCC	-0.80	63.6%
2020	35	30.8	41.3	CCC	1.37	0.0%
2021	19	26.6	48.2	CCC	-0.31	10.5%
2022	64	25.0	49.0	CCC	-0.64	15.6%
2023	67	24.3	47.8	CCC	0.80	4.5%
Averages	58	28.8	45.2	CCC	0.45	19.7%

However, it also seems that the portfolio is less correlated to the high yield index (BBHY) than the CCC index is. The CCC index is almost a perfect correlation to the BBHY at 0.95, while the factor portfolio's correlation to the BBHY is 0.68. This difference can be attributed to the idiosyncratic nature of the factor portfolio. While CCC risk is still mainly idiosyncratic, it's almost perfect correlation suggests that systematic risk is still a prevalent factor in its returns, which is not as present in the factor portfolio. Although, the median credit rating in the factor portfolio is CCC in all but four years. This shows that the credit risk profile is somewhat similar to the CCC index, but the portfolio includes a dosage of low-priced, low-rated bonds, which seems to be absent in the CCC index. In fact, when tailoring this portfolio to a

Figure 5: Performance and Changes in High Yield Spreads[8]

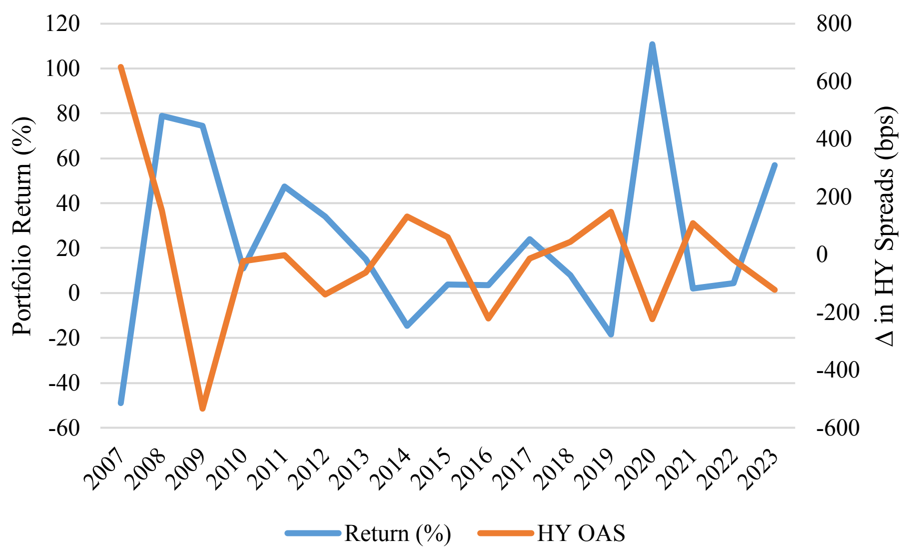


Table 5: Portfolio Performance and Changes in High Yield Spreads[9]

	Return (%)	CCC OAS	B OAS	HY OAS
2007	-59.0	1088	670	650
2008	69.7	316	33	153
2009	73.5	-973	-441	-534
2010	9.0	13	2	-23
2011	45.3	73	-24	-1
2012	31.2	-277	-144	-139
2013	35.1	-70	-53	-63
2014	-14.6	341	154	133
2015	3.9	339	45	60
2016	3.5	-577	-224	-221
2017	33.0	-93	6	-13
2018	7.9	225	58	45
2019	-18.6	269	144	147
2020	110.8	-602	-207	-223
2021	12.8	340	102	108
2022	4.3	0	-36	-19
2023	56.9	-209	-143	-122
R Sq.		0.45	0.50	0.43
Corr.		-0.67	-0.71	-0.65

[8] Options-adjusted spread (OAS) measures the incremental yield over a duration-matched Treasury security that investors require for the default and liquidity risk of the bond.

[9] A negative change in OAS indicates credit spreads tightening, and a positive change in OAS indicates credit spreads widening.

price parameter of 65 to 100, the correlation and R^2 of the higher-priced portfolio to the CCC index is 0.98 and 0.96, respectively, and all other statistics are nearly identical as well. This is a telling sign that index is not holding the lower-priced, lower-rated bonds, but rather it is owning bonds that are close to par, which is the likely explanation for the negatively skewed returns and subpar risk-adjusted returns of the index.

I ran a multiple regression on the time-independent, individual bond returns of the portfolio, and duration was a statistically insignificant and weak factor in variation of returns. This makes sense because once a bond trades to a low enough level, interest rate risk is practically not a factor anymore, as the bond is likely trading off of its recovery value which is precisely tied to the enterprise value of the firm. So, these low-priced distressed bonds still retain the fixed-income contractual payment structure, but their value resembles equity in the firm. Interestingly enough however, although the portfolio consists of bonds that act like equity, the portfolio's performance is not correlated with the performance of small capitalization value stocks, which tend to be the riskiest equities with the highest degree of idiosyncratic risk.

Changes in interest rates do not affect the price of these bonds as much, rather it is almost entirely company specific develops that will cause price movements. However, I think that the correlation to the BBHY has to do with more macroeconomic and business cycle factors. As seen in the Figure 5 and Table 5, the portfolio's performance is tied to changes in credit spreads. Credit spreads reflect the market's confidence in corporate borrowers to repay their debts. When credit spreads tighten, investors are risk-on and have a high degree of confidence in the ability of companies to service their debts, due to strong corporate fundamentals and/or a favorable macroeconomic backdrop. The opposite is true of credit spreads widening, which tends to happen in recessions and weak economic conditions. This portfolio does well when credit spreads tighten and does not do as well when credit spreads are widening.

Time-Independent Portfolio-Level Price Analysis

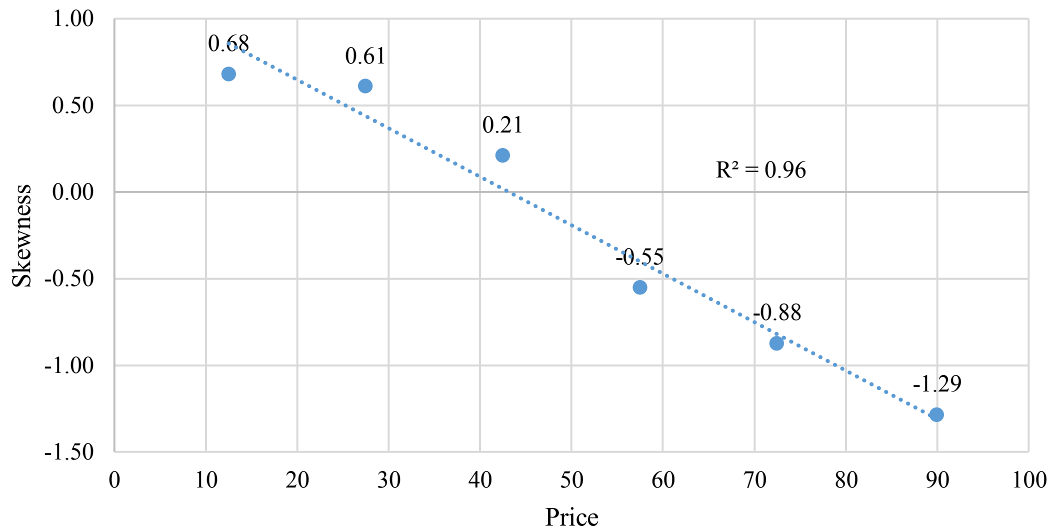
In order to determine if the price factor is causing the portfolio's return characteristics, I did various regressions on general time-independent relationships between bond portfolio prices and returns, volatility, skewness, and risk-adjusted returns. The goal was to test how price affected portfolio characteristics to see if the price factor could explain the skewness and/or higher risk-adjusted returns that the portfolio exhibited. Because I could only pull the 1-year forward returns due to data limitations, examining the relationships at the portfolio level was the only route to go. Although, due to the limited data available, it was difficult to isolate price from credit rating at the portfolio level; there were simply not enough bonds to test in various price buckets in a given credit rating. However, I was able to neutralize credit rating through time-independent individual-bond regressions. I gathered every bond in the given rating and ran the return regression. As seen in Appendix B and Appendix C, I ran a multiple regression on return with well-known bond characteristics in addition to price while controlling for credit rating, and I found that price has a statistically significant and strong explanatory power in the variation of corporate bond returns.

Because the data screen ran for these bonds only included bonds that mature in over four years, testing the time-to-maturity factor could not be done with confidence since testing bonds that mature inside of four years could not be done. The time-to-maturity factor is rather seen as a threshold, where a certain distance to maturity would be seen as adequate protection against the company filing for bankruptcy. I did a regression with time to maturity and a binary default dummy variable, and time to maturity had a weak and statistically insignificant relationship with default. Again, the data ran in this regression was with bonds that mature in over four years, so it seems that incremental time to maturity over the four-year mark reaps no benefit to holders of distressed bonds. However, running this regression with bonds that mature inside of four years would be an interesting area for future research in the distressed credit space.

Skewness Relationship with Price

I found that a bond portfolio's price has a strong inverse relationship with skewness, with high statistical significance, as seen in Figure 6. I also tested skewness in a multiple regression with price, time to maturity, and credit rating, and price was the only statistically significant factor in the variation of a bond portfolio's skewness. However, there may be a degree of multicollinearity between the price and rating variables, as a lower price typically indicates lower credit quality. However, when done in standalone regressions, price is considerably more statistically significant than rating and makes more interpretable sense. So, I believe that the price alone is what is making the portfolio exhibit a positively skewed distribution of returns. Interesting to note is the stark drop in skewness of returns for higher-priced bonds. Intuitively, this makes sense because bonds that are closer to par have less price upside. Thus, the main variation in return is on the downside, which is shown by the extreme negative skewness of returns for bonds closer to 100.

Figure 6: Skewness and Price Relationship



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.96783748
R Square	0.93670939
Adjusted R Sq	0.92879806
Standard Erro	0.22588781
Observations	19

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	12.0828997	6.04144983	118.401058	2.5746E-10
Residual	16	0.81640484	0.0510253		
Total	18	12.8993045			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.44954694	0.45537314	3.18320697	0.0057780122	0.48419902	2.41489487	0.48419902	2.41489487
Price	-0.03054153	0.003142	-9.72041077	0.0000000407	-0.03720227	-0.02388079	-0.03720227	-0.02388079
Rating	-0.05149421	0.0895238	-0.57520138	0.5731559096	-0.24127619	0.13828777	-0.24127619	0.13828777

Volatility Relationship with Price

I also tested the relationship between price and volatility, as well as price and downside volatility. I found that the price of a bond portfolio has a strong inverse relationship with volatility. This makes sense because the lower-priced portfolios have lower credit ratings and are inherently riskier. Because of the linear relationship of price and downside volatility, the hypothesis that lower-priced bonds would have less downside volatility because of the recovery value floor seems to be largely false for bonds that perform (i.e., do not default) for the entirety of the holding period. However, for bonds that do default, this hypothesis can be accepted.

Figure 7: Volatility and Price Relationship

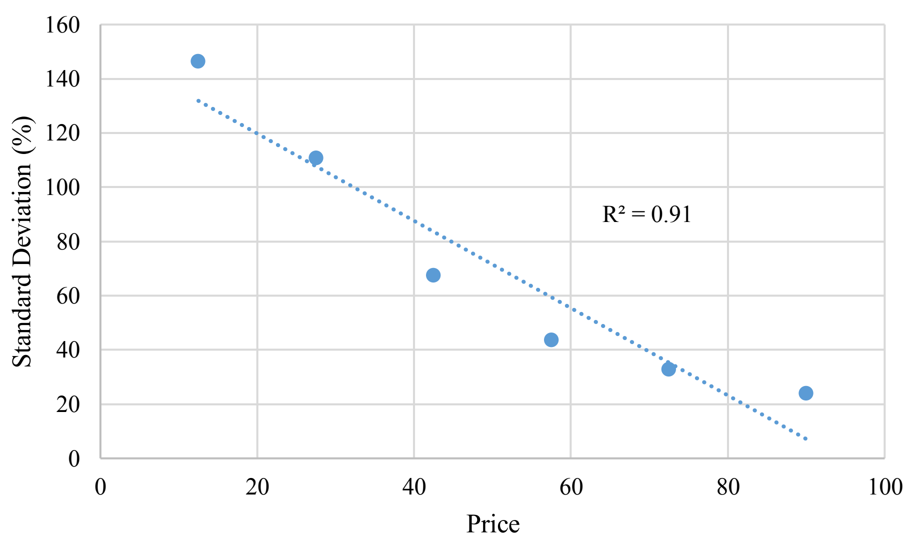
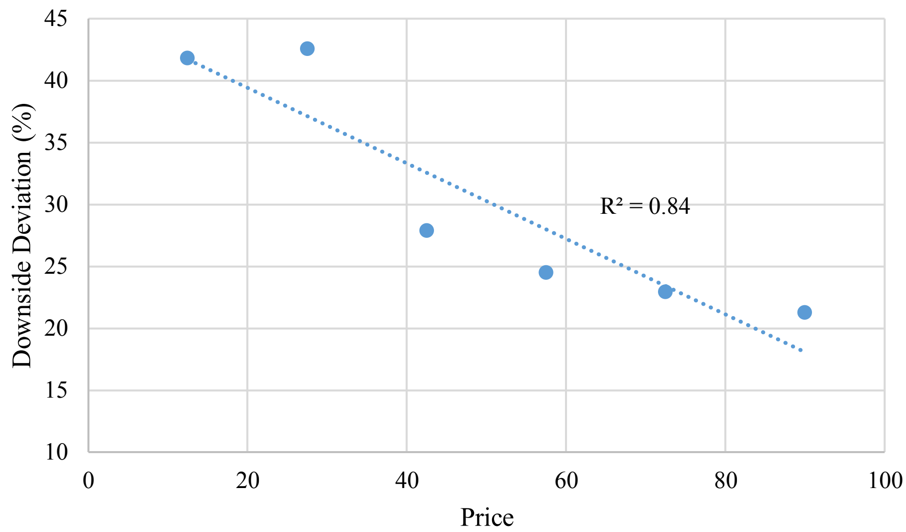


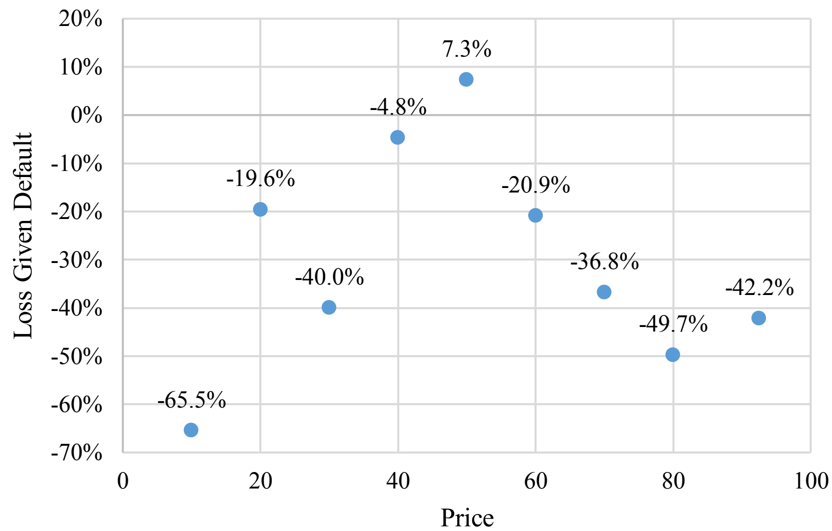
Figure 8: Downside Volatility and Price Relationship



Loss Given Default (LGD) Relationship with Price

Middle-priced bonds that lie in the 30 to 60 range suffer far less downward volatility when defaulted, while bonds with a price below and above this range drop considerably more in value. In fact, some of the middle-priced bond portfolios returned slightly positive after default. This shows that middle-priced bonds are most likely to be trading off of their recovery value and offer the most protection against defaults. On the other hand, the lower-priced bonds more likely resemble out-of-the-money options with no real, tangible recovery value and are a claim on the company's assets that are out of reach. The higher-priced bonds lose roughly half their value because they are closer to par, and the historical recovery rates on corporate bonds tend to be around 50% of par.

Figure 9: Loss Given Default and Price



Risk-adjusted Return Relationship with Price

Next, I ran regressions on a bond portfolio's price and risk-adjusted return, including both standard deviation and downside deviation as measures of risk. I found that a bond portfolio's price has a statistically significant inverse relationship with risk-adjusted return. It is interesting to see that in the highest price buckets, the risk-adjusted returns are extremely low. This is likely causing the CCC and B-rated indexes to have lower risk-adjusted returns because they own higher-priced bonds. When looking at the relationship between price and Sharpe ratio, the middle-priced buckets exhibit the highest Sharpe ratios. This could be due to the lower loss given default that this price bucket experiences. Additionally, I found that a bond portfolio's price has an extremely strong, statistically significant inverse relationship with downside risk-adjusted returns, as seen in Figure 11. This linear relationship with Sortino ratio is likely due to the positive skewness of the lower-priced portfolios; the positive outliers more than compensate the defaults in the portfolio.

Figure 10: Sharpe Ratio and Price Relationship

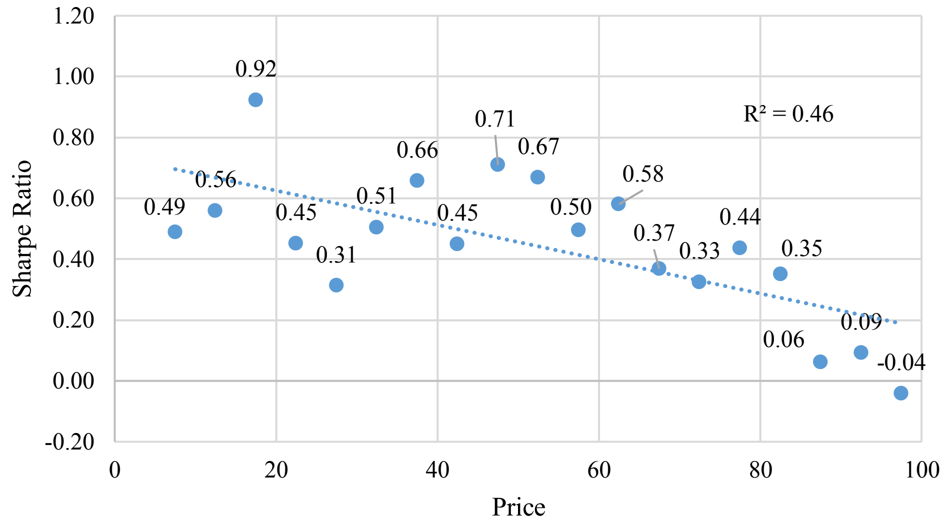
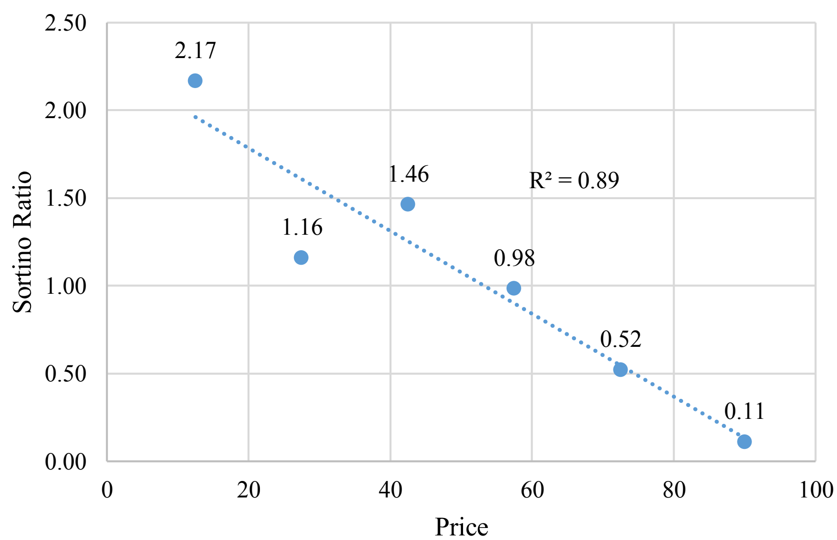


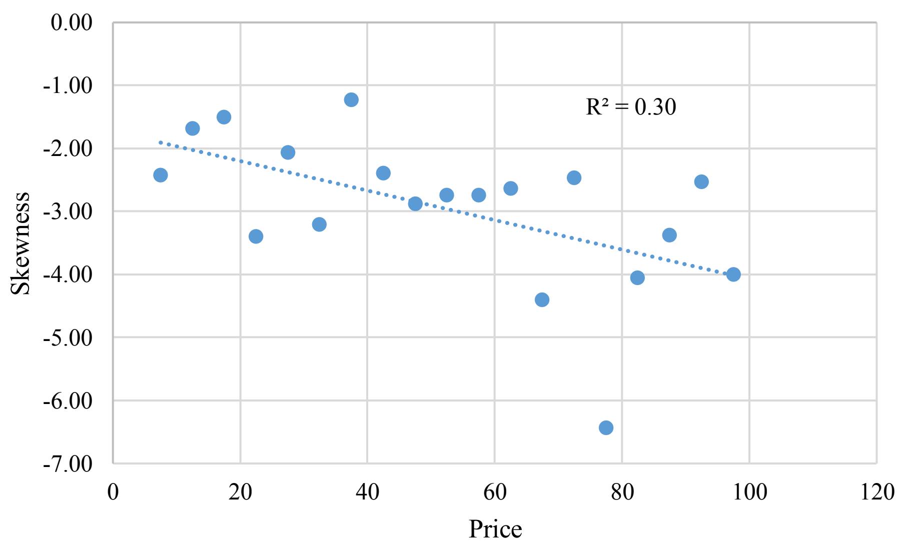
Figure 11: Sortino Ratio and Price Relationship



Log Return Skewness Relationship with Price

When finding the skewness of log returns, all price buckets exhibit negatively skewed returns, which is in stark opposition to the skewness of simple returns. However, the lower-priced portfolios have a higher skewness than higher-priced portfolios, although still negative. All price buckets having negative skewness of log returns shows how sensitive this investment strategy is to outliers. A few bonds compromise the bulk of the return. Without these bonds, the distribution of returns changes, leaving the portfolio with risky bonds but with less extreme upside potential.

Figure 12: Skewness of Log Returns and Price Relationship



Chapter 5

Conclusion

The price and time-to-maturity factor high yield bond portfolio gives investors higher raw and risk-adjusted returns than any of the high yield benchmarks on average. While this factor portfolio is more volatile and comes with more credit risk, it more than compensates investors with higher returns and offers less correlation to overall credit markets because of the high idiosyncratic risk of the portfolio. After doing many regressions, it can be concluded that price has an important role in the skewness and risk-adjusted returns of the portfolio. The price of a bond portfolio has an inverse relationship with skewness and risk-adjusted return. Additionally, middle-priced portfolios of bonds have higher Sharpe ratios and a significantly lower loss given default, showing that bonds of this nature are likely trading off of their recovery values while the lowest-priced bonds most likely resemble option value. The true margin of safety seems to lie in the middle-priced bonds.

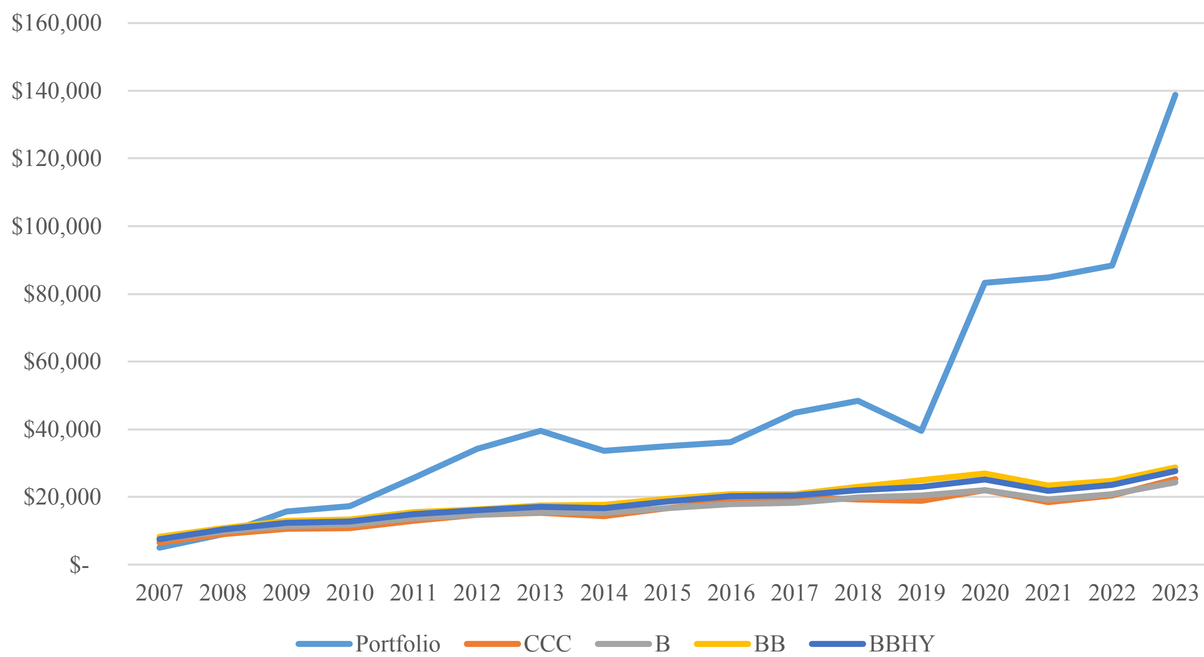
This kind of factor portfolio could help active managers outperform in credit bull markets, due to the higher degree of outperformance in bull markets that this portfolio exhibits. Because active managers almost always underperform in bull markets due to the focus on downside mitigation, this portfolio strategy could be added as a dosage into their portfolios to inject positive skewness to help with performance in positive credit markets.

This portfolio could also pave the way for a passive investment vehicle in the lowest grades of corporate credit. This could be an area for future research on the matter of distressed credit. I think that in the future, distressed bond data will continue to be more clean, accessible and reliable. Future research could include more years and factors studied, use monthly returns, and include a wider array of qualitative and quantitative data on the asset class.

For the potential passive investors in lower-rated high yield, whether retail or institutional, the one solution this paper provides is to be cognizant of price. Passive investing in the lowest credit quality available is a bad investment. In other words, owning a bucket of CCC or B-rated bonds near par seems to be the worst debt investment an investor can make. In buying the CCC or B-rated index, an investor takes on idiosyncratic, equity-like risk without the equity-like upside. This results in a return distribution that mimics picking up pennies in front of a bulldozer (which are defaults), and defaults are a certainty in the index. So, investors look to active managers to skillfully avoid the bonds that default. As of right now, this is the only lucrative avenue into the depths of high yield investing. High returns can be achieved by active managers selecting CCC bonds near par, but they must be certain that the company will not default. The punishment for being wrong about a near par CCC bond is too harsh; there is no upside to offset mistakes. While buying a portfolio that has a lower average bond price than the CCC and B-rated indexes, an investor takes on elevated credit risk but captures positive, equity-like skewness that more than justifies the risk taken, as seen in the relative risk-adjusted performance. This portfolio provides investors with a margin of safety via the positive skewness to offset the defaults and through exposure to middle-price bonds that trade off of recovery value.

Appendix A

$10,000 Initial Investment Performance



Appendix B

Time-Independent CCC Bond Return Multiple Regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.67447267
R Square	0.45491339
Adjusted R Square	0.45056661
Standard Error	42.7514076
Observations	633

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	956382.412	191276.482	104.655183	3.1234E-80
Residual	627	1145957.15	1827.68285		
Total	632	2102339.56			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	84.3978044	11.8100919	7.14624452	2.4868E-12	61.2056809	107.589928	61.2056809	107.589928
Coupon	1.86901851	0.82377209	2.26885389	0.02361624	0.25133219	3.48670482	0.25133219	3.48670482
Modified Duration	0.00270783	1.17193241	0.00231057	0.99815717	-2.29867995	2.30409561	-2.29867995	2.30409561
Price	-1.13466593	0.09677679	-11.7245671	7.6437E-29	-1.3247118	-0.94462006	-1.3247118	-0.94462006
Default	-74.5389958	6.27622725	-11.8764017	1.7462E-29	-86.8639666	-62.2140251	-86.8639666	-62.2140251
CCC Index Return	1.08513033	0.11297033	9.60544503	1.7917E-20	0.8632843	1.30697635	0.8632843	1.30697635

Appendix C

Time-Independent B- Bond Return Multiple Regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.68946899
R Square	0.47536749
Adjusted R Square	0.47329056
Standard Error	29.2973053
Observations	1269

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	982274.75	196454.95	228.879882	4.824E-174
Residual	1263	1084073.44	858.3321		
Total	1268	2066348.19			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	100.712937	6.45759153	15.5960525	2.7665E-50	88.0441491	113.381724	88.0441491	113.381724
Coupon	-0.76287856	0.40612694	-1.8784239	0.06055339	-1.55963629	0.03387916	-1.55963629	0.03387916
Modified Duration	-2.21277815	0.43283592	-5.11227941	3.6739E-07	-3.06193471	-1.36362158	-3.06193471	-1.36362158
Price	-0.92492204	0.05807461	-15.9264437	3.5043E-52	-1.03885537	-0.81098871	-1.03885537	-0.81098871
Default	-67.7545299	3.96255536	-17.0986961	4.0427E-59	-75.5284455	-59.9806143	-75.5284455	-59.9806143
BBHY Return	0.9444249	0.05568981	16.9586674	2.8298E-58	0.83517019	1.05367961	0.83517019	1.05367961

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Pearse J. Kelly

EDUCATION

The Pennsylvania State University | Schreyer Honors College **University Park, PA**
Smeal College of Business | Bachelor of Science in Finance *Class of May 2025*

RELEVANT/WORK EXPERIENCE

Bank of America **New York, NY**
Incoming Global Research Analyst *July 2025*
Credit Research Summer Analyst | High Yield Consumer and Retail *Jun 2024 – Aug 2024*

- Evaluated leveraged loans and high yield bonds within the Consumer and Retail sector by conducting credit analysis, building financial models, assessing capital structures, and analyzing credit agreements
- Created and presented an overweight trading recommendation on PetSmart's 7.75% Senior Unsecured Notes due 2029
- Built the financial model for the coverage initiation report on Torrid Holdings Inc. (CURV)
- Assisted team members on earnings calls, weekly reports, quarterly updates, and research reports

Essential Utilities **Bryn Mawr, PA**
Finance Intern *May 2023 – Aug 2023*

- Essential Utilities (WTRG) is the nation's second largest publicly traded water utility, valued at ~$9.45 billion market capitalization, servicing communities in Pennsylvania, Illinois, New Jersey, North Carolina, Ohio, Texas, and Virginia
- Assisted the CFO in creating a macroeconomic and demographic slide presentation for the board of directors

Leveraged Lion Capital **University Park, PA**
Vice President, Director of Credit Research, Director of Recruiting, Lead Analyst, Associate Analyst *Nov 2021 – Dec 2024*

- Selected to the Executive Leadership Team of the nation's first student-run paper leveraged loan and high yield bond portfolio, partnered with Bank of America Merrill Lynch, the Loan Syndications and Trading Association, and S&P Global
- Managed the $19.26 million paper fund in the Consumer and Retail sector of the $125.00 million portfolio while striving to outperform the S&P/LSTA Leveraged Loan Index and Bloomberg Barclays U.S. High Yield Index
- Analyzed prospective leveraged loan and high yield bond investments by performing bottom-up credit analyses, evaluating credit agreements, examining capital structures, building financial models, and conducting ratio analyses
- Led recruiting efforts and taught weekly workshops for the organization's feeder program, the Penn State Fixed Income Association, which provides the basic understandings of the credit markets, valuation techniques, and financial accounting

Wall Street Boot Camp **University Park, PA**
Graduate *Aug 2021 – Dec 2021*

- Selected from hundreds of applicants university-wide to be one of the top 50 students in the Smeal College of Business for the Fall 2021 Semester in a 15-week program that prepares individuals for high level finance careers

Aqua America, Inc. **Springfield, PA**
Distribution | Hydrant Painter *May 2022 – Aug 2022*

- Located, painted, and assessed condition of ~500 fire hydrant systems through the resource of company-provided maps for several neighborhoods in the Greater Philadelphia area, including Montgomery, Delaware, Philadelphia, and Chester counties

EXTRACURRICULAR EXPERIENCE

The Headstrong Foundation Lacrosse Club **Philadelphia, PA**
Athlete & Volunteer *Aug 2018 – Mar 2021*

- Competed in interstate lacrosse tournaments during the summers and learned how to form collaborative relationships both on and off the field to achieve common goals
- Collaborated with teammates and the University of Pennsylvania's coaching staff to raise money for financial, residential, and emotional support to families affected by cancer

A Mother's Wish Foundation **Philadelphia, PA**
Volunteer *Mar 2014 – Present*

- Assist in establishing fundraisers to discover new research effective for curing Crohn's Disease and Colitis
- Help arrange structure of events and independently managed a raffle station for rewards and prizes

HONORS, SKILLS AND INTERESTS

Academic Honors: Schreyer Honors College Academic Excellence Scholarship, Thomas Bermingham Scholarship, Dean's List (7/7)

Computer Skills: Microsoft PowerPoint, Microsoft Excel, FactSet, Bloomberg, Capital IQ

Interests: Skiing, lacrosse, Penn State football, country music, *Margin of Safety*, Ireland, Philadelphia sports, *Breaking Bad,* NBA 2K, Fantasy Football, stick-shift cars, Cape May, St. Joseph's Prep, Villanova basketball, *The Most Important Thing*