

## An Analysis of Closed End Funds Discount Puzzle

\*Abdul Majid Nasir, Riaz Ahmed, Rehmat Ullah, Muhammad Waris,

Department of Commerce, University of Turbat, Balochistan, Pakistan

### Abstract

This study aims to analyze the influence of fund characteristics, market characteristics and underlying assets characteristics on the closed end funds discount. We selected quarterly data for 10 closed end funds traded at the Pakistan Stock Exchange from the first quarter of 2005 to the second quarter of 2015. The pooled ordinary least square method is used to explain the relationships. Among Fund characteristics; diversification, among market characteristics; KSE 100 index return, consumer price index and real exchange rate and among underlying asset characteristics; financial leverage, return on equity and market capitalization have significantly influenced the closed end funds discount. The study has a novel contribution in explaining the tendency of the discount. The current study investigates the impact of fund characteristics, underlying assets characteristics and market characteristics on the funds discount. However, the existing studies lack an explanation of the relationship between underlying asset characteristics and the discount. Our results are robust from all biases and discrepancies, since we robust the model by rectifying the serial correlation problem indicated by the Wooldridge test. Moreover, all the analyses and results are the authors' original works. Additionally, we propose that Closed End Funds Discount is a function of funds characteristics, market characteristics and underlying assets characteristics.

**Keywords:** CAPM, KSE-100, Chemical sector, Fertilizer sector, Pakistan Stock Exchange

\*Corresponding Author: Abdul Majid Nasir, Abdul.majid@uot.edu.pk

## Introduction

Variability in prices of capital market securities hold two contrasting theoretical dimensions; on one side financial market theories suggest that investors are rational (Sharpe, 1964), they hold all publicly available information (Fama, 1965), and make investment decisions accordingly. On the other side, empirical investigations prove that a substantial amount of individual investors are irrational and their decisions influence the prices and return of stocks traded in the capital market (Ljungqvist, Nanda, & Singh, 2006; Hwang, 2011; Abbes & Abdelh'edi-Zouch, 2015).

Lee, Shleifer, and Thaler (1991) investigated the behavior of closed end funds, hereafter CEFs where (CEFs) are traded at a discount in the secondary market. The fundamental reason for the deviation of CEFs market prices to Net Asset Value (NAV) is the comparative illiquidity of the certificates. CEFs as compared to open end funds are not redeemable; hence their current market prices would deviate from the fund's NAV. This deviation should be equal to the sum of agency cost, illiquidity of assets and tax liability and the deviation (of market price to NAV which is termed as a discount) is un-explanatory through rational theories; therefore, it is an irrational investor sentiment towards the market which derives the discount to NAV (Lee et al., 1991). Researchers termed this anomaly as a closed end fund puzzle.

CEFs are dominated by individual investors since CEFs tend to hold illiquid securities and shares of the funds which motivate small individual investors towards such types of funds (Cherkes, Sagi, & Stanton, 2009). Moreover, individual investors rely on investment in funds because they lack expertise in sections of portfolios. The discount increases with the age of the fund, and investors may sell at a higher discount as compared to the discount at the initial long position. Higher discount affects the price negatively, which has a negative effect on the wealth and confidence of individual investors in the CEFs (Bradley, Brav, Goldstein, & Jiang, 2010). A serious problem occurs for individual investors in the market when institutional investors have more and better information on the trends and fluctuation in the discount of the funds that help them benefit from the loss of individual investors.

According to Sharpe (1964), stocks are traded at the security market line, which is the function of a firm's sensitivity to the market risk. However, this line ignores the firm specific or diversifiable risk. Since funds NAV fluctuate with the fluctuations of underlying stock prices, funds prices apart from NAV may fluctuate because of changes in such factors which are not incorporated in the underlying stock prices. Thus NAV is failed to incorporate all the information of the underlying stock in the price of the fund. Existing empirical studies lack this explanation of the funds discount. Subsequently, underlying asset characteristics along with the fund's specific characteristics and market characteristics may holistically describe the variation in the CEFD.

The critical review of the CEFs puzzle, investor information, interpretation and possible risk exposure reveals the need for a rigorous investigation of factors affecting the discount of CEFs.

Therefore, this study aims to adopt a holistic approach to explain the behavior of CEFD and have a novel contribution in explaining the tendency of the puzzle. The current study investigates the impact of fund characteristics, underlying assets characteristics and market characteristics on the CEFD. However, the existing studies lack an explanation of the relationship between underlying asset characteristics and the discount.

### **Literature Review**

Markowitz (1952) has provided the benchmark for both the portfolio and rational theories of finance. Investment in diversified portfolios instead of single or limited assets enhances the discounted return of that investment. The consideration of the capital asset pricing model (CAPM) as compared to the Markowitz theory is the determination of discount rate which may be employed for further determination of capital asset prices. The CAPM proposed by Treynor (1961), Sharpe (1964), Lintner (1965a,b) and Mossin (1966) developed the model of capital asset prices under conditions of risk. As per the theory, rational investors diversify the unsystematic risk and bring equilibrium in the capital market, where every investor invests on the capital market line according to the priority of risk. In contrast to the mean-variance asset pricing model, the linear relationship of mean and variance depends on a lot of unpractical assumptions, although its linear relationship has ensured its popularity Ross (1976). Arbitrage pricing theory (APT) tends to provide a similar equation to CAPM, but the expected return is not dependent on the risk rather it depends on various macroeconomic factors. In contrast to the capital asset pricing theories, the efficient market hypothesis (EMH) proposed by Fama (1965) claims that past, or current information may predict future prices.

Thus, rational finance theorists conclude that the capital market is dominated by sophisticated/rational investors who by their decision incorporate all the available information in the prices of the financial assets and build equilibrium in the market. Whereas a group of capital market theorists led by Slovic (1972) cited in Branch (2014) claim that capital markets do not always work in equilibrium, some irrational investors in the market supersede the sophisticated investors and bring disequilibrium in the capital market.

In this scenario, Lee et al. (1991) proposed the theory of investor sentiment and CEFs puzzle where they initiated their study with the argument to arbitrage. Arbitrage activity is limited in CEFs trading since noise traders dominate the trading. Noise traders are those who hold less information or misinformation and create mispricing which results in a discount to NAV. Lee et al. (1991) proposed three variables that explain the continuous and fluctuating discount of the fund; i. agency cost ii. illiquidity of assets and iii. tax liability. They further concluded that these three factors combined couldn't explain the CEFs puzzle. Therefore, they concluded that this phenomenon is an irrational investor sentiment which leads to mispricing of the assets.

Apart from theoretical studies, the CEF puzzle has been experimented on empirically since 1991. In continuation of the study of Lee et al. (1991), various studies discussed the impact of fund level variables on CEFD. A summary of such studies is discussed below. In this setting, Cherkes et al. (2009) claim that CEFD is a trade-off between funds' liquidity and fund manager fees. Moreover, Parwada and Keng (2014) further empirically proved the model of Cherkes et al. (2009). On the other hand, Berk and Stanton (2007) interrelate the management fees with managerial ability for the determination of CEFD. While Kim and Lee (2007) concluded that management fees, principal-agent problem effect and diversification benefits may influence the discount. Wu, Wermers, and Zechner (2015) further explain that poor manager performance as compared to managerial fees leads to higher discounts. However, Dimson and Minio-kozerski's (2001) results indicate that CEFD is not a factor in the quality of fund management. A different aspect of the fund manager role is discussed by Bhattacharyya and Nanda (2013) who claimed that a larger inside ownership in CEFs results in a larger discount to NAV.

Gemmill and Thomas (2011) studied the factors affecting long-run premiums on closed-end equity funds for the UK and USA. Management fee and liquidity had a negative influence on CEF premium on UK funds, and idiosyncratic risks and dividend payout had a positive influence on US equity fund premium. Cherkes (2003), Johnson, Lin, and Song (2006) and Wang, and Nanda (2006) support the correlation as well. A distinct analysis by Bleaney and Smith (2003) discussed the impact of past performance on the CEFD. They explained that CEF premiums should reflect the past performance only in bond funds excluding stock funds, but their results were the opposite. Therefore, they support the irrational investor theorem. Flynn (2012) asserts that factors explaining the CEFD in the UK and USA are quite different. In the UK, rational factors such as arbitrage barriers, higher expenses and replication risk are the key factors explaining the CEFD, however, in the USA, noise traders' risk or investor sentiment is the key factor determining the discount. These results reveal that CEFD is elucidated by distinct factors in different economies. This motivates the current study to be conducted in a distinct economic setting. Our data is collected from the Pakistan Stock Exchange, which possesses an entirely different environment and distinct investor behavior as compared to the developed stock exchanges. This may lead to some unique and interesting results for the researchers as well as for investors.

In contrast to fund characteristics, the studies of market characteristics are limited in explaining the behavior of CEFD. Since CEF is a separate entity and it issues its shares, therefore its stocks can be treated as the stocks of a publicly traded company. Based on this presumption, we discuss the empirical studies which explain the relationship between market wide or macroeconomic characteristics with stock prices and we assume that these factors also affect the price of funds. Moreover, we present some specific studies conducted on the relationship between market characteristics and CEFD as well.

Based on the theory of Ross (1976), Chen, Roll, and Ross (1986) studied the influence of economic-wide forces on stock prices, and they claim that economic-wide forces affect the prices of stocks traded in the capital market. In addition, Shen and Yu (2012) consider that macroeconomic factors should affect the stock price. However, they found it true during low investor sentiment but during high investor sentiment, these factors were unable to influence the stock prices. The study of Stambaugh, Yu and Yuan (2012) supports the discussion which states that stock returns determinants must be controlled for macro-economic factors. In continuation Schwert (1981) states that inflation brings a small change in the stock price. Recently Ke (2015) claimed that the bid-ask spread represents the liquidity of the share, this spread may affect the discount to the NAV of property companies.

However, we couldn't find many empirical studies investigating the impact of such variables on the CEFD/price. The reason behind the limitation of such a study is the assumption that these risks are already priced in the underlying assets. However, we argue that since funds are different entities from the underlying assets, investors re-price the macro-economic risks into the funds' prices by ignoring the reflection of macro-economic risks in the prices of the underlying asset. Additionally, a limited number of studies explaining the association between market characteristics and CEFD are summarized below. Ramchander, Simpson, and Thiewes (2008) studied the impact of macroeconomic announcements on the CEFD in the German and US markets. Researchers found divergent results in Germany and the USA; thus, they conclude that investors in the two markets respond differently to such announcements. Thus, the literature suggests a considerable affiliation of market or economic characteristics in general and CEF discount in specific. Furthermore, the limitation in the number of literatures also suggests a need for rigorous study in the area. Therefore, this study evaluates the consequence of market characteristics on the CEF discount.

Like market characteristics, there is a limited number of studies discussing the association of CEFD with the underlying asset characteristics. However, the literature evidence of the affiliation is summarized below. To acquire a broad sense of the relationship between the CEF price or discount with the underlying asset characteristics we refer to the study of Pontiff (2006) which states that idiosyncratic risk limits the arbitrage. Manzler and Slezak (2008) contribute further that CEF has a distinct identity from its underlying assets, therefore idiosyncratic risk explains the deviation of fund price from its NAV. Besides, the returns of the funds possess higher risk as compared to the returns of the underlying assets.

Lenkey (2015) assess the situation in a different context, he asserts that discount or premium on NAV depends on the ability of the fund manager to gain and exploit underlying asset private information for increased value as compared to manager fees. Moreover, Grullon and Wang (2001) developed a model which claims that discount arises because underlying asset prices possess better private information as compared to the fund prices. We argue that all the information possessed

by the underlying assets' prices are reflected in the fund's NAV, however, the fund manager may exploit such private information of the assets which are not incorporated in the underlying asset prices but may affect the fund's prices leading to a premium or discount. Furthermore, the successive studies explain the impact of underlying asset characteristics on portfolio pricing instead of CEF specifically. Hence Hamada (1972) elucidated that corporate leverage of underlying assets considerably changes the systematic risk of the portfolio if the pricing model is in line with CAPM. However, Reinganum (1981) claims that portfolios based on firm size or earnings/price (*E/P*) ratios experience average returns systematically different from those predicted by the CAPM.

The discussion in this section indicates a need for a rigorous study explaining the relationship between the mentioned proxies of underlying asset characteristics with the discount. Therefore, this study undertakes to examine the impact of underlying asset characteristics on CEFD.

The summary of the literature shows an extensive inspection of the relationship of fund characteristics with CEFD. Yet, studies are limited in explaining the association of market characteristics and underlying asset characteristics with the discount. Consequently, this research examines the affiliation of CEFD with fund characteristics, market characteristics and underlying asset characteristics.

## Methodology

### Conceptual Framework and Hypotheses

Considering the gist of the study, this section guardedly pays duly consideration to the framework, scope, data and data analysis method of the study. Hence, this study investigates the impact of funds characteristics, market characteristics and underlying asset characteristics on the CEFD.

Among these variables, CEFD is the percentage change of price from Net asset value (NAV) of closed end funds units/stocks (Lee et al., 1991).

$$CEFD_{it} = ((P_{it} - NAV_{it})/NAV_{it}) * 100 \quad 1$$

CEFD<sub>it</sub> = Closed End Funds Discount of Fund i at time t

P<sub>it</sub> = Price of stock of Fund i at time t

NAV<sub>it</sub> = Net Asset Value of Fund i at time t

On the other hand, funds characteristics are fund-specific features which may explain the CEFD. Fund characteristics involve agency cost (Lee et al., 1991), diversification (Markowitz, 1952), and Past performance (Bleaney, & Smith, 2013). Agency cost is the operating expenses for the quarter. Diversification is the percentage of the top 10 underlying assets in the total portfolio of the fund, a higher percentage represents a concentrated portfolio and a lower percentage represents a diversified portfolio. Past performance is the past 12 months' return rate of the fund.

Consistent with the theoretical and empirical discussion in section two, the relationship of fund characteristics with CEFD was highlighted in the theoretical study of Lee et al. (1991). Moreover,

Cherkes et al. (2009), Bradley et al. (2010) and Firth et al. (2014) have further verified the relationship. For analysis of the relationship between fund characteristics and CEFD, we selected three variables and developed the following three hypotheses.

In this scenario, Lee et al. (1991) proposed agency cost as the explanatory variable for CEFD, which leads to our first hypothesis.

H<sub>A1</sub>: Agency cost has a significant impact on CEFD.

Moreover, Markowitz (1952) proposed in his theoretical literature that diversification in investment may result in a reduction of diversifiable risk. Moreover, dividend discount models of stock price valuation prove that reduction of risk may then enhance the price of the assets. We then assume that with the given NAV if the price increases, then it will either reduce the discount or result in the premium. This discussion leads to the second hypothesis.

H<sub>A2</sub>: Diversification in investment significantly influences the CEFD.

Furthermore, Bleaney & Smith (2013) claim that past performance affects the discount, therefore we hypothesize that:

H<sub>A3</sub>: Past performance has a significant impact on the CEFD.

According to the arbitrage pricing theory proposed by Ross (1976), securities prices are affected by macroeconomic variables. In this study, KSE 100 index return (Sharpe, 1964), interest rate, inflation (Brown & Cliff, 2005) and real exchange rate are considered proxies for the market characteristics. KSE 100 index return is the percentage per quarter return on the Pakistan stock exchange KSE 100 index, the interest rate is the quarterly discount rate declared by the central bank of Pakistan (State Bank of Pakistan), inflation is the quarterly consumer price index (CPI) of Pakistan and the real exchange rate is the CPI adjusted quarterly Pakistani rupees (PKR) over United States dollar (USD).

Besides, the theoretical justification of the association of market characteristics with CEFD is limited; however, Ross (1976) proposed a theoretical relationship between stock price the market-wide variations. The literature leads to the following four hypotheses.

The relationship between the price of the assets and market returns is verified through the capital asset pricing model proposed by (Treyner, 1961; Sharpe 1964; Lintner, 1965a, 1965b; Mossin, 1966), whereby the theory claims that asset-specific cost of capital is sensitive to the market beta, which is a function of the market return.

H<sub>B1</sub>: KSE 100 Index returns have a significant effect on the CEFD.

The discount rate can have a strong influence since fixed-income securities and money market securities are the substitute investment opportunities, therefore an increase in the interest rate or

discount rate may switch the investors to the substitutes thus reducing the price of stocks and increasing the discount (Pontiff, 1996).

H<sub>B2</sub>: There is a significant influence of discount rate on the CEFD.

Chen, Roll, and Ross (1986), and Shen and Yu (2012) verified the relationship between the consumer price index and CEFD.

H<sub>B3</sub>: There is a significant impact of the consumer price index on CEFD.

The literature is limited in studying the relationship between the real exchange rate and stock price and studies are very limited in explaining the CEFD through the real exchange rate, however, we hypothesize that there may be a significant relationship.

H<sub>B4</sub>: There is a significant influence of the real exchange rate on CEFD.

This study contributes to the analysis of the impact of underlying asset characteristics on the CEFD. Underlying asset characteristics are financial features of such companies which are part of the portfolio of the fund. These characteristics in combination may affect the investors' decision while pricing the funds stock. The analysis of these characteristics is technically difficult since fund managers randomly sell and purchase the assets, however, for ease of analysis, it is assumed that each asset is held at least for three months by the fund, and then the average of the asset portfolio's effect is analyzed on the discount to NAV. Leverage (Hamada, 1972), return on equity (Baker & Wurgler, 2007), and firm size Reinganum (1981) of underlying assets are considered as the proxies for underlying asset characteristics. Leverage is the ratio of total debts to total assets, earning per share is the percentage of net profit after tax from total equities and firm size is the total market capitalization of firm stock.

Theoretical studies are limited to explaining the link between underlying asset characteristics and CEFD. However, Pontiff (2006) states that idiosyncratic risk enlightens the variations in the CEFD. Therefore, we claim the following hypothesis to examine the relationship between underlying asset characteristics and CEFD.

Investors price the risk of financial leverage in the underlying asset prices; however, we claim that they price the cumulative or average financial leverage risk of the underlying assets in the funds' financial assets.

H<sub>C1</sub>: There is a significant influence of underlying assets leverage on CEFD.

In continuation to the justification of underlying assets leverage, the underlying assets' average return on equity represents the profitability of the overall investment of the funds, which is priced in the funds' assets.

H<sub>C2</sub>: There is a significant impact of underlying assets' return on equity on the CEFD.



The size of underlying assets may also be priced in the assets of the funds since investors price higher to the funds which invest in the big and large capitalized assets because of investors' confidence in the stability and return of such assets.

H<sub>C3</sub>: There is a significant effect of underlying assets market capitalization on the CEFD.

### Data and Scope

This study takes into account quarterly unbalanced long panel data starting from the first quarter of 2005 to the second quarter of 2015 for three active and seven winded up closed end funds traded in the Pakistan Stock Exchange (PSX), Pakistan.

PSX is one of the fastest-growing stock exchanges in the world; the KSE 100 index showed an approximate growth of 230% since 2010. Besides, Ali and Afzal (2012) report that Pakistan's stock exchange was not as vulnerable to the financial market crisis as other developed and developing markets (e.g. India) were. Likewise, Pakistan's economy has shown tremendous stability in the recent past. Only a 3% change in Pakistani Rupees (PKR) to the United States Dollar (USD) was reported in the last 2 years. Apart from the above facts, the International Monetary Fund (2015) has reported that the economic indicators of Pakistan represent a stable economy. These all factors indicate the far-reaching potential of PSX for local, international, individual, and institutional investors.

### Data Analysis Method

Pooled Ordinary Least Square (OLS) was used for the justification of our model explaining the empirical relationship among fund characteristics, market characteristics and underlying asset characteristics with CEFD.

Following is the model which reflects the Pooled OLS.

$$CEFD_{it} = \alpha + \beta_1 ex_{it} + \beta_2 div_{it} + \beta_3 r12_{it} + \beta_4 kser_t + \beta_5 cpi_t + \beta_6 rer_t + \beta_7 disr_t + \beta_8 adr_{it} + \beta_9 aroe_{it} + \beta_{10} lamc_{it} + \varepsilon \quad 2$$

CEFD has been explained in *equation i*.

$\alpha$  = Intercept of the equation

$ex_{it}$  = Agency cost of fund i at time t

$div_{it}$  = Diversification of Portfolio fund i at time t

$r12_{it}$  = Past 12 months stock returns of fund i at time t

$kser_t$  = KSE 100 index return at time t

$cpi_t$  = Consumer Price Index at time t

$rer_t$  = Real Exchange Rate at time t

$disr_t$  = Discount Rate announced by State Bank of Pakistan at time t

$udr_{it}$  = Underlying Assets Average Debt Ratio of fund  $i$  at time  $t$   
 $uroe_{it}$  = Underlying Assets Average Return on Equity of fund  $i$  at time  $t$   
 $lumc_{it}$  = Log of Underlying Assets Market Capitalization of fund  $i$  at time  $t$   
 $\varepsilon$  = Error Term  
 $\beta_1$  to  $\beta_{10}$  = Coefficients of all the independent variables

## Results and Discussion

### Summary Statistics

Summary statistics are shown in Table 1. The mean of CEFD is negative which represents that on average, closed end funds are traded at a discount, The data reveals that closed end funds are traded maximally at a 3% premium and they were at a discount of as minimum as 64.5%.

**Table 1: Summary Statistics**

| Variable | Mean      | Std. Dev. | Min       | Max      |
|----------|-----------|-----------|-----------|----------|
| CEFD     | -34.01238 | 15.47875  | -64.5211  | 3.02793  |
| EX       | 19857.5   | 22638.66  | 2179      | 113322   |
| DIV      | 61.33215  | 10.16045  | 41.32     | 84.1     |
| R12      | 22.22602  | 26.51364  | -52.2433  | 90.37    |
| CPI      | 106.0575  | 25.72735  | 53.53     | 144.82   |
| RER      | 102.0391  | 5.386048  | 90.98     | 119.73   |
| UD       | 27.64117  | 9.173538  | 3.20868   | 42.61302 |
| UROE     | 2.675675  | 1.190595  | -.857406  | 4.986851 |
| LUMC     | 24.32683  | .4623371  | 22.0316   | 25.06577 |
| KSER     | 2.420329  | 15.28523  | -71.72656 | 26.90332 |
| DISR     | 11.36099  | 2.019824  | 7         | 15       |

CEFD: Closed End Funds Discount, EX: Agency cost, DIV: Diversification, R12: Past 12 months returns, CPI: Consumer Price Index, RER: Real Exchange Rate, UDR: Underlying assets Average Debt Ratio, UROE: Underlying assets average Return On Equity, LUMC: Log of Underlying assets average Market Capitalization, KSER: KSE 100 Index Return, DISR: Discount Rate

### Analysis of Closed End Funds Discount

Pooled ordinary least square results displayed in Table 2 show a R-square of 92%, which reveals that 92% of variations in CEFD are explained by the fund characteristics, market characteristics and underlying asset characteristics. Specifically, among the fund characteristics, agency cost and 12-month returns have no significant influence on closed end funds discount; however, diversification significantly explains the CEFD ( $p < 0.01$ ). Test for agency cost resulted in the rejection of the alternate hypothesis  $H_{A1}$ . These results are inconsistent with Lee et. al. (1991), It is possible that when investors invest in funds they don't simply price the agency cost, however, they price the net of funds manager ability and funds agency cost (Berk & Stanton, 2007). This is why agency cost individually does not affect the CEFD.

The analysis of diversification explains that as the proportion of the top 10 companies' investment increases in the total portfolio investment, the discount also increases. These results reveal a positive relationship between the concentration of investment with the discount and a negative relationship with diversification.

These results are consistent with the Markowitz (1952) theory, which states that a portfolio with diversified investment would reduce the unsystematic risk thus increasing the price of the stock; hence our results indicate that concentration/diversification of investment has significantly affected the discount. A 1% increase in the investment in the top 10 companies has increased the discount by 0.473%. Thus, our analysis resulted in the acceptance of the alternate hypothesis  $H_{A2}$ . The Results suggest that the behavior of investors at the Pakistan Stock Exchange is rational whereby they price higher to the diversified assets and thus reduce the discount and price lower to the concentrated assets which enhances the discount.

**Table 2: Pooled OLS Results: Dependent Variable: Closed End Funds Discount (CEFD)**

| Latent Variables                 | Measurable Variables                           | Results                |
|----------------------------------|--|------------------------|
|                                  | Constant                                       | 159.5<br>(94.54)       |
|                                  | Agency Cost                                    | 2.37E-05<br>(5.64E-05) |
| Fund Characteristics             | Diversification                                | 0.473***<br>(0.146)    |
|                                  | 12 Months return                               | 0.0912<br>(0.0583)     |
|                                  | Consumer Price Index                           | 1.002***<br>(0.204)    |
| Market Characteristics           | Real Exchange rate                             | 1.000**<br>(0.374)     |
|                                  | KSE 100 Index Return                           | -0.187**<br>(0.0815)   |
|                                  | Discount Rate                                  | 0.0464<br>(0.849)      |
|                                  | Underlying Assets Leverage                     | -0.980***<br>(0.195)   |
| Underlying Asset Characteristics | Underlying Assets Return on Equity             | 6.495***<br>(1.535)    |
|                                  | Log of Underlying Assets Market Capitalization | -17.81***<br>(4.803)   |
|                                  | R-squared                                      | 0.917                  |

Standard Errors in Parenthesis. \*\*\* p<0.01, \*\* p<0.05

For  $H_{A3}$ , there is no significant relationship between past performance and the discount. Our results are consistent with Fama (1965), who believes in the random walk theory, which explains that each successive price is independent of past prices and performances, where the prices of assets are sensitive to new information. We assume investors at PSX follow the current trends and information despite pricing the past performance.

Market characteristics' proxies, including consumer price index and real exchange rate, have significant positive effects at 0.01 level of significance and 0.05 level of significance respectively. KSE 100 index return has a significant negative relationship with the CEFD at a 0.01 level of significance, while the discount rate has not significantly influenced the CEFD. A 1% increase in the KSE 100 index return has caused a 0.187% reduction in the discount. These results indicate that investors' confidence in the funds is enhanced as compared to the individual stocks when the market return is high and vice versa, due to the fact they consider the funds stocks as the true reflective assets of the market. These results led to the acceptance of  $H_{B1}$ .

We reject the alternate hypothesis  $H_{B2}$ , which is inconsistent with the results of (Pontiff, 1996), though our results are consistent with (Cherkes, 2003), who claims discount is not affected by the interest rate. Irrespective of rejecting the alternate hypothesis, our results are still rational, since (CEFs) hold both stocks and bonds in their portfolio. Therefore, investors don't incorporate the interest rate in the prices of the panel of distinct characteristics specific funds, however, they may price the discount rate in the individual funds based on the weightage of investment in bonds and stocks in the total portfolio. Higher weightage of stocks may lead to an increased discount and lower may result in a lower discount.

Besides, One Pakistani Rupee increase in the CPI has increased the discount by 1.002%, which suggests that an increase in inflation reduces the real income of the households which then diminishes savings and investment. A decreased investment in the stock market would reduce the price and enhance the discount. The increase in CPI would also decrease the NAV but the price of the fund's stocks reduces at a sharper rate as compared to the NAV, since investors incorporate the risk of inflation first in the underlying asset's prices and then in the fund's stock prices. This dual pricing of inflation risk enhances the discount to NAV. Thus  $H_{B3}$  is accepted.

Finally, a 1 PKR per USD increase in the real exchange rate has caused a 1% rise in discount. This is because the depreciation of the domestic currency decreases the investors' confidence in the economy in general and in the capital market in specific. Again, the investors re-price the exchange rate risk in the funds' prices since they consider the funds as separate and independent entities from their underlying assets, therefore, alternate hypothesis  $H_{B4}$  is accepted.

All the representative variables of underlying asset characteristics have a significant relationship with CEFD. The underlying asset's average financial leverage and log of average market capitalization have significantly negative coefficients. While average return on equity has a significantly positive coefficient at 0.01 level of significance. A negative relationship of -0.980

between the underlying assets' average leverage and discount indicates that a 1% increase in the leverage of the underlying assets has decreased the discount by 0.98%. These results contradict with the Modigliani and Miller (1958) theory and the empirical study of Hamada (1972), however, our results agree with Hamada's proposition that higher leverage increases the risk of the stocks. We further claim that higher risks would ultimately reduce the price of stock thus reducing the NAV of the funds. Investors prefer to diversify their investments through investing in the funds instead of underlying assets, which enhances the fund's prices and shrinks the discount. Therefore, we accept  $H_{C1}$ .

On the other side, the return on equity of the underlying assets has positive consequences (6.495) on the discount. In contrast to leverage analysis, when returns of the underlying assets increase, investors tend to invest directly in the underlying assets to grasp the direct returns derived from the underlying assets. Investors' such behavior reduces the demand for funds' stocks thus reducing the price and increasing the discount. The response of discount to underlying assets return on equity is as high as 6.495%. These results lead to the acceptance of  $H_{C2}$ .

Last, a 1% increase in the log of market capitalization resulted in a 17.81% reduction in the discount, which indicates that portfolio concentration in the large capitalized firms boosts the investors' confidence in the funds and reduces the discount. These results are consistent with Reinganum (1981) and we accept  $H_{C3}$ .

The multicollinearity was examined through a variance inflation factor (VIF) test representing 4.94, which suggests the non-existence of multicollinearity in our model, since Gujarati and Porter (2009) state that a VIF with a value of less than 10 represents no multicollinearity.

The Wooldridge test for autocorrelation resulted in the existence of autocorrelation in the model; however, the Durbin Watson test and Breusch- Godfrey serial correlation LM-test indicate the non-existence of autocorrelation. Moreover, the Breusch-Pagan-Godfrey heteroskedasticity test confirms the non-existence of heteroskedasticity.

Subsequently, we robust the model by rectifying the serial correlation problem indicated by the Wooldridge test. After robustness (results are tabulated in Table 3), the coefficients and significance level of all the variables are not affected except the real exchange rate which was significant at 0.05 level of significance before robustness; however, the significance has improved to 0.01 level. Besides, robustness has reduced the standard error and satisfied the model with all diagnostic checks.

Based on our results, discussion and analysis, we conclude partial support for the relationship between fund characteristics and CEFD, and among the fund characteristics; agency cost and past returns have no significant influence on the closed end funds discount, while diversity has significantly impacted on the discount. Furthermore, market characteristics have a significant influence on the CEFD, as except for the discount rate, all other variables of market characteristics

have strongly affected the discount. And finally, the proposition of underlying assets is supported as well, since all the representative variables of underlying asset characteristics have a strong impact on the discount. Finally, we conclude that fund characteristics, market characteristics and underlying asset characteristics collectively have a significant influence on the CEFD.

**Table 3: Pooled OLS Results before and after Robustness: Dependent Variable: Closed End Funds Discount (CEFD)**

| Latent Variables                 | Measurable Variables                           | Results before Robustness | Results after Robustness |
|----------------------------------|--|---------------------------|--------------------------|
|                                  | Constant                                       | 159.5<br>(94.54)          | 159.5**<br>(74.21)       |
|                                  | Agency Cost                                    | 2.37E-05<br>(5.64E-05)    | 2.37E-05<br>(4.13E-05)   |
| Fund Characteristics             | Diversification                                | 0.473***<br>(0.146)       | 0.473***<br>(0.173)      |
|                                  | 12 Months return                               | 0.0912<br>(0.0583)        | 0.0912<br>(0.0527)       |
|                                  | Consumer Price Index                           | 1.002***<br>(0.204)       | 1.002***<br>(0.21)       |
| Market Characteristics           | Real Exchange rate                             | 1.000**<br>(0.374)        | 1.000***<br>(0.358)      |
|                                  | KSE 100 Index Return                           | -0.187**<br>(0.0815)      | -0.187**<br>(0.0853)     |
|                                  | Discount Rate                                  | 0.0464<br>(0.849)         | 0.0464<br>(0.899)        |
|                                  | Underlying Assets Leverage                     | -0.980***<br>(0.195)      | -0.980***<br>(0.181)     |
| Underlying Asset Characteristics | Underlying Assets Return on Equity             | 6.495***<br>(1.535)       | 6.495***<br>(1.593)      |
|                                  | Log of Underlying Assets Market Capitalization | -17.81***<br>(4.803)      | -17.81***<br>(4.074)     |
|                                  | R-squared                                      | 0.917                     | 0.917                    |

Standard Errors in Parenthesis. \*\*\* p<0.01, \*\* p<0.05

$CEFD = f(\text{Fund characteristics, market characteristics, underlying assets characteristics})$

## Conclusion

This study aims to analyze the influence of fund characteristics, market characteristics and underlying assets characteristics on the closed end funds discount. We developed 10 hypotheses. Quarterly data for 10 closed end funds traded at Pakistan Stock Exchange were selected from the first quarter of 2005 to the second quarter of 2015. The pooled ordinary least square method was used to explain the relationships. Among fund characteristics; diversification, market characteristics, KSE 100 index return, consumer price index and real exchange rate, underlying asset characteristics; financial leverage, return on equity and market capitalization have significantly influenced the CEFD. Our results are robust from all biases and discrepancies.

Moreover, this study has a novel contribution to the existing literature on closed-end fund discount analysis. The existing literature reveals partial support for the rational theories of finance; however, literature led by (Lee et al., 1991) claims that the behavior of CEFD is a puzzle which is un-explanatory through rational theories. Our results proved that closed end funds discount is a function of funds characteristics, market characteristics and underlying assets characteristics.

Now, this is the responsibility of future researchers to further specify the equation by incorporating the most influential factors in the equation within the three categories. Moreover, the literature is limited in explaining the impact of market characteristics and underlying asset characteristics on the CEFD. This study incorporated the two aspects which helped to build an optimistic rational model for CEFD. Moreover, we recommend that future researchers apply our proposed model in the developed market setting for further viability of the model. Besides, the current model can be tested in a panel of more than a single country.

Furthermore, this study has highlighted the closed end funds discount behavior at Pakistan Stock Exchange (PSX), which is distinct in various manners, such as the literature showing a significant relationship between agency cost and CEFD. Our results indicate an insignificant relationship, though our results are different from Chinese results, as Chan, Kot, & Li (2008) claim that in the Chinese stock exchange, discount and diversification have a positive relationship whereby a diversified portfolio is exposed to larger discounts. Our results of CEF traded in PSX support the Markowitz (1952) theory, which claims that a diversified portfolio reduces the risk, which ultimately increases the price and according to our results increased price would reduce the discount. Moreover, the analysis of PSX is significant since PSX is not as vulnerable to international market shocks as other markets are, and it historically proved itself as a stable market.

This research results may help the policy makers, institutions and specifically the individual investors to survive in the CEF market rationally; and they would be able to consider the disclosed factors in their investment choice and their future outcomes. Policymakers may develop certain indices for the market characteristics, fund characteristics and underlying asset characteristics which may lead to the investors in general and small individual investors in specific.

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