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**A multivariate analysis of rational and behavioral factors that
may explain the existence of discounts (premiums) of Closed-end
Investment Funds.**

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Abstract

Using multivariate analysis and based on a theoretical framework that we call hybrid theory (which considers rational and behavioral explanations for the close-end investment funds discounts/premiums), we intend to test the validity of certain factors such as agency costs, dividend policy and liquidity (so-called rational factors), combined with investor sentiment and limits to arbitrage (behavioral factors) to explain the structure of closed-end funds discounts (premiums) in the US market. Note that, as far as we know, few empirical papers have tested the validity of this approach.

Based on a sample of 346 US closed-end funds, we present evidence that dividend policy (dividend yield), the portfolio composition (restricted assets) and turnover ratio, as well as the investor sentiment and replication costs (as arbitrage limits) are statistically significant variables by the multivariate regression analysis undertaken, which seems to support empirically the hybrid hypothesis.

This paper also intends, by stepwise discriminant analysis, to identify which of these explanatory factors of closed-end funds discounts (premiums) contribute most to discriminate between bond and equity funds. Results indicate that the dividend yield, management fee and replication costs (limits to arbitrage) are the main contributors to the discriminant function, with about 92% of the funds properly classified.

Key words: closed-end funds discounts; behavioral theories; investor sentiment; rational factors; discriminant analysis

1. INTRODUCTION.

For the past few decades that existence and persistence of closed-end investment funds discounts (premiums) (which we designate now and then, only by closed-end funds) has intrigued academic and professionals, since that seem to defy the principle of markets efficiency. Discounts/premiums of closed-end funds result from the difference between the market price at which fund shares are traded and its fundamental value, called the Net Asset Value (NAV). It should be noted that discounts (i.e., when the NAV is higher than the funds' shares price) has paradoxically been the most common and persistent up to date (Copland, 2007; Malkiel & Xu, 2005; Gemmill & Thomas, 2002; Dimson & Minio-Koserski, 1999; Elton, Gruber & Busse, 1998).

In an attempt to understand this puzzle have been discussed mainly two theoretical frameworks: those who argue that the discounts (premiums) can be explained by the so-called rational factors - the rational theory - and those who advocate that these are result from the sentiment investor or asymmetric information and arbitrage limits - the behavioral theory. The former approach considers that investors are rational and the market is efficient, so the discounts (premiums) will be a challenge to these assumptions, pointing to factors (so-called rational) as explanations this "anomaly" like the potential tax liability for unrealized capital gains, the dividend policy, the fund portfolio composition, the agency costs and performance management, among others. The behavioral approach, for its part, seeks to explain the puzzle based on behavioral and psychological factors, such as the investor sentiment theory, asymmetric information and arbitrage limits (particularly the replication costs). More recently, a new set of hypothesis (which we call the hybrid framework or theory) seeks to explain this dilemma by combining the so-called rational factors and behavioral factors. In our opinion the research of Gemmill and Thomas (2002) and Wang (2003a, b) are examples of this approach.

The rational approach (based on factors such as agency costs, potential tax liabilities, liquidity, political distribution, etc.), in general, has difficulty to justify the variability of the discounts of the funds over time and the existence of premiums, but have some relevance to explain the existence and persistence of discounts between funds. The investor sentiment theory (especially the individual investor sentiment), although it seems to explain most of the pieces of the puzzle, there are researchers that disagree with the tests and methods used to validate it, concluding that this is not relevant to the discounts (premiums) explanation, as they found no empirical evidence to corroborate that. Notice that this theory does not seem to make sense as explanation of UK closed-end funds discounts (premiums), since these are mainly traded among institutional investors and individuals have a small relative expression in this market.

Assuming that the closed-end funds market may imply either rational investors or noise traders, institutional and individual, we believe that either rational or behavioral factors may be relevant to explain the closed-end funds discounts (premiums). We also observed that there are few studies that systematically explore the combination of these assumptions, especially in the US market. Accordingly, we use a cross sectional multiple regression, based

on a sample of US closed-end funds, to test rational and behavioral factors, simultaneously, (like dividend policy, agency costs – as implied by the management fees and management expenses), liquidity – as implied by restricted assets and turnover ratio, investor sentiment risk and arbitrage limits) that may explain the discounts (premiums). Highlight that in this analysis, we will use as a proxy of investor sentiment not a single indicator (such as the weighted average discount, as it has been used by several authors), but a composite index of investor sentiment, as proposed by Baker and Wurgler (2006). This composite investor sentiment index combines and reflects the common behavior of various indirect indicators of investor sentiment. This composite indicator, to our knowledge, has not been used in the analysis of factors that potentially explains the closed-end funds discounts level by other authors, as so far. Another objective of this paper is to investigate whether the closed-end funds can be distinguished taking into account the potential explanatory variables of the structure of closed-end funds discounts (or premiums), giving the most commonly factors provided (resulting from the review of the literature) and which best discriminates between funds groups. To achieve this objective the multivariate technique of descriptive and classificatory discriminant analysis will be applied categorizing funds into two major generic groups: equity funds and bond funds.

The results, based on a sample of 346 US closed-end, between 1994 and 1998, seem to support the hybrid approach, verifying that rational factors (such as dividend yield, turnover ratio and restricted assets) and behavioral (investor sentiment and replication costs - as limits to arbitrage) were considered significant and the model of multiple linear regression showed an explanatory power of 64% and 65% respectively for each model tested for the total sample. The variables, so-called rational: dividend yield and management fee, and the behavioral variable “replication costs” are those that contribute more to the discriminant function between the groups of equity and bond funds, while 49% of the variation of the discriminant function be explained by the model obtained.

This paper is then structured as follows: in the following section, we make a brief literature review and discuss the theories that seek to justify the existence and persistence of the closed-end funds discounts (premiums) level to form our theoretical framework. Then, we exposed the methodology and describe variables to be used in our empirical research. The fourth section describes the sample, present and analyzes the obtained results in the investigation and, finally, concludes and points out some suggestions for future research.

2. THEORETICAL FRAMEWORK.

In the literature we can identify two dominant sets of hypothesis that seek to explain the existence and persistence of closed-end funds discounts (premiums): the rational approach and behavioral approach. However, more recently, has emerged another framework, which we call hybrid approach, that advocates that the puzzle can be explained by both rational factors as behavioral ones.

Proponents of the rational approach, which prevailed during the 60s to 80s of the twentieth century, studied and identified factors such as tax liability on unrealized capital gains and

dividend policy, agency costs, including management fees; fund assets turnover ratio and liquidity, among others. The authors considered that the policy of dividends distribution and tax liabilities on potential unrealized capital gains (e.g.: Malkiel, 1977 and 1995, Anderson & Born, 1987, among others) argue that funds that have high unrealized capital gains should sell at a discount because investors in these funds will assume tax obligations when those earnings are distributed. Thus, when the funds adopt a generous dividend policy, discounts (premiums) will tend to decrease (increase). This relationship will be strengthened when funds pursue a dividend policy with guaranteed minimum dividend (Wang, 2003a,b; Johnson, Lin & Song, 2006). However, this approach does not seem very consistent with some facts about the behavior of discounts, especially on IPO and the announcement of an open-ending operation as well as the existence of premiums. It is true that some authors obtained some statistical significance for these factors using univariate and multivariate analysis (e.g. Malkiel, 1977 and 1995; Gemmill & Thomas, 2002), however, this cannot explain why funds are usually issued at a premium or low discount and, in general, when the seasoned funds are at a premium or low discount. Moreover, this argument seems not have reason to be, given the British closed-end funds have discounts with magnitude and behavior identical to the US ones¹, although they have different tax environment. Lee and Moore (2003), which sought to explain the existence of premiums in US closed-end bond funds, supported the hypothesis based on preference for dividend yield, assuming that the individual investors, major customers of these funds (according to the authors) has shorter investment horizons. Therefore, the closed-end bond funds will be more demand than its shares, since the price of the shares of those funds are less volatile and pay monthly dividends (while equity funds usually only pay annually). This research, although appears to be relevant from the rational point of view, it raises some questions relating to assumptions and the results obtained: is that closed-end funds have an advantage over mutual funds to attract, in fact, individual investors with short investment horizons; the inhibition of high turnover ratio will not be a consequence of the fact of closed-end funds shares be less liquid than the ordinary shares of others companies, which leads to having higher transaction costs; during the sample period (1992 to 1999) the rates were very low, will that results remain in periods when rates are higher. Authors were not explicit if they tested multicollinearity of variables and do not show the determination coefficients of the models tested.

The arguments relating to the portfolio composition, liquidity and turnover, the existence of restricted assets, generally illiquid assets, and foreign assets may lead to a mispriced NAV because the determining of the "fair" value of these assets may be a bit subjective and usually based on the principle of conservatism in accounting of these assets (Malkiel, 1977 and 1995; Anderson & Born, 1987; and Draper & Paudyal, 1991). Thus, discounts may be a result of the existence of these assets in the fund portfolio. However, this bias does not fit with the behavior of discounts when funds initiate an open-ending process, as the price converges to the NAV and not vice versa, or even the existence of premiums. Some authors examined the relationship between liquidity and discounts from the perspective of differential liquidity risk

¹ In the UK, closed-end funds cannot distribute any realized capital gain (they must reinvest it in the portfolio) and shareholders of the fund are not subject to taxes on capital gains unless they sell their positions on the fund (Dimson & Minio Kozerski , 1999; Dimson & Mini-Paluello, 2002 and Gemmill & Thomas, 2002).

between fund shares and its NAV (Datar, 2001 and Jain, Xia & Wu, 2004), whereas the discounts increase with fund shares illiquidity and reduce with the underlying portfolio liquidity. To study this factor they used proxies such as trading volume and underlying volatility. The liquidity of the funds may be a factor, along with others, in explaining cross-sectional discounts (Datar, 2001). Neal and Wheatley (1998), Clarke and Shastri (2001) and Chen, Jiang, Kim and McInish (2003) analyzed the adverse selection component of the bid-ask spread of closed-end funds in comparison with shares of other firms, suggesting the presence of asymmetric information. This should not be evident in closed-end funds discounts, theoretically, because there is little uncertainty about the fundamental value of the funds, since both price and NAV of the fund are published regularly and publicly available. Even considering the nature of this argument, it seems that it does not embrace all facets of the closed-end funds discounts puzzle, namely why they are issued at a premium to be reduced over time or why there is a convergence of price to NAV. In relation to turnover ratio, which is the level of transactions in the fund's portfolio, any purchase or sale of securities in the portfolio, more than necessary to maintain the level of profitability and diversification, will increase transaction costs and taxes payable without result in better performance of the fund. Thus, funds with high turnover will sell at a discount higher than those with a lower ratio (Boudreaux, 1973; Malkiel, 1977 and 1995, Anderson & Born, 1987). However, the authors found no statistically significant evidence in their samples.

Agency costs, including management fee and expense ratio, has been widely studied or applied to samples of US or UK closed-end funds, sometimes with a few variations or different approaches (e.g. Malkiel, 1977 and 1995 Draper & Paudyal, 1991, Kumar & Noronha, 1992; Deaves & Krinsky, 1994; Baroni-Adesi & Kim, 1999; Ross, 2002; Gemmill & Thomas, 2002; Flynn, 2002 or Cherkes, 2003). According to this argument, the higher the management costs, especially management fees, higher (lower) the closed-end funds discount (premium). In this context was also analyzed the relationship between discounts and agency problems arising from the ownership structure of the funds (e.g. Draper & Paudyal, 1991, Barclay, Holderness & Pontiff, 1993, Malkiel, 1995, Coles, Suay & Woodbury, 2000; Khorana, Wahal & Zenner, 2001, Del Guercio, Dann & Partch, 2003). This argument seems to have some economic significance for the explanation of the existence of discounts (premiums) in closed-end funds, but even so, still have limitations in some aspects. For example, the model of Baroni-Adesi and Kim (1999) cannot explain time series behavior of discounts - its volatility and variability over time, or because new funds are issued and are in great demand. Even the models suggested by Ross (2002), Flynn (2002) and Cherkes (2003) have some difficulty in explaining the variability of discounts over time, although they seem to reasonably explain the cross sectional level of discounts. In particular, the model proposed by Cherkes (2003) cannot explain the expected decline (increase) of premiums (discounts) after the IPO of the fund, while it may explain the co-movement of discounts on related funds. Ross (2002) to explain the behavior of IPO discounts assumed the hypothesis of asymmetric information between those who issue and sell the fund and investors but also fails to explain the behavior after the IPO.

Wang (2001a) presented a model that seeks to explain the variation in discounts, over time, based on the nature of information flow, whereby variations in the discounts would have to reflect the innovations of the fundamental value of the underlying fund assets, i.e. the variation in discounts should be able to estimate the fund share returns. However, the Wang (2001a) model only considers funds that invest in liquid assets and medium and high market capitalization shares, which raises the question whether the model will be compatible with funds that invest in restricted assets and bonds. If not, is not possible to generalize this model. Bhattacharyya and Nanda (2003) present another factor that may explain at least part of the puzzle of closed-end funds discounts, and that meets the rational theory: the information asymmetry between investors and fund managers as the risk associated with the fund composition that they designated as inventory risk. According to them, discounts may persist even if there are taxes and transaction costs dispersive and correlated actions of investors to influence the prices of closed-end funds, so the fund NAV should be biased upwards and not its price. This argument seems to explain the behavior of discounts in an open-ending operation and at its launch on the market (IPO), however, does not seem to justify the reason for time series behavior of discounts and its time series variance.

Like Lee, Shleifer and Thaler (1990 and 1991) and other critics, we also have questioned these theories. It seems that although a few of these arguments have some explanatory power on the existence of discounts (sometimes more difficult to justify the premiums), are not sufficient to explain their behavior and time series variability. Be noted that some of these factors are not mutually exclusive. Given the difficulty of the so-called rational theory to explain several aspects of the puzzle of closed-end funds discounts, some authors have cast doubts on the rationality of investors, or that at least they have a limited rationality, even among those who favored initially more traditional arguments and rational assumption (e.g. Bleaney & Smith, 2003 and 2008).

Proponents of behavioral theory, particularly the investor sentiment theory, have presented evidence, sometimes contradictory, on their behalf (e.g.: Chen, Kan & Miller, 1993; Brauer, 1993, Abraham, Elan & Marcus, 1993; Bordutha, Kim & Lee, 1995; Cheung, Kwan & Lee, 1997; Neal & Wheatley, 1998, Brown, 1999). This has been widely tested in the country funds, especially if the US domestic investor sentiment explain the existence and behavior of these country funds discounts or the local market. Lee, Shleifer and Thaler (1991) based on the model proposed by De Long, Shleifer, Summers and Waldmann (1990) advocated the presence of two types of investors in the market: the noise traders and rational investors. The former are individual investors who are not as well informed as the institutional ones, often relying on the advice of experts to make their investment decisions. The latter are institutional investors who make decisions more rational and informed. The random behavior and irrational manner of noise traders can lead to an additional risk associated with the price of closed-end funds, due to changes in the sentiment, and lead to stronger discounts than expected, by inhibiting the actions of rational investors. This argument is justified by the fact new funds appear when the markets are already at a premium or lower discount or by the positive correlation between discounts across funds and over time.

However, back in 1973, Zweig had charged that the discounts (premiums) of closed-end funds should be due to pessimistic expectations (optimistic) to retail investors, who have access to all information regarding the price of the fund, but are not shared by professionals, leading to discrepancies between the price of the fund and its NAV. According to Lee, Shleifer and Thaler (1991), this approach also justifies the correlation between discounts and the prices of other assets, including the price low market capitalization shares. Conversely, this argument was challenged by Elton, Gruber and Busse (1998) and even by Doukas and Milonas (2004) who found no evidence that investor sentiment, since the varying discounts on closed-end funds is not a factor measured in the generation of assets return. Brauer (1993) to assess the relevance of investor sentiment in the variability of discounts applied to US domestic closed-end funds was able to justify just about 7% of its variability. Monte and Armada (2008), in a similar study to the Brauer (1993) but considering different time period, could justify only 8.6% of the variance of standardized discount. Gemmill and Thomas (2002) suggest that variations in discounts are due to changes in (individual) investor sentiment, while its existence can be explained by rational factors such as management expenses and arbitrage limits. Some researches on the discounts volatility and mean reversion suggest investor psychology, or a degree of investor irrationality, as a justification for the excessive volatility detected and the fact that some fund discounts may not reverse and even further increase (e.g. Pontiff, 1997; Gasbarro, Johnson & Zumwalt, 2003; Agyei-Ampomah & Davis, 2005).

There is, however, a certain incongruity between this theory, assuming that noise traders are individual investors, and the facts established in UK closed-end funds discounts, where institutional investors have a relatively high weight. As already mentioned previously, there is a certain similarity between US and UK funds, in terms of behavior and level. Jackson (2003) questions whether the noise traders are individual or institutional investors, as he found no evidence of risk associated with the key participation of the latter on the market. Thus, institutional investors might also act as noise traders. Previously, Sias (1996, 1997) suggested that the noise trader risk could result from the participation of institutional investors in the closed-end funds market. There is also growing research on the influence of investor sentiment in the assets return and their volatility and if investor sentiment is different among individual and institutional investors (in addition to the authors cited above, see e.g. Kelly, 1997; Fisher & Statman, 1999; Wang, 2000; Shefrin, 2000; Wang, 2001b; Lee, Jiang & Indro, 2002; Malmendier & Shanthikumar, 2003; Baker & Wurgler, 2003, 2006; Brown & Cliff, 2004; Verma & Verma, 2007; Mian & Sankaraguruswamy, 2008; among others).

Also within the behavioral theory have been analyzed the limits of arbitrage and asymmetric information that may also give some contribution to the justification of the closed-end funds discounts puzzle. Gemmill and Thomas (2002) and Korke, Nakamura and Turtle (2001) considered that the arbitrage costs and other arbitrage limits could explain why discounts persists. Pontiff (1996) also found that the arbitrage, by incurring costs associated with the fact that market participants may face noise trader risk, see their ability to drive fund prices to its fundamental value limited, finding a relationship between discounts and proxies for the arbitrage costs. Flynn (2005a, b) also argues that the discounts persist and vary over time as a

result of arbitrage limits. He found the presence of noise traders in the US closed-end fund market and that the noise trader risk is not diversifiable, thus imposing limits on arbitrage to these assets. Grullon and Wang (2001) put the emphasis on asymmetric information accessed by investors in closed-end funds but mainly on the quality of information accessed by private institutional investors.

More recently has been coming up a framework which combines rational factors with behavioral ones, since both rational and behavioral hypotheses cannot fully explain all the pieces of the closed-end funds discount puzzle. According to this framework, there will be factors such as dividend policy, management fees and performance or liquidity coupled with investor sentiment and arbitrage limits that could justify the existence of discounts (premiums) and its behavior along time. Gemmill and Thomas (2002), which can be considered as the first to test these assumptions, argue that the discounts (premiums) are the result of the dynamic relationship between noise traders and rational arbitrageurs. Thus the existence of discounts is a rational phenomenon that depends on the level of management fees and arbitrage costs, while its persistence and variability results from the investor sentiment (the noise traders). According to Gemmill and Thomas (2002), the behavior of discounts over time could be explained by investor sentiment (that is reflected by the retail-investor flow so that the fluctuation in the discount results from variation in small investors' sentiment, both short term and the long term. Also Wang (2003a, b) argues that many factors, whether rational or behavioral, may contribute to the existence and persistence of discounts. They examined factors such as agency costs, potential tax liability, the investor sentiment theory and arbitrage costs. According to them, the closed-end funds managers use the dividend policy and share repurchases as a means of reducing the discounts. It also argues that a dividend policy of distributing a minimum level of dividends makes that the fund can reduce the potential tax liability for its investors and the arbitrage costs imposed on arbitrageurs as well as reduce the exposure to investor sentiment risk. Wang (2003a, b) also found that a target distribution policy, which guarantees a minimum level of dividends to ordinary shareholders, helped to explain the variation between funds on the discounts level by reducing the total net assets. Johnson, Lin and Song (2006), as previous authors, even though they give emphasis to the role of guaranteed dividend policy, they do not exclude the hypothesis that there are rational and behavioral factors that may explain the existence and persistence of discounts closed-end funds.

In the following section, giving this theoretical framework, we describe the methodology and assumptions to be tested and define the variables.

3. METHODOLOGY AND DEFINITION OF VARIABLES.

As we noticed in previous section, different hypothesis were presented to explain the existence and persistence of discounts and other associated anomalies but they are not unanimous and conclusive, and none of the hypotheses advanced alone can cover all the pieces of puzzle. In this way, we believe that the combination of rational factors with behavioral ones can make a better contribution to the clarification of this "anomaly" (namely the dividend policy; the portfolio composition and the differential liquidity between funds

shares and underlying portfolio; the agency costs - measured by management expenses or management fee; the asymmetry of information and limitations of arbitration as well as investor sentiment).

Thus, based on the hybrid theoretical framework², but not using a particular model, we will analyze the relationship between the funds discounts and a number of factors that have been reported in the literature as relevant to explain these phenomena, specifically: dividend policy, agency costs, composition/ liquidity of the fund's portfolio, turnover ratio, investor sentiment risk and limits to arbitrage. It will also be considered, as controlling factors, the fund size and its age (since it could potentially affect the discount). It is expected, however, they do not show significant impacts. Table A.1 in the annex summarizes the hypotheses under research, for each factor analyzed.

In this way, we will apply a multiple linear regression where all the factors under investigation are considered together, not forgetting the issues of multicollinearity. The generic model to consider is the following:

$$Disc_i = a_i + b_i AC_i + c_i DR_i + d_i LIQ_i + e_i SI_i + f_i CA_i + g_i SIZE_i + h_i AGE_i + \varepsilon_i \quad (3.1)$$

Where,

- $Disc_i$ - represents the average discount in the analyzed period, to the fund i ;
- AC_i - corresponds to the factors related to agency costs or management;
- DR_i - represents the dividend policy;
- LIQ_i - represents the factors related to the composition/liquidity of the fund's portfolio and turnover ratio;
- SI_i - corresponds to the factors related to investor sentiment;
- CA_i - is related to the arbitrage costs and the difficulty of replication of funds;
- $SIZE_i$ and AGE_i represents, respectively, the control variables: size and age of the fund.

The average discount during the analyzed period ($Disc_i$) is calculated as the arithmetic mean of the recorded discounts during the period under analysis, for each fund, and the discount ($D_{i,t}$) calculated from the spread between market price and NAV, compared to NAV³:

$$D_{i,t} = \frac{P_{i,t} - V_{i,t}}{V_{i,t}} \times 100 \quad (3.2)$$

where,

$P_{i,t} \equiv$ Market price of the shares of closed-end fund i , in period t .

² Following the hybrid approach, it is considered that in the market can find non homogeneous investors in relation to access and how they interpret the information linked on the market. So, there are informed investors, noise traders and investors who act on the basis of liquidity needs. These investors, as a rule, are risk averse, but have different levels of aversion.

³ Notice, for instance, that the website of the Association of Investment Funds Closed (www.cefa.org), which contains information on the discount/premium of US closed-end fund, calculates discounts by this formula.

$V_{i,t} \equiv$ Net asset value of closed-end fund i , in period t .

So, if $D_{i,t} > 0$, the fund is at a premium; if $D_{i,t} < 0$, the fund is at a discount.

In relation to agency or management costs factor - AC_i - will be used proxies for the variables "management expenses" (Dg_i), which is calculated by total expenditure management, which includes the management fee paid to fund managers, in relation to total net assets (NAV) of the fund, and "management fee" (Mf_i) charged by the fund manager that is expressed as a percentage of total net assets.

The dividend policy factor - DR_i - will be employed, as proxies, the "Dividend yield" (Dy_i), which is the percentage of dividends paid by the fund in relation to total net assets in the portfolio; and the "Capital gains distributed" (Gc_i), which corresponds to the percentage of realized capital gains distributed by the fund in relation to total net assets in the portfolio.

For Composition and liquidity of the fund's portfolio and turnover ratio factor - LIQ_i - will be used by a proxy for restricted assets (Ar_i), a dummy variable which takes the value 1 for funds that invest in assets generally considered as illiquid such as municipal bonds, foreign assets and other securities like convertible; and 0 for the remaining funds. The turnover ratio ($Turn_i$) denotes the degree of rotation of the assets in the fund portfolio, corresponding to the ratio between the value of acquired assets deducted from assets sold, by quarter, and the average value of portfolio assets held in this period, in percentage.

As investor sentiment variable, since is not a variable directly observable and objective, have been used by various authors, different proxies, but usually only considering a single indicator. One of the most commonly used proxies for investor sentiment have been average discounts (premiums) of domestic closed-end funds (e.g. Elton, Gruber & Busse, 1998; Neal & Wheatley, 1998; Sias, Starks & Tinic, 2001; Gemmil & Thomas, 2002; Doukas & Milonas, 2004, among others). However, other proxies have been used instead, such as indicators measured by the survey investors, consumers and financial analysts, such as the AAI Sentiment Survey Index, sentiment index developed by surveys to members of the American Association of Individual Investors (Brown, 1999), the Investors Intelligence Index, which gathers the opinions of financial analysts (Lee, Jiang & Indro, 2002), or the index on consumer confidence, as the University Michigan Consumer Confidence Index (Lemmon & Portniaguina, 2004; Qiu & Welch, 2004). These are direct indicators of investor sentiment to the extent that is the result of questionnaires, in which, however does not fully reflect investor sentiment, as investors may respond that they are optimistic or pessimistic about market behavior but their actions in the market might point to another direction. Other proxies used (individually) as indicators of investor sentiment have been, for example, the relative weight of equity in new issues (Baker & Wurgler, 2000), the buy and sell imbalance (Kumar & Lee, 2003; Kaniel, Saar & Titman, 2004), or the net flow of mutual funds - net new cash flow of equity mutual funds (Gemmill & Thomas, 2002; Brown, Goetzmann, Hiraki, Shiraishi & Watanabe, 2003; Frazzini & Lamont, 2006) or trading volume trend

(Johnson, Lei, Lin & Sanger, 2005, 2007). Brown and Cliff (2005), Glushkov (2006) and Baker and Wurgler (2006) proposed the use of an index of investor sentiment taken from the combination of several proxies of investor sentiment. In our point of view, the advantage of using these composite indexes, and not just a single indicator, is the fact that, by combining direct and indirect indicators, allows that the relative power of each component varies over time.

In this study we choose to use the Composite Index of Investor Sentiment ($ICSI_{it}$) proposed by Baker and Wurgler (2006), which is accessible on the website of the authors (<http://pages.stern.nyu.edu/~jwurgler/>)⁴. This is based on the common variation of six underlying proxies of investor sentiment: the domestic discounts of closed-end investment funds, the NYSE shares turnover, the number and the average first day return on IPO, share of equity issues in total equity and debt issues and the dividend premium, which is calculated as the log difference of the average market-to-book ratios of payers (companies that pay dividends) and non-payers. They used the principal component analysis to isolate the common component of each of these six proxies. In constructing the index had also note that there are variables that may reflect changes in investor sentiment earlier (or later) than others, therefore examined whether each set should be integrated with lead or lag. Moreover, as these variables may also be influenced by macroeconomic conditions and business cycles, they orthogonalized proxy variables (gross) of investor sentiment for the following variables: the growth rate of industrial production (Federal Reserve Statistical Release G .17), the growth in consumption of durable goods, nondurable goods and services (BEA National Income Account, Table 2.10), and a dummy variable for recessions of the NBER (National Bureau of Economic Research).

So as a factor "investor sentiment - SI_i ", we will consider the sensitivity of fund discounts to Composite Index of Investor Sentiment - proposed by Baker and Wurgler (2006). Thus, $SI_{i,t} = \beta_{i,t}$ (3.3), where the beta is calculated using the linear regression by the ordinary least squares method:

$$D_{i,t} = \alpha_{i,t} + \beta_{i,t}ICSI_t + \varepsilon_{i,t} \quad (3.4)$$

As a proxy of the "arbitrage costs and the difficulty of replication of funds" - CA_i - will be used the variable "replication cost" ($CR_{i,t}$) which represents a limits to arbitrage on the fund, and that can be measured, as suggested by Gemmill and Thomas (2000), by the variance of the residual error of the following linear regression:

$$RV_{it} = \alpha_{it} + \beta_{it}Rm_{it} + \varepsilon_{it} \quad (3.5)$$

Being,

$RV_{it} \equiv$ the NAV return of the fund i , at time t .

$Rm_{it} \equiv$ the market return of the fund i , at time t . For domestic equity funds it will be used the market return calculated by Fama and French (1993) and reported in the Webpage

⁴The authors allowed us to apply it in this work, for which we thank both, and in particular to Professor Wurgler.

K. French. For bond funds and other taxable fixed-income securities, the Lehman Brothers Corporate A + index. For municipal bonds funds, we use the Lehman Brothers U.S. Municipal Index. For international equity funds, we applied the MSCI World Index.

ε_{it} \equiv Random error term.

Regarding the control variables "Age - AGE_i " and "Size - $SIZE_i$ ", were defined as the logarithm of the fund age since its inception by the end of the period, in years, and the logarithm of the market capitalization value of the fund, in every moment, respectively.

As another objective of this research is to investigate the explaining factors of the closed-end fund discounts, said rational and behavioral (that were discussed earlier), that differentiate better the several categories of closed-end funds existing in the U.S. market, and we applied the stepwise discriminant analysis using Wilks' Lambda method. This is a multivariate statistical technique for identifying variables that differentiate two or more groups of individuals structurally different and mutually exclusive, which begins with no variables in the following steps and variables are added or removed as its contribution to the discriminating capacity of first discriminant function (Maroco, 2007). It should be noted that the Wilks' Lambda statistic is only valid if the sample comes from a multivariate normal population with homogeneous variance-covariance matrix for each group. Another condition is that none of the variables can be linear combination of other, i.e. cannot be multicollinear (Hair, Anderson, Tatham & Black, 1998; Pestana & Gageiro, 2003; Maroco, 2007). Most statistical software provides statistical M-Box test for homogeneity of variance-covariance matrix, but this statistic is very sensitive to sample size, as large samples usually lead to rejection of null hypothesis, even though the difference between the variances-covariances matrix are very small. Nevertheless, according to Maroco (2007), this technique is very robust to assumptions violations since the size of the smallest group is greater than the number of variables under analysis and the groups' mean are not proportional to their variances. The Wilks' Lambda was used to test the significance of discriminant functions as whole and if it significantly discriminate groups. This test applies to all the discriminant functions simultaneously and the rejection of null hypothesis⁵ indicates that at least the first discriminant function is significant (the other may or may not be) and conclude the model is discriminating (Maroco, 2007).

In the next section we proceed to sample characterization and analysis of results.

⁵ The null hypothesis is $H_0 : \mu_{ij} = \mu_{kl}$ vs $H_1 : \exists(i, j); (k, l) : \mu_{ij} \neq \mu_{kl}$, com $i \neq k$ e $i, k = 1, \dots, m$; $j \neq l$ e $j, l = 1, \dots, g$, i.e., tests whether the average of all m discriminant functions for each of g groups are equal or there is at least one different.

4. SAMPLE AND ANALYSIS OF RESULTS.

4.1 Description of the sample.

For this research we collected a sample of US listed closed-end funds from the CDA/Wiesenberg – a Thomson Financial Company database, during the period of January 1, 1994 to December 31, 1998⁶, including funds with at least 300 weekly observations, both market price and its NPV, during this period. Those funds that had more than 1% of total observations missing data in the series time series of discounts, market price and NAV were excluded. The final sample represents 346 US closed-end funds from the following general categories⁷: equity funds (diversified and specialized), bond funds (fund fixed income subject to tax - taxable income funds), municipal funds and international funds (either global or specialized countries or geographical regions) - see Table A.2 in the annex. For each fund in the sample we collected the following information, with weekly observations: the net asset value, market price (fund price), discounts, return on net asset value and market price, in percentage, corrected for the dividend distribution and stock splits. Other information collected by fund, was the ratio of management expenses and management fees, the turnover fund's ratio, the fund total net assets, the fund market capitalization value, the value of total dividends distributed (income and capital gains) by the fund. Notice that, since 1997, ceases to be registered in the database of CDA/Weisenberger information on the management fees and the management expenses begin to be recorded since 1996.

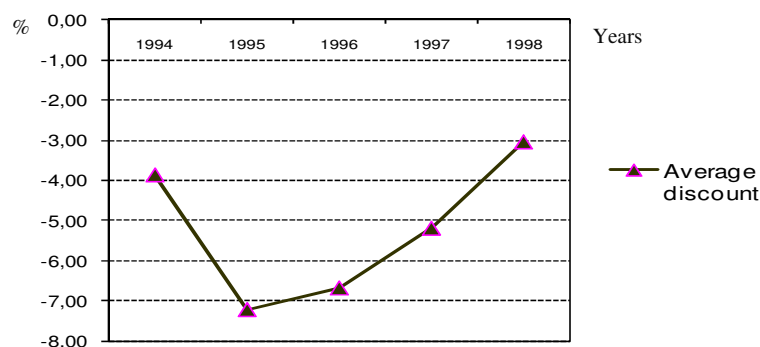


Figure 4.1 - The average discount of closed-end funds during the period 1/01/1994 to 31/12/1998.

Our sample of 346 US funds traded on the NYSE and AMEX, represents 52% of all funds contained in the database, and the most closed-end funds are classified as fixed income funds and Municipal Bonds. About 22% of these are international or global funds and only 5.4% are domestic equity funds and diversified funds (see Table A.2. in annex). During the period from 1/01/1994 to 31/12/1998, were placed on the 118 funds and became extinct (they open-ending) 31 funds. Analyzing the behavior of fund discounts, based on the average discount of

⁶ For budget constraints reasons we were unable to extend the sample to a more recent period and include more variables. However, we think that the use of historical data does not invalidate the conclusions reached by itself, especially since it is not our primary objective with this research to develop a predictive model.

⁷ We excluded from this research, the Dual-purpose funds- also known as "Split-capital funds" - and the Real Estate Investment Trust Funds (REIT), due to their peculiar characteristics.

the funds in the database shows that on average closed-end funds have traded at a discount during this period⁸ (see Figure 4.1, above).

4.2. Multivariate analysis of factors that explain the closed-end funds discounts.

As was pointed out in Section 3, to examine the joint relation between the rational and behavioral factors to explain closed-end funds discounts, their common structure between funds and along time, we applied multiple linear regressions, considering the average values each of the variables (dependent and explanatory) in the five-year period. As for the agency costs factor we use two proxies that may be multicollinear, we estimate the linear regression (according to equation 3.1) considering two models, separately: model 1- management fee as proxy for agency costs; model 2 – management expenses as proxy for agency costs. The assumptions of the model of multiple linear regression (i.e., the normal distribution, homogeneity and independence of errors) were validated graphically and analyzed the residuals through the statistics of Durbin-Watson, in the case of independence. In order to eliminate possible outliers, we make the analysis of studentized residuals⁹ testing the hypothesis $H_0: \Delta_j = \varepsilon_j - \varepsilon_{j-1} = 0$ vs. $H_1: \Delta_j \neq 0$. That is, compare the value of t_j with the

critical value of t-student distribution with $(np-1)$ degrees of freedom: $t_j = \frac{e_j}{s_{-j} \sqrt{1-h_{jj}}}$, with

$$s_{-j} = \sqrt{\frac{(n-p)SME - \frac{e_j^2}{1-h_{jj}}}{n-p-1}}, \text{ where SME corresponds to a sample estimate of error standard}$$

deviation; h_{jj} is the diagonal element of the matrix $H = (X'X)^{-1}X'$, e_j is the error for observation j , n is the number of observations and p the number of regressors (Maroco, 2007:585). If $|t_j| \geq t_{1-\alpha/2, (n-p-1)}$, we reject H_0 for observation j and conclude that x_{ij} is a multivariate outlier (Maroco, 2007:586). In practical terms, we do not reject H_0 , taking the significance level of 5%, if the value of each studentized residual, calculated by SPSS - v.16 (SPSS Inc, Chicago, IL), has a p -value less than or equal to the level of significance, giving the statistical test mentioned above.

To test the multicollinearity assumption, we used the variance inflation factor (VIF). According to Maroco (2007:603), VIF values greater than 5 or even 10 indicate problems in the estimation due to the presence of multicollinearity in the independent variables. Table 4.1 presents the results of multiple linear regressions, on Panel A, the Model 1 - the management fee and on Panel B, the Model 2 - management expenses, respectively, based on the equation 3.1. To avoid heteroscedasticity problems, a multiple linear regression was applied using the weighted least squares method (Weighted Least Squares Regressions), using the discount volatility as a weighting factor.

⁸ Taking into account the empirical research made by other authors, namely by Brauer (1984) and Peavy (1990), we made two adjustments in the time-series of the variables discount, NAV and price in the sample. Hence, the first 24 observations were not considered (equivalent to six months) after the fund IPO date and those observations of the previous six months to the open-ending operation announcement date.

⁹ Also known as PRESS (*Predicted Sum of Squares*) residual or Studentized deleted Residual.

Table 4.1: Summary of regression analysis (Equation 3.1) in the period 1994-98
 Panel A - Model 1: WLS Regression, with management fee proxy for agency costs

Explanatory Variable	C ₀	Dy	Cg	Mf	Turn	Ar	SI	Cr	Size	Age
Coef.	-28,845	1,844	0,017	1,252	-0,016	4,886	0,310	1,466	-0,211	2,517
t-stat	-7,041	20,011	1,715	1,265	-3,774	7,894	6,064	6,861	-0,792	4,603
(p-value)	0,000	0,000	0,087	0,207	0,000	0,000	0,000	0,000	0,429	0,000
VIF		1,935	1,167	1,620	1,584	2,209	1,700	1,811	1,079	1,446
$\overline{R^2}$	0,643						F-stat	58,655	0,000	
SEreg	27382,2						DW	1,954		
SSRes	14471,9						# Obs	288		

Panel B - Model 2: WLS Regression, with management expenses proxy for agency costs

Explanatory Variable	C ₀	Dy	Cg	Dg	Turn	Ar	SI	Cr	Size	Age
Coef.	-25,684	1,802	0,018	-0,490	-0,015	4,694	0,234	1,445	-0,174	2,089
t-stat	-6,026	20,631	1,769	-1,417	-3,646	6,876	4,018	6,632	-0,643	3,585
(p-value)	0,000	0,000	0,078	0,158	0,000	0,000	0,000	0,000	0,521	0,000
VIF		1,750	1,167	1,437	1,514	2,667	1,917	1,892	1,094	1,652
$\overline{R^2}$	0,645						F-stat	58,555	0,000	
SEreg	27143,8						DW	1,915		
SSRes	14215,8						# Obs	285		

Where,

Dy - Dividend yield; Cg - Capital Gains; Dg - Management Expenses; Turn - Turnover; Ar - Restricted Assets; SI - investor sentiment, measured by the beta coefficient (as a result of the application of eq. 3.4), Cr - replication cost, measured by the residual variance of eq. 3.5, as suggested by Gemmill and Thomas (2002), Age - Age, measured by the logarithm of fund age; Size - size, measured by the logarithm of fund market capitalization, during the analyzed period; VIF - Variance Inflation Factor; SE.reg. - Standard error of Regression; SSRes. - Sum of squared residuals; DW - Durbin-Watson Statistics, F-stat. - F-statistic with F-Snedecor distribution with p and $(np-1)$ degrees of freedom; # obs. - Number of observations.

Analyzing the results shown in Table 4.1 (Panel A and B), we observe that the variables: dividend yield (Dy), the proxy for dividend policy, have positive regression coefficient (as expected) and are statistically significant to a significance level (s.l.) of 5% in any of the models considered. The turnover ratio is also statistically significant, with a s.l. of 5% and a negative coefficient (as expected) in any of the models considered. Surprisingly, the variable "restricted assets" (Ar) showed positive and statistically significant, in general, that not allow us to validate the hypothesis H₃, indicating that the illiquidity of the underlying assets in the fund's portfolio helps to reduce the discount, which do not seems "reasonable" of rational point of view. This seems to contradict the assumption of those authors that defends the preference for liquidity hypothesis as explanation of closed-end fund discounts¹⁰.

Regarding the variables, investor sentiment and replication cost, are statistically significant, in any model considered, but the sign of the coefficients is contrary to the expected (according to the hypothesis formulated, respectively, H₅ and H₆). Note that for the calculation of the variable "replication cost", as described in Section 3, we used linear regressions of fund's return NAV on the fund market return, considering for that market indexes more specific to different categories of closed-end funds, in accordance with its investment policy¹¹. These results seem to indicate that these factors will be relevant to

¹⁰ These results may perhaps be justified by how it was built (and set) the variable and lack of using a better proxy for measuring the liquidity of funds, such as Bid-ask spread or trading volume of fund or other.

¹¹ Interestingly to note is that some of the funds that are classified as bonds (or fixed income securities) or by Wiesenberger or currently by Lipper, Inc., had very low coefficients of determination when it was considered a bond market index return. This result raised suspicion that, eventually, these funds were misclassified, which was confirmed when we analyzed the composition of the fund's portfolio over time. We observed that funds had changed their investment strategy, reducing the weight of investment in bonds to stocks and other assets but

explain the level of discounts but, unexpectedly, their relationship with the level of discounts will be opposite to the assumption.

Given the quality of models fit ($\overline{R^2}$) presented, the variable "management expenses" seems to be a better indicator of the relationship between discounts and agency costs. This variable has a negative coefficient, as expected in H₂, but no statistically significance (at s.l. 5%). Thus, the results show that the rational factors: dividend policy, agency costs and liquidity will be relevant to justify the discount rate, its cross-sectional structure. As for behavioral factors, the results suggest that these may be relevant to the explanation of discounts, going against the results obtained by other researchers as Gemmill and Thomas (2002) and Wang (2003a,b) as well as Monte and Armada (2007, 2008) and Monte (2008).

In the next section we analyze if the structure of explanatory factors of discounts, as a whole, differs according to the category of funds, taking into account the general classification according to the portfolio composition in equity funds and bond funds.

4.3. Multivariate analysis of explanatory factors of the closed-end funds discounts, by funds category.

To make this analysis we divided the sample into equity funds and bond funds. In the first group were included all funds that invest primarily in US domestic equity securities (also known as domestic funds) or in shares of companies from other countries, specialized or diversified. In the second group was considered funds that invest in corporate bonds or other fixed income securities including those that invest in bonds issued by governments and regional and federal entities (known as Munibond funds). Similar to the previous analysis, for the total sample for the 1994-98 period, we used multiple linear regressions with the weighted least squares method (using as a weighting factor the volatility of funds' discounts). It was also considered two models of regression equation because proxies of agency costs can be highly collinear. The assumptions of the model of multiple linear regressions, namely the normal distribution, homogeneity and independence of errors were tested. The first two assumptions were validated graphically and independence has been validated with the statistic Durbin-Watson, as said previously. To detect possible multicollinearity problems we used the VIF and eliminate the outliers' observations we applied the same procedure described above. The table below shows the results for these regressions for each type of funds, by general category as given by funds investment policy (bonds and equity funds).

continued to be classified as bonds (fixed income). In such cases, because the coefficient of determination was higher and taking into account the portfolio composition, we considered the linear regression not with a bond index but with a stock index return.

Table 4.2: Summary of multiple linear regressions (Equation 3.1) in the period 1994-98, by fund category

Panel A - Model 1: WLS Regression, with management fee variable as proxy for agency cost.

Fund category	Explanatory Var.	C ₀	Dy	Cg	Mf	Turn	Ar	SI	Cr	Size	Age
Bonds	Coef.	-31,593	2,136	0,097	1,924	-0,013	5,948	0,409	0,394	-0,315	2,710
	<i>t-stat</i>	-7,303	13,036	0,982	1,311	-3,196	8,464	6,808	0,933	-1,199	4,172
	(<i>p-value</i>)	0,000	0,000	0,327	0,191	0,002	0,000	0,000	0,352	0,232	0,000
	VIF		2,777	1,449	1,221	1,678	2,525	1,394	1,920	1,044	1,458
	$\overline{R^2}$	0,583							F-stat	37,619	0,000
	SE.reg	15064,8							DW	1,930	
	SSRes	10100,6						# Obs	236		
Equity	Coef.	-39,094	2,023	0,004	3,407	0,000	0,774	0,014	1,859	1,205	1,187
	<i>t-stat</i>	-3,883	7,981	0,309	1,597	0,008	0,589	0,149	6,248	1,396	0,974
	(<i>p-value</i>)	0,000	0,000	0,759	0,118	0,993	0,559	0,882	0,000	0,170	0,336
	VIF		3,784	1,909	3,283	2,256	2,465	2,165	1,832	1,534	2,668
	$\overline{R^2}$	0,744							F-stat	16,863	0,000
	SE.reg	7343,1							DW	2,004	
	SSRes	1935,4						# Obs	49		

Panel B - Model 2: WLS Regression, with management expenses variable as proxy for agency cost.

Fund category	Explanatory Var.	C ₀	Dy	Cg	Dg	Turn	Ar	SI	Cr	Size	Age
Bonds	Coef.	-32,203	2,257	0,143	-0,012	-0,101	6,521	0,305	0,083	-0,224	2,617
	<i>t-stat</i>	-6,644	13,825	1,453	-2,976	-0,286	7,928	4,050	0,187	-0,826	3,705
	(<i>p-value</i>)	0,000	0,000	0,148	0,003	0,775	0,000	0,000	0,852	0,410	0,000
	VIF		2,729	1,430	1,609	1,510	3,394	1,643	2,103	1,075	1,719
	$\overline{R^2}$	0,584							F-stat	37,277	0,000
	SE.reg	14923,7							DW	1,895	
	SSRes	9964,1						# Obs	233		
Equity	Coef.	-29,958	1,774	0,000	0,009	0,248	0,611	0,048	1,827	1,038	0,296
	<i>t-stat</i>	-2,747	7,616	-0,010	0,417	0,133	0,438	0,464	5,728	1,169	0,222
	(<i>p-value</i>)	0,009	0,000	0,992	0,679	0,895	0,664	0,645	0,000	0,249	0,825
	VIF		3,005	2,054	2,351	4,278	2,611	2,384	1,979	1,527	3,003
	$\overline{R^2}$	0,728							F-stat	15,595	0,000
	SE.reg	7220,7							DW	2,078	
	SSRes	2057,9						# Obs	49		

Where,

Dy - Dividend yield; *Cg* - Capital Gains; *Dg* - Management Expenses; *Turn* - Turnover; *Ar* - Restricted Assets; *SI* - investor sentiment, measured by the beta coefficient (as a result of the application of eq. 3.4), *Cr* - replication cost, measured by the residual variance of eq. 3.5, as suggested by Gemmill and Thomas (2002), *Age* - Age, measured by the logarithm of fund age; *Size* - size, measured by the logarithm of fund market capitalization, during the analyzed period; VIF - Variance Inflation Factor; SE.reg. - Standard error of Regression; SSRes. - Sum of squared residuals; DW - Durbin-Watson Statistics, F-stat. - F-statistic with F-Snedecor distribution with *p* and (*np*-1) degrees of freedom; # obs. - Number of observations.

An analysis of the previous table (panel A and B), it appears that, for bond funds, dividend yield variable, a proxy of dividend policy, liquidity (as measured by the variable "restricted assets") and the behavioral variable "investor sentiment" are statistically significant, although not always with the sign as provided in the assumptions made in Section 3, and consequently these hypotheses (respectively, H₁, H₃ and H₅) seem to be validated by any of the models under discussion. The agency costs variable, as measured by "management expenses" proxy (model 2) is statistically significant and has a negative sign as provided in the formulation of

H₂. The variable "Turnover" is also statistically significant and negative, as expected, for the bond funds (Model 1).

For equity funds, the variable "dividend yield" (proxy of dividend policy) is statistically significant and signed in the same direction as postulated in the hypotheses in Section 3 (hypothesis H₁). So these seem to be validated by any models considered and the behavioral variable "replication cost" does not display, though, the coefficient sign as expected. The remaining variables are not statistically significant in any of the analyzed models.

Comparing the two models, and each group of funds, it seems to us that model 2 (which consider management expenses as a proxy for agency cost) is that better explains the structure of the discounts level for bond funds, while for the equity funds model 1 (with agency costs represented by the management fee) seems to be the best, given the determination coefficient ($\overline{R^2}$). Having regard to the above, it seems that there is slight difference between the factors that may explain the existence of discounts in bond funds and equity funds. For the former, dividend policy, agency costs (measured by management expenses), liquidity/portfolio composition and the behavioral factors, including investor sentiment, seems to be the most significant factors. For equity funds, the variables of dividend policy (measured by dividend yield) and replication cost (limits to arbitrage) are the most significant.

4.4. Rational and behavioral factors that explain closed-end funds discounts, by discriminant analysis.

Since it was found in the previous subsection that, upon the closed-end funds category, closed-end funds discounts may be explained by different factors, i.e., the explaining factors structure of discounts varies according to whether the equity funds or bond funds. In this point, we investigate, using discriminant analysis, which potentially explanatory factors of discounts may discriminate equity funds of bond funds. The assumptions of discriminant analysis (normality, linearity and multicollinearity) were initially tested, as well as the assumption of homogeneity of the variance-covariance matrix for all groups. With the exception of variable size, all other variables reject the null hypothesis of normality of their distributions¹². The M-Box test rejects the hypothesis of homogeneous variance-covariance matrix. This rejection may be due to the fact that some variables do not follow the normal distribution even after transformation of variables. It should be noted that Maroco (2007) also mentions that the discriminant analysis is quite robust to assumptions violations since the size of the smallest group is greater than the number of variables under investigation and the groups mean are not proportional to their variance, as stated Section 3. This is what we have in our sample data. However, as suggested by Hair, Anderson, Tatham and Black (1998),

¹² Eisenbeis (1977) states that economic and financial data often do not have normal distributions (even transforming the variables). He argues that we can proceed with discriminant analysis relaxing this assumption but taking into account that the tests have less predictive power.

since there is high discrepancy between the groups size, we proceed with discriminant analysis making the appropriate adjustments in the level of significance¹³.

According to the determinant of the variance-covariance matrix of the equity funds group, which is the smallest group, it has higher variance and therefore we consider significance levels above 5%. Given the test of equality of means between groups, the dividend yield, capital gains, management fees, investor sentiment, replication cost and age have significant differences in means between groups.

By application of the stepwise procedure, using as a criterion for variable selection method of the Wilks' Lambda, by the SPSS software (v. 16, SPSS Inc, Chicago, IL), we obtained a discriminant function as we have under analysis only two groups. The standardized canonical and unstandardized discriminant coefficients are presented in the following table.

Table 4.3: Coefficients of the discriminant function (canonical) extracted

Variable	standardized	unstandardized
Dy	,799	,353
Turn	,212	,003
Mf	-,467	-2,261
Ar	,574	1,167
Cr	-,432	-,520
Age	-,242	-,510
Const		,809

Where: *Dy* - Dividend yield; *Turn* - Turnover; *Mf* - Management fee; *Ar* - Restricted Assets; *Cr* - replication cost, as measured by the residual variance of eq. 3.5, as suggested by Gemmill and Thomas (2002); *Age* – fund's age, measured by the logarithm of age of the fund during the analyzed period; *Const.* - Constant.

As can be seen in the previous table, the variables dividend yield, turnover, management fee, restricted assets, replication costs and age are significantly discriminating funds, according to their category. The discriminant function has a canonical correlation of 0.7 and is highly significant. Since the squared canonical correlation indicates the proportion of discriminant function variance is explained by the groups (Pestana & Gageiro, 2003), 49% of the discriminant function variance is explained by the groups. Yet, as our aim is to identify the variables that contribute most to discriminate the funds under its generic category, we must analyze the structure matrix that highlights the contribution of each variable to the discriminant function, as it can be observed in the Table 4.4.

¹³ Hair, Anderson, Tatham and Black (1998:348) suggest that when the homoscedasticity in the variance-covariance matrix persists, even after carrying out variables transformations and there is a marked discrepancy between the groups size (a difference of more than 1,5) adjustments should be made to its effects. First you must analyze which group has higher variance, using the determinant of the variance-covariance matrix. If the highest variance is recorded in the larger group, the differences should be analyzed using a lower significance level (e.g. 3% instead of the normal 5%), if the variance is higher in the smaller group, a higher alpha should be used.

Table 4.4: Matrix structure

Variable	Function loadings
Dy	0,568*
Mf	-0,484*
Cr	-0,461*
Si ^a	0,291
Age	-0,233
Cg ^a	-0,229
Dg ^a	-0,159
Ar	0,101
Turn	0,033
Size ^a	0,014

a. This variable was not used in the analysis.

Where: *Dy* - Dividend yield; *Cg* - Capital Gains; *Mf* - Management fee; *Dg* - Management Expenses; *Turn* - Turnover; *Ar* - Restricted Assets; *SI* - investor sentiment, measured by the beta coefficient (as a result of the implementation of eq. 3.4); *Cr* - replication cost, measured by the residual variance of eq. 3.5, as suggested by Gemmill and Thomas (2002); *Age* – fund age, measured by the logarithm of fund age, in the analyzed period; *Size* – fund size, measured by the logarithm of fund market capitalization during the analyzed period.

The variables that contribute most to the discriminant function (identified with the asterisk symbol) are dividend yield, management fee and replication cost. The classificatory discriminant function (Fisher's Linear Discriminant Function) is as follows:
 $G(bonds) = -112481 + 3.722 Dy + 0.055 Turn + 33.463 Mf + 29.959 Ar - 1.322 Cr + 35.320 Age$
 $G(equity) = -116684 + 2.818 Dy + 0.046 Turn + 39.257 Mf + 26.969 Ar + 0.011 Cr + 36.628 Age$

The following table (Table 4.5) presents the classification statistics, noticing that the percentage of funds classified correctly with the original classification was 91.6%.

Table 4.5: classification results

			Predicted Group Membership		
			Bond	Equity	Total
Original	Count	Bond	227	10	237
		Equity	14	36	50
		Ungrouped cases	1	1	2
	%	Bond	95,8	4,2	100
		Equity	28	72	100
		Ungrouped cases	50	50	100

These results, while keeping in mind that we are not directly examining the relationship between the factors that potentially explain the closed-end funds discounts, seems to support is the difference in the explanatory factors structure found in the previous subsection when we examined whether there was difference among funds as they were classified as equity or bonds funds. It should be noted that we cannot compare the results obtained in the discriminant analysis with those of other research, as far as we know so far, this technique had not been used by other researchers or empirical researches in the classification of closed-end investment funds.

5. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH.

The issue of closed-end investment funds discounts (premiums), although a subject widely studied and discussed by academia and industry, continues to cause perplexity and further research. To explain its existence and persistence some theoretical models and approaches have been emerged. Those theories and approach based on so-called rational factors (such as the dividend policy, agency costs, liquidity, performance management, among others) are the most advocated ones as well as those based on behavioral factors (like the investor sentiment theory, the asymmetric information and arbitrage limits).

The rational theories (and variants) seem to be able to explain (not completely) the existence of discounts, but not always the existence of premiums or its behavior at an IPO or an open-ending operation. However, there are some so-called rational factors that seem to have some economic and statistical significance in explaining the behavior cross sectional discounts (premiums). These factors are: the characteristics of the fund's portfolio (the existence of restricted assets, illiquid or foreign), the dividend policy (distribution of dividends and unrealized capital gains), and the agency costs (as we could see from the literature review presented in section 2).

The second theoretical framework, especially the investor sentiment theory, seems to fit nearly every aspect of the puzzle, looking not only explain the existence of discounts but also premiums and their behavior across funds and over time. The investor sentiment theory is based on the notion of rational and informed investors versus poorly informed and irrational investors (the noise traders) and how this type of investors affects asset prices. The noise traders risk results from the optimistic or pessimistic reaction of noise traders that makes unpredictable the resale price of assets. It may limit the activities of arbitrageurs since noise traders' opinion can change (or to become even more extreme) during the arbitrage strategies implementation period by rational investors, thus imposing an additional risk. As a result, closed-end funds should, on average, sell at a discount to compensate for the associated noise traders risk, according to this argument. However, some researchers have criticized and found no explicit and precise empirical evidence, especially as investor sentiment is an unobservable variable that is inevitable the use of proxies. More recently a latest framework emerged that we call the hybrid framework, combines rational and behavioral factors to explain the puzzle (see Gemmill & Thomas, 2000 and Wang 2003a, b).

On the basis of brief review of the literature and empirical papers published to date addressing this issue, and having as theoretical framework the hybrid theories, this paper aimed to test the statistical significance of rational and behavioral factors that have been submitted by rational and behavioral approaches to explain the level of closed-end funds discounts (or premiums). That is, it intended to investigate which factors, commonly mentioned by the literature, can explain the existence and persistence of discounts, its cross-sectional structure. This work is innovation, as noted above, by the fact that it does not employ a single and simple proxy of investor sentiment, as has generally been used by most authors (which often used as investor sentiment indicator the weighted average domestic closed-end funds discounts, in particular in research related to behavioral factors that

influence the discounts) but a composite index of investor sentiment. In this paper we used the composite index of investor sentiment suggested by Baker and Wurgler (2006), which had not yet been tested, as far as we know, as an explanatory factor on the discounts level.

The empirical results allow us to find evidence supporting the hybrid approach, particularly in the US closed-end funds market. The variables dividend yield, turnover ratio, restricted assets, investor sentiment and replication cost (limited to arbitration) showed statistical significance in cross-sectional multivariate linear regression analysis in the period 1994 to 1998, considering a diversified sample of 346 US closed-end investment funds (it contained several categories of funds: stocks, bonds, tax-exempt Municipal bonds and international funds). These results confirm previous work carried out by Monte and Armada (2007, 2008), Monte (2008) as well as those of Gemmill and Thomas (2002) and Wang (2003a, b).

As we have a relatively diverse sample, we proceeded to a discriminant analysis of data in order to address the other goal we set ourselves: if the closed-end funds can be distinguished taking into account the potential explanatory variables of the closed-end funds discount structure (or premiums) most commonly provided (as a result of the literature review) and which best discriminate the groups of funds. As mentioned earlier, this methodology has not yet been used in other studies by other authors on closed-end funds discounts. The results show that the so-called rational variables, dividend yield and management fee, as well as the behavioral variable replication costs (limits to arbitrage) are the variables that contribute most to the discriminant function between groups of equity and bond funds. Even though one cannot establish a direct link between the discriminant analysis and multivariate regressions results, it seems that these results suggest that the so-called rational and behavioral factors are relevant for explanation of US closed-end fund discounts and that structure factors may differ depending on the category of funds (have different weights), thus corroborating the arguments put forward by the hybrid framework.

The results for the behavioral factors, whose regression coefficients were statistically significant but positive, contrary to expectations, in keeping with the arguments in favor of these factors suggest that it should continue to investigate these relations, finding more explicit and complete proxies, that combine direct methods (investors surveys) and indirect (indicators from the markets operation), for these variables, and in particular for the unobservable variable of investor sentiment. The variables concerning the portfolio composition and liquidity (turnover and restricted assets) also need to find better proxies. We may suggest, for example, the use the liquidity spread between fund shares and the underlying securities of fund's portfolio (due to budget constraints, these data were not obtained, so it was not possible to test this new variable).

Another interesting question to consider in future is whether the discounts vary significantly depending on the fund category and what are the distinguishing characteristics (including the structure of factors explain the discounts level) of those funds that are at a premium, those who are moderate and higher discount level.

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Annex

Table A.1: Hypothesis to test the factors that potentially explain the existence, persistence and variation of discounts (premiums) between closed-end funds.

Explanatory Factors:	Hypothesis to test:
Dividend policy and potential tax liabilities	H ₁ : there is a negative relation between the level of closed-end fund discount and the dividend policy, i.e., when the dividend distribution raises (as given by payout ratio or as a proxy, the dividend yield), the discount level decreases. So, in terms of linear regression coefficient, $\beta > 0$.
Agency costs	H ₂ : there is a positive (negative) relation between the level of closed-end fund discount and management expenses (or management fee), i.e., as higher management expenses (or management fee) higher (lower) the discount (premium) level. This imply that, in terms of linear regression coefficient, we expect a negative coefficient: $\beta < 0$.
Liquidity and <i>turnover</i>	H ₃ : there is a positive (negative) relation between the proportion of restricted assets and the level of discounts (premiums), i.e., higher the proportion of restricted assets higher (lower) the level of discounts (premiums). Though, in terms of linear regression: $\beta < 0$. H ₄ : there is a positive relation between the turnover ratio and the level of discounts, i.e., higher turnover ratio higher (lower) the discount (premium) level. So, in terms of linear regression coefficient, we expect a negative coefficient, $\beta < 0$.
Investor sentiment risk do and arbitrage limits	H ₅ : there is a positive relation between investor sentiment risk and the discount/premium level, i.e., higher fund sensitivity to investor sentiment higher (lower) the discount (premium) level. Thus, in terms of linear regression coefficient, $\beta < 0$. H ₆ : there is a positive relation between discounts (premiums) and the difficulty of fund replication, i.e., higher the replication costs higher (lower) the discount level. Thus, in terms of linear regression coefficient, $\beta < 0$.
Other factors (size and age)	H ₇ : there is a negative relation between fund size and discounts (premiums), i.e., bigger funds should present lower (higher) level of discounts (premiums). Therefore, in terms of linear regression coefficient, $\beta > 0$. H ₈ : There is a positive relation between fund age and discounts (premiums), i.e., younger funds should present lower (higher) level of discounts (premiums). Consequently, in terms of linear regression coefficient, $\beta < 0$.

Table A.2. – Characterization of the sample of U.S. closed-end funds during the period 1/01/1994 to 31/12/1998.

Total Number of Funds	BD-Weisenberger		Sample				
	662		346				
Classification by investment goal (simplified)	Total	%	Total	%			
Muni Bond	250	37.8%	149	43.1%			
Fixed Income	141	21.3%	93	26.9%			
General equity	36	5.4%	21	6.1%			
Global & International	143	21.6%	58	16.8%			
Others	92	13.9%	25	7.2%			
Classification by category							
Fixed Income - taxable	248	37.5%	159	46.0%			
Fixed Income – tax-exempt	171	25.8%	92	26.6%			
General equity	61	9.2%	38	11.0%			
Global/International Equity	127	19.2%	52	15.0%			
Others	55	8.3%	5	1.4%			
Number of Closed-end funds IPO in (year):							
1994	44		--				
1995	3		--				
1996	30		--				
1997	8		--				
1998	33		--				
Number of extinct funds due to open-ending operations in (year):							
1995	8		--				
1996	4		--				
1997	9		3				
1998	10		5				
For all funds in CDA/Weisenberger database, for 1994-1998 period and without adjustment to time series.							
Year	Average Discount	Median	Variance	standard deviation	Max.	Min.	# Obs.
1994	-3.87	-4.71	71.55	8.46	100.26	-37.14	26496
1995	-7.21	-7.99	67.80	8.23	70.92	-38.96	26413
1996	-6.67	-6.94	69.31	8.33	37.80	-42.56	26775
1997	-5.19	-5.57	91.37	9.56	81.10	-42.48	26048
1998	-3.05	-3.61	147.85	12.16	155.42	-42.48	26002
1994-98	-4.40	-5.16	87.47	9.35	138.97	-34.91	88075

source: based on CDA-Weisenberger data.