



## **ASHESI UNIVERSITY**

### **AN EMPIRICAL ANALYSIS OF THE IMPACT OF MACROECONOMIC FACTORS ON OPEN-END MUTUAL FUND PRICES IN GHANA**

By

Mark Stephen Coffie

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Supervised by Mr. Anthony Essel-Anderson

April 2019

**DECLARATION**

I hereby declare, that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: .....

Candidate's Name: Mark Stephen Coffie

Date: 23<sup>rd</sup> April 2019

I hereby declare that the preparation and presentation of dissertation were supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University.

Supervisor's signature: .....

Supervisor's Name: Mr. Anthony Essel-Anderson

Date: 23<sup>rd</sup> April 2019

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### ABSTRACT

It is conventional knowledge that changes in macroeconomic risk factors have significant impact on the capital markets (Bali, Brown & Caglayan, 2014). Mutual funds primarily invest in the capital markets (Fairley, 1999); hence it is expected that these systematic factors will have a bearing on their prices. The nexus between macroeconomic factors and mutual funds have been explored extensively for developed markets (Marfo, 2017; Ansong, 2013), however, the evidence is weak for frontier markets like Ghana. The lack of compelling evidence for Ghana is inconceivable as it is a very critical relationship especially for emerging and frontier markets due to their massive response to changes in macroeconomic policy (Muradoglu, Taskin and Bigen, 2000). To fill this gap, this study empirically investigates the relationship between macroeconomic factors and mutual fund prices in Ghana.

Based on the literature, macroeconomic variables considered for the study are quarterly data on interest rates, inflation rates, exchange rates, broad money supply (M2) and real GDP covering the period from 2007 to 2017. This study uses a short-run Autoregressive Distributed Lag model to estimate the relationship. The study reveals that interest rates, inflation rates, money supply and real GDP are insignificant determinants of variations in mutual fund prices. The lagged values of fund prices and exchange rates were found to be the significant determinants of mutual fund prices in Ghana. A plausible reason for this result is that the Ghanaian mutual fund industry has failed to price in risks emanating from changes in interest rate, inflation and money supply variations.

*Keywords:* mutual fund prices, macroeconomic factors, Autoregressive Distributed Lag (ARDL) model.

**LIST OF ACRONYMS**

<b>Acronym</b>	<b>Meaning</b>
MF	Mutual fund
NAV	Net Asset Value
PP	Phillips-Perron
GSS	Ghana Statistical Service
BOG	Bank of Ghana
ARDL	Autoregressive Distributed Lag
AIC	Akaike Information Criteria
Real GDP	Real Gross Domestic Product
CPI	Consumer Price Index
FINSAP	Financial Sector Adjustment Program
SEC	Securities and Exchanges Commission

**DEFINITION OF TERMS**

**ACTIVE MANAGEMENT:** Active management is a portfolio management style that is based on the premise that with an efficient portfolio management strategy, portfolios could outperform broad market indices. It involves analytical research, forecasts, tactical asset allocation decisions and frequent portfolio rebalancing aimed at reducing risk exposure and making substantial risk-adjusted returns (Fabozzi, 1998).

**PASSIVE MANAGEMENT:** A portfolio is either managed using an active management style or a passive style. Passive management is based on the premise that active management tends to underperform the market, hence it involves matching the risk/return profiles of underlying market indices (Fabozzi, 1998).

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## CHAPTER ONE: INTRODUCTION

### 1.1. BACKGROUND

Global collective investment schemes have recorded explosive growth over the past decades led by mutual funds, unit trusts, and hedge funds (Hubbard and Koehn, 2010; Ferreira, Keswani, Miguel and Ramos, 2012). The active management industry began by experiencing a period of creeping growth in the 1920s (Fernando et al., 2003; Ferreira et al., 2012) on the back of stalling economic activity leading up to the great depression of the 1930s (Fernando et al., 2003). However, there was an upsurge in growth after the 1970s pointing to a boom in global capital markets which rendered equity, money-market and balanced funds very attractive (Fernando et al., 2003). The Investment Company Institute (ICI) contends that assets under Management (AUMs) of worldwide open-end mutual funds stood at a staggering \$49.39 trillion at the end of the second quarter of 2018 (Investment Company Institute, 2003). The key driver of the global mutual fund industry expansion has been the persistent increase in demand for investment vehicles that can minimize the risk exposure of investors while producing risk-adjusted returns well above the market returns (Ferreira et al., 2012).

The development of Ghana's capital markets and the subsequent growth in the collective investment scheme industry stems from the introduction of the financial sector reform program (FINSAP) in 1987 (Marfo, 2017). FINSAP spearheaded the gradual liberalization of Ghana's financial sector by enhancing the stability of banks through reforms that focused on restructuring distressed bank and non-bank financial institutions; enhancing deposit mobilization and expanding the scope of the Ghanaian capital markets (Aryeetey & Kanbur, 2017). The establishment of the Securities and Exchanges

Commission and the enactment of the Securities Industry Law, 1993 (P.N.D.C.L 333) formally set up collective investment schemes (Marfo, 2017). The open-end mutual fund and the unit trust industry, which are the dominant collective investment schemes in Ghana, have seen a massive surge in growth over the years. Per the Securities and Exchanges Commission, AUMs of open-end mutual funds in Ghana increased by approximately 54 percent at the end of 2017 from GHS 20.15 billion in 2016 to GHS 31.06 billion compared to an increase of 48 percent at the end of 2016 (Securities and Exchanges Commission, 2017). In that same year, the net asset value of collective investment schemes increased significantly by approximately 92 percent, while funds managed by pension funds surged by approximately 63 percent (Securities and Exchanges Commission, 2017). The mutual fund industry is increasingly gaining widespread attention from investors due to the diversification, professional management, tax exemption, flexibility and risk-adjusted return benefits it offers to both retail and institutional investors who are keen on enhancing their risk-adjusted returns (Marfo, 2017).

Moreover, the massive flows to mutual funds in Ghana over the past years has also been strongly driven by the advent of product lines and services that caters to the investment needs of a broader spectrum of institutional and retail investors (Marfo, 2017). By providing liquidity, lower downside risks due to pooled risk-taking and promising upside potential, which is limited with direct investment in the capital markets, investors are increasingly showing patronage for the collective investment scheme industry in Ghana (Ansong, 2013).

### **1.1.1. THE MUTUAL FUND INDUSTRY IN GHANA**

A mutual fund is a public or external company incorporated solely to hold and manage securities and other financial assets on behalf of investors (retail and institutional) (Securities and Exchanges Commission, 2017). The company receives funds from investors and invests in the capital markets with those funds (Fairley, 1999). The mutual fund industry in Ghana is regulated by the Securities Industry Act 2000 (Act 590), which is administered and enforced by the Securities and Exchanges Commission (SEC). The industry consists of equity, money market funds, balanced funds, and Real Estate Investment Trusts (REITs). Each of these schemes allocate assets to specific asset classes and securities consistent with their investment objectives while efficiently managing them to generate alpha for their investors and mitigate risks (Hasleem, 2010). Majority of the mutual funds in Ghana are actively managed since they employ portfolio management strategies that involve a combination of investment analysis, asset allocation, portfolio rebalancing, etc. as opposed to passive funds which track broad indices (Bodie, Kane & Marcus, 2008).

Open-end mutual funds are the commonest type of investment companies in Ghana. Open-end funds employ professional managers to manage a portfolio of assets on behalf of their clients with a specific set of investment objectives and strategies (Hasleem, 2010). A very crucial distinction between open-end mutual funds and closed-end mutual funds is that the former can issue an unlimited number of shares to the public (Fairley, 1999) while the latter can only issue a limited number of shares to the public which allows them to trade on the Stock Exchange (Hasleem, 2010). Also, Open-end mutual funds stand ready to buy back shares from investors at the net asset value (NAV)

(Bodie et al, 2008). This implies that when investors are willing to redeem their mutual fund shares, they return them to the mutual fund company for cash instead of selling them on the secondary market as it is done with closed-end mutual funds (Securities and Exchanges Commission, 2012). Investors of open-end and closed-end mutual funds benefit immensely since mutual funds generally provide greater liquidity, diversification, accessibility, professional management, and are relatively affordable (Fairley, 1999). The risk of investment is primarily borne by investors, and it becomes significant during periods of a market slowdown or recession (Hasleem, 2010; Marfo, 2017). On the other hand, investors receive a significant risk-adjusted return on their investment when the assets under management record strong performance due to favorable market conditions (Marfo, 2017).

### **1.1.2. MACROECONOMIC FACTORS**

Macroeconomic variables are broad indicators of economic growth and stability. They include interest rates, inflation rates, exchange rates, GDP (real and nominal), money supply, balance of payments, etc. (Brinson, Singer & Beebower, 1991). These macroeconomic factors have seen dramatic variations in Ghana over the past years. Per Bank of Ghana's historical time series data, interest rates in Ghana have increased by more than 48 percent between 2012 and 2016 alone. According to the same dataset, it is observed that interest rates have been on a declining streak since its highs in 2016 shedding more than 35 percent between 2016 and mid-2018 on the back of the Government of Ghana's fiscal discipline agenda (Ansong, 2013). Year-on-year inflation rate as measured by CPI has also surged by approximately 66 percent between 2012 and 2016 based on Bank of Ghana's historical CPI values. However, like interest rates they

have steadily declined from their 2016 highs (Ghana Statistical Service, 2018). Ghana's economic growth measured by real GDP growth has stalled for the past few years. A report by the Institute of Statistical, Social and Economic Research (ISSER) in 2014 revealed that Ghana's all-time GDP growth of 14 percent was not sustainable as GDP growth rate in 2014 (about 4.2 percent) was well below the Sub-Saharan African (SSA) average of 5 percent. GDP growth continuously declined to approximately 3.7 percent in 2016, the lowest in over two decades (ISSER, 2016) signaling a weakening economic growth. By observing historical exchange rate figures from BOG, it is observed that Ghana's currency has depreciated on average against a basket of the major currencies over the years led by the U.S dollar on the back of strong economic fundamentals.

## **1.2. PROBLEM STATEMENT**

It is widely accepted that prices of risky assets are exposed to macroeconomic risk factors (Ross, 1984; Sharpe, 1964; Lintner, 1965 etc.). Peiro (2015) contends that industrial production and long-term interest rates are significant variables that account for approximately one-half of annual variations in stock prices. The short-run and long-run explanatory power of exchange rates, inflation rates, commodity prices and money supply on capital market returns are also supported by Ross et al. (1986); Solnik, (1987); Smith, (1992) and Agarwal et al., (1981); Talla (2013) and Humpe & Macmillan (2007). Hence, it is logical to assume that the prices of mutual funds equally have significant exposure to these macroeconomic risk factors since they invest primarily in the equity and debt markets (Fairley, 1999). As a result, interactions between mutual funds and macroeconomic factors have been explored extensively for developed and emerging markets. Studies by Ferreira et al. (2012); Indro et al. (1999); Yadav et al. (2016) and



Elton et al. (1995) have indicated that the data supports the hypothesis that mutual funds have a significant correlation with movements in macroeconomic factors.

However, the evidence is inconclusive and weak for frontier markets like Ghana. Studies by Boahene (2015) and Marfo (2017) have shown that macroeconomic factors seem to have a bearing on Ghana's mutual fund performance, but they only explored the relationship as case studies of specific mutual funds. Studying this critical relationship as a case study renders generalization and inference of study results problematic (Bonett & Wright, 2011). The lack of compelling evidence on the interactions between open-end mutual funds and macroeconomic variables in Ghana is particularly unbelievable. As maintained by Muradoglu, Taskin and Bigen (2000), such links are very crucial for frontier markets owing to the staggering influence of governments in economic activity. Frontier markets like Ghana have a relatively younger capital markets, lower liquidity and lower level of informational efficiency compared to developed markets, hence capital markets are highly responsive to changes in macroeconomic policy (Bekaert & Harvey, 1998). Therefore, further studies are needed to gain a better understanding of the nexus between mutual fund prices and macroeconomic factors. In this regard, this study fills this gap by empirically exploring the impact of macroeconomic factors on mutual fund prices in Ghana.

This study is pertinent and timely given the current surge in the Ghanaian open-end mutual fund industry regarding fund flows and the growing need for investors and policymakers to be aware of the impact of the dramatic movements of some macroeconomic indicators on mutual fund prices in order to make more informed decisions.

### **1.3. RESEARCH QUESTION**

The result of this study will provide evidence to support an answer to the question: are mutual fund prices impacted by movements in macroeconomic variables?

### **1.4. RESEARCH OBJECTIVES**

The objective of this study is two-fold: (1) to empirically assess the relationship between macroeconomic factors and mutual fund prices in Ghana; (2) to investigate the direction of the correlation between macroeconomic factors and mutual fund prices, i.e. whether macroeconomic factors affect mutual fund prices positively or negatively.

### **1.5. HYPOTHESIS**

The Arbitrage Pricing Theory (APT) developed by Ross (1984) offers a functional relationship between macroeconomic factors and portfolio returns. The Ross (1984) asserts that portfolios only face systematic risk factors (broad risk factors that affects all asset prices and firms an economy) since unsystematic risk factors (firm-specific risk) can be diversified away without efficient diversification strategies. Moreover, Ross (1984) maintained that the sensitivity of portfolio returns to those systematic factors largely depend on the degree of sensitivity of the portfolio to that factor, which is represented by the portfolio's beta. Based on the APT model, it can be inferred that mutual fund returns and prices are equally correlated with systematic factors (macroeconomic factors). Mutual funds manage portfolios which maintain significant holdings in the equity, debt and derivatives market. As a result, they are faced with significant macroeconomic risks that have the potential to moderate their net asset values. Against this backdrop, this study investigates the impact of macroeconomic factors on prices of open-end mutual funds operating in Ghana by testing the following hypotheses:

H<sub>0</sub>: There is no relationship between mutual fund prices and macroeconomic risk factors in Ghana.

H<sub>1</sub>. There is a relationship between mutual fund prices and macroeconomic risk factors in Ghana.

This can be expressed mathematically as:

$$H_0: (\beta_1, \beta_2, \beta_3, \beta_4, \beta_5) = 0$$

$$H_1: (\beta_1, \beta_2, \beta_3, \beta_4, \beta_5) \neq 0$$

## **1.6. RELEVANCE OF STUDY**

This section expounds the importance of the results of this study to varied stakeholders of the collective investment scheme industry in Ghana.

### **1.6.1. MUTUAL FUND MANAGEMENT**

The results of this study will serve as a decision guide to fund managers of actively managed mutual funds and investment officers of other buy-side firms like pension schemes, unit trusts, endowments etc. Specifically, the findings highlight the most significant macroeconomic factors driving asset prices and portfolio returns in the collective investment scheme industry in Ghana. By indicating the direction of the relationship, active managers will be able to make more informed strategic and tactical asset allocation decisions that will mitigate downside risks and boost fund prices.

### **1.6.2. POLICY MAKERS**

The results of this study will provide a compelling evidence to the Securities and Exchanges Commission, the government of Ghana and BOG about the interactions

between macroeconomic factors and the collective investment scheme industry. With an understanding of this link, policy makers will be able to make more informed monetary and fiscal policy decisions aimed at enhancing mutual fund prices and providing the requisite environment for better performance and enhancing stability in mutual fund Industry. This will go a long way to support the capital preservation and capital growth objectives of investors.

## **CHAPTER 2: LITERATURE REVIEW**

### **INTRODUCTION**

In this chapter, I discuss some of the key theories that underpin the link between mutual fund prices and macroeconomic factors. I also review some empirical studies on the nexus between mutual fund prices and macroeconomic factors in developed markets and frontier markets alike.

### **2.1. THEORETICAL REVIEW**

Asset pricing models provide a framework for explaining portfolio risk and return. The Arbitrage Pricing Theory (APT) developed by Ross (1973) is the most appropriate theory that provides the framework for assessing the interaction between mutual fund prices and macroeconomic factors. However, Markowitz Portfolio Theory (Markowitz, 1952) and the Capital Asset Pricing Model (Sharpe, 1964; Lintner, 1965) are also discussed briefly since they serve as the theoretical underpinnings of the APT model.

#### **2.1.1. MARKOWITZ PORTFOLIO THEORY**

The Markowitz portfolio theory was developed by Harry Markowitz in the 1950s (Myles, 2013). Markowitz's seminal work titled 'Portfolio Selection' formed the foundation for what is now referred to as the 'Modern Portfolio Theory' (Myles, 2013). Markowitz (1952) posited that the two fundamental factors to be considered in constructing a portfolio are expected returns and variance or risk. By assuming that investors consider expected return a "desirable thing" and variance or risk "an undesirable thing", Markowitz (1952) promulgated the idea that investors are typically risk-averse. He further noted that diversification is very paramount in portfolio construction. Hence, an efficiently diversified portfolio eliminates unsystematic risk –

risk factors that are specific to individual securities – if the securities selected are uncorrelated with each other (Markowitz, 1952). However, diversification cannot eliminate systematic risks: broad risk factors that affect all securities. This leads to the reliable conclusion that the performance of an efficiently diversified portfolio is strongly explained by systematic risk factors (Markowitz, 1952).

Markowitz (1952) further opined that the portfolio with the maximum expected return is not necessarily the one with the minimum level of risk. Hence, investors can gain more returns by taking on more risk or reduce risk by giving up some level of expected return, which reaffirmed the widely accepted risk-return tradeoff. The theory further established that faced with the decision to choose between two portfolios; investors should select the portfolio that offers the highest level of expected return for a given level of risk (variance) or the portfolio that provides the lowest level of risk for a given level of expected return (Myles, 2013). Hence, a rational investor will always subscribe to the portfolio with the best risk-return profile. This theory provides the premise that underlies the decisions mutual fund managers take with regards to asset allocation, security selection, and overall portfolio management to generate alpha and reduce risks.

### **2.1.2 CAPITAL ASSET PRICING MODEL (CAPM)**

The Capital Asset Pricing Model (CAPM) was primarily based on the work of Markowitz (1952). The CAPM is the pioneering work that served as the foundation for asset pricing theory. The CAPM was developed independently by William Sharpe (1964) and John Lintner (1965). The model builds on the portfolio theory established by Markowitz (1952). The CAPM specifies a functional relationship between the expected

return and risk of a portfolio. Sharpe (1964) posited that two most important risks that plague portfolios are systematic risk (undiversifiable) and unsystematic (diversifiable) risk, which is consistent with theories expounded by Markowitz (1952). Sharpe (1964) further argued that the market presents an investor with the “price of time: the pure interest rate and the ‘price of risk’: the additional expected return per unit of risk borne. By assuming that all rational investors want to hold the market portfolio, which is affected by systematic risk factors, the model established that for a given portfolio, its expected return is determined by the pure interest rate (risk free rate) and the degree of responsiveness of the portfolio to changes in the market risk premium (Lintner, 1965). Therefore, portfolios which are more responsive to market returns will have higher expected returns than those which are less responsive. Essentially, portfolios that are less affected by systematic risk factors will return the risk-free rate, while those affected by changes in economic activity will “promise appropriately higher expected rates of return” (Sharpe, 1964). The Sharpe-Lintner (1964) CAPM equation is given as:

$$E(R_i) = R_f + [(E(R_M) - R_f)] \beta_{iM}, i = 1, \dots, N. \quad (1)$$

This implies that the expected return on a portfolio  $i$  is the sum of the risk-free rate,  $R_f$ , and a risk premium, which is the product of the asset’s beta,  $\beta_{iM}$ , and the market risk premium,  $(E(R_M) - R_f)$  (Sharpe-Lintner, 1964).

### **2.1.3. ARBITRAGE PRICING THEORY (APT)**

The Arbitrage Pricing Theory (APT) is an extension of the Capital Asset Pricing Model. The APT introduces a multi-factor perspective into the relationship between risk and expected return. It posits that a portfolio’s risk and return are not only determined by its beta against the market risk premium but broadly determined by its sensitivity to

changes in macroeconomic factors including: inflation, Gross Domestic Product (GDP), risk premiums and “the slope of the term structure of interest rates” (Ross, 1984). Hence portfolios with the same CAPM beta will have different degrees of sensitivities to the above-mentioned systematic factors (Ross, 1984). APT recognizes that a plethora of systematic factors could have a toll on the variability in returns of a portfolio, but it focuses on the significant macroeconomic that have high explanatory power on returns of large portfolios (Ross, 1984). Mostly, the principal determinants of actual or expected portfolio returns are systematic risk factors (Ross, 1984). Even though all portfolios are faced with the same systematic risks, they perform differently due to their different levels of exposure to those systematic risk factors (Ross, 1984).

An important contribution of the APT model is the reaffirmation of the law of one price. Ross (1984) submitted that two similar assets or two identical portfolios with the same expected return and sensitivity to systematic risk factors in an efficient market must sell for the same price. Otherwise, when there is a discrepancy in their prices, investors will earn arbitrage profit by buying the asset in the market with the cheaper price and selling it at the high-priced market. In the long-run, benefits from the riskless arbitrage will be eliminated and there will be an equilibrium in prices across markets (Ross, 1984). The Arbitrage pricing theory was expressed mathematically by Ross (1984) as:

$$R_i = E + \beta_1(f_1) + \beta_2(f_2) + \beta_3(f_3) + \beta_4(f_4) + e_i \quad (2)$$

where  $R_i$  is the return on asset  $i$ ,  $E$  is the expected return on the asset (the risk-free rate);  $\beta$  is the asset's sensitivity to a change in the systematic factors ( $f_1, \dots, f_n$ ) and  $e_i$  is the return on the unsystematic factors, also expressed as the residual risk.



The APT model provides a reliable conclusion that assets managed by mutual funds have patterns of sensitivities to economic risk factors. Therefore, the onus is on the fund manager to determine the most appropriate exposure of the portfolio to systematic risk factors in a way that is consistent with the fund's investment strategy (Ross, 1984). The APT will be the fundamental theoretical underpinning that will provide a basis for the establishment of a relationship between mutual fund prices and macroeconomic factors in this study.

## **2.2. EMPIRICAL REVIEW**

The empirical literature on the effect of macroeconomic factors on mutual fund prices is mixed. While some scholars argue that the relationship is negative, others hold the view based on evidence that the direction of the relationship is positive. However, the interesting observation is that most of the researchers do not deny the existence of some form of a significant interaction between macroeconomic variables and mutual fund prices.

### **2.2.1. EMPIRICAL STUDIES IN DEVELOPED MARKETS**

Theories propounded by Ross (1984), Sharpe (1964) and Lintner (1965) have provided the foundation for several subsequent empirical works on the macroeconomic factors and the capital markets over the years. Notable among these studies focused on the developed markets is Peiro's (2016) work. Peiro (2016) empirically analyzed the dependence of stock prices on macroeconomic factors in the three largest European economies: France, Germany and the United Kingdom. Using a multiple linear regression model, Peiro (2016) validated the hypothesis that movements in industrial production and interest rates significantly determine stock prices in the three countries studied. Peiro

(2016) found that industrial production and shifts in long-term interest rates explain half of the variations in stock returns. However, the data only supported the evidence for the three European countries as there was a noticeable discrepancy in the results obtained for the U.S. (Peiro, 2016). Industrial Production was found to be the only factor that seems to have a high explanatory power over stock market returns.

Similarly, Flannery and Protopapadakis (2002) suggested that stock market returns are significantly correlated with macroeconomic factors. They used one of the most extensive data set spanning the period, 1980 – 1996 for 17 macroeconomic variables. They found six of the 17 macroeconomic factors to have a strong relationship with variations in stock market returns (Flannery et al., 2002). They opined that the Consumer Price Index (CPI) and Producer Price Index (PPI) have a significant impact only on the level of the market portfolio's returns ((Flannery et al., 2002). The balance of Trade, Employment and Housing statistics tend to affect only the returns' conditional volatility whereas money supply (M1) significantly impacts both the returns and conditional volatility. Ludvigson and Ng (2009) equally found similar evidence for bond returns. Focusing on U.S government bonds, Ludvigson and Ng (2009) investigated the empirical linkages between variations in excess bond returns and macroeconomic factors. They found that macroeconomic factors like inflation rate, production, commodity prices, nominal interest rate explain a significant amount of the variation in bond returns.

Elton, Gruber, and Blake (1995) empirically studied the relationship between fundamental economic variables, expected returns and bond fund performance. Elton et al. (1995) employed a canonical correlation model to test the link for 123 bond funds using datapoints from between February 1980 to December 1992. A time-series

regression model was used to determine the sensitivity of the 123 mutual fund returns to unexpected changes in the fundamental economic variables. By treating the underlying economic variables (changes in inflation and Gross National Product) as observable variables, Elton et al. (1995) found that adding the primary variables improves the ability to explain the time-series pattern of bond fund patterns and expected returns. They equally discovered that fundamental economic variables have significant explanatory power on the variations of bond fund returns (Elton et al., 1995). For all the bond funds studied, the sensitivity coefficient for unexpected changes in inflation is negative pointing to a reliable conclusion that bond funds have lower returns when inflation unexpectedly increases. However, Gross National Product (GNP) was found to have a positive impact on corporate fund returns and an adverse effect on other fixed-income funds, which is plausible given that a rise in GNP leads to an increase in interest rates which suppresses returns (Elton et al, 1995). The surge in GNP reduces the risk of corporate bonds, hence the positive relationship (Elton et al., 1995).

Bali, Brown and Caglayan (2011) found that both parametric and non-parametric tests indicate a significantly positive relationship between default premium beta and future hedge fund returns, while the link between inflation beta and mutual fund returns were economically and significantly negative. In a much later study, Bali et al. (2014), conceded that uncertainty betas explain a substantial portion of the cross-sectional dispersion in hedge fund returns. After controlling for a considerable number of fund-specific factors, they still found an economically and significant relationship between systematic risk factors and hedge returns.

### **2.2.2. EMPIRICAL STUDIES IN FRONTIER AND EMERGING MARKETS**

The nexus between macroeconomic factors and mutual fund performance has equally been explored for actively managed mutual funds in developing economies. One of these studies was conducted by Yadav, Sudhakar, and Kumar (2016). The study sought to investigate the interactions between mutual fund performance and macroeconomic factors with a focus on 80 equity mutual funds in India spanning between 2005 and 2015. Using a multiple linear regression model, Yadav et al. (2016) found compelling evidence that supports the hypothesis that mutual fund performance is influenced by macroeconomic factors. Consumer Price Index (CPI), gold prices, oil prices, exchange rate, and interest rate, seem to explain a significant amount of variation in the performance of the 80 equity mutual funds under study.

Karuiki (2014) found slightly conflicting evidence by investigating the nexus between macroeconomic factors and mutual fund performance of selected Kenyan mutual funds. Using a multiple linear regression and data points from 2009 to 2015, Karuiki (2014) posited that the data supports the finding that money supply, interest rates, inflation rate, GDP growth rate, and exchange rates explain a substantial 70.9 percent of the fund performance among actively-managed mutual funds operating in Kenya. Karuiki (2014) further opined that money supply, interest rate, inflation rate, and GDP positively and significantly affect mutual fund performance while exchange rate negatively impacts mutual fund performance. These findings were consistent with Makau's (2016) study on the link between selected macro variables and unit trust performance. Using a multiple linear regression model, he discovered that the selected macroeconomic factors explain 90.3 percent of the variations in unit trust returns. Unit trust performance reacts positively

to inflation (CPI), negatively to interest rate and money supply (M3) and is not significantly affected by changes in real GDP (Makau, 2016).

Kumar and Dash (2008) also examined the effect of macroeconomic variables on mutual fund schemes in India with regards to returns and volatility. Kumar and Dash (2008) employed the Granger causality test in the context of the APT to empirically measure the interaction. They found that 35.29 percent of the variations in returns of the Indian mutual funds considered were significantly influenced by the macroeconomic variables (Kumar & Dash, 2008). Thus, inflation rate, oil prices, interest rates, and exchange rate (INR/USD) are significant determinants of performance of the schemes studied. Further, it was found that 47.06 percent of the variance of returns of the sample schemes were explained by the macroeconomic variables considered.

Nishat, Shasheen, and Hijazi (2004) analyzed the long-term equilibrium relationships between selected macroeconomic variables and the Karachi Stock Exchange Index in Pakistan. To avoid potential misspecification biases, Nishat et al. (2004) employed a vector error correction model to explore the relationship. They found that the five variables considered are cointegrated and two long-term equilibrium relationships exist among the variables (Nishat et al., 2004). They submitted that industrial production is the most significant positive determinant of stock prices in Pakistan, while inflation is the most significant negative determinant of stock prices in Pakistan (Nishat et al., 2004). Also, they discovered a “causal” relationship between the stock market and the fundamental macro factors. However, industrial production and stock prices showed signs of reverse causality.

Some studies have equally been conducted on the relationship using Ghana as a case study. One of such of studies is Marfo's (2016). His study revealed that there is a significant link between macroeconomic factors and mutual fund performance in Ghana with a specific emphasis on Anidaso Mutual Fund. Using the Autoregressive Distributed Lag (ADRL) model, Marfo (2016) found that the exchange rate has a negative but insignificant long-run and short-run impact on the performance of mutual funds in Ghana. Also, he discovered that there is a significant relationship between inflation and mutual fund performance. However the long-run and short-run effect of interest rate on mutual fund performance was adverse. The latter implies that as interest rates surge, it is highly likely that there will be declines in mutual fund performance. Marfo (2016)'s study only focused on Anidaso mutual fund even though there were over 25 open-end mutual funds in Ghana in 2016. This reduces the generalizability of the study as other mutual funds operating in Ghana have inconsistent characteristics and investment strategies.

Ansong (2013) also empirically assessed the interaction between mutual fund prices and macroeconomic factors using Databank EPACK as a case study. Ansong (2013) studied the relationship using 190 observations spanning the period between 1997 and 2012 and the Vector Autoregressive Model (VAR). With regards to the broad relationship between the prices of the EPACK fund and the macroeconomic variables, the level series regression results revealed that there was a short-term positive relationship between the price of the fund and inflation. However, Ansong (2013) found no significant relationship between exchange rates and the price of the fund. Similar to Marfo (2016), Ansong (2013) also focused on only one large mutual fund, which is not

fully reflective of the overall situation in Ghana's collective investment schemes industry. Moreover, Ansong's (2013) study used Vector Autoregressive (VAR) model which implies that the results of the study should not be accepted in absolute terms but to be treated with caution as there is a possibility of spurious regression estimates associated with the methodology.

### **2.3. CONCLUSION**

The empirical work on the interaction between macroeconomic risk factors such as interest rates, exchange rates, GDP growth, money supply, etc. and mutual fund prices have been concluded for diverse markets, on distinct datasets, with various empirical models (Sumuya, Yang, Yang & Sun, 2017). There is still no conclusive evidence on the strength and the direction of the relationship for both developed and frontier capital markets. With regards to studies conducted using licensed open-end mutual funds in Ghana, a number of problems still remain: (1) empirical evidence on the presence of macroeconomic factors on mutual fund prices in Ghana is weak as researchers have not paid attention to the Ghanaian mutual fund industry compared to the commercial banking industry; (2) the nexus between macroeconomic risk factors and mutual fund prices have only been studied as case studies of specific open-end mutual funds in Ghana. This reduces the robustness and the generalizability of findings since the mutual funds considered are not representative of the entire Ghanaian open-end mutual industry. Hence, this study seeks to fill this gap by employing averaged time series data from ten licensed actively managed open-end mutual funds to improve the generalizability and reliability of the findings.

## **CHAPTER THREE: METHODOLOGY**

### **INTRODUCTION**

In this chapter, I specify the research method, data collection and the data analysis techniques and the limitations of the methodology. This is important because it provides the necessary conditions for the validation of this study through replication by other researchers.

### **3.1. RESEARCH DESIGN**

This study uses a causal research design approach. A causal research design is used to empirically investigate the effect of a specific event on a set of events or variable(s) of interest (Dahlstrom, 1957). A set of hypotheses are developed and tested to validate the interaction between the variables under study (Dahlstrom, 1957). The primary objective of this study is to assess the effect of macroeconomic factors and on mutual fund prices, hence a causal research design is the most appropriate research design to adopt for the purpose of hypothesis testing and drawing relevant inferences.

### **3.2. THEORETICAL MODEL**

The Arbitrage Pricing Theory (APT) developed by Ross (1984) establishes a sound theoretical underpinning for the mathematical relationship between mutual fund prices and macroeconomic factors (interest rates, inflation rate, exchange rate, money supply and real GDP). The APT model creates a functional relationship between expected returns on portfolios and systematic factors (Gilles & LeRoy, 1991). The APT proposes that systematic factors are critical determinants of the variability in portfolio returns (Ross, 1984). Essentially the expected return on a mutual fund is determined by movements in systematic factors and the fund's sensitivity to those factors as measured



by the fund's beta. Therefore, the systematic risk factors with the highest beta will account for more of the variations in a mutual fund's expected return as opposed to systematic factors with the lowest beta (Reinganum, 1981).

The APT model is based on three fundamental assumptions: (1) there is perfect competition in the capital markets; (2) investors have a preference for more uncertain returns than fewer returns with certainty; (3) the stochastic process that generates portfolio returns can be given by a  $k$ -factor model of the form:

$$R_i = E_i + \beta_{i1}\delta_1 + \dots + \beta_{ik}\delta_k + e_i \quad \text{for } i = 1, \dots, N. \quad (3)$$

where  $R_i$  is the return on portfolio  $i$ ;  $E_i$  is the expected return of portfolio  $i$ ;  $\beta_{ik}$  is the sensitivity in portfolio  $i$ 's returns to movements in the systematic factors and the  $\delta_k$  is a common risk factor that accounts for variations in portfolio returns. The  $e_i$  is an idiosyncratic error, which is assumed to have a mean of zero.  $N$  represents the number of assets in the portfolio (Reinganum, 1981).

The choice of APT as a theoretical model for this study is based on the work of Boahene (2015); Marfo (2017); Ansong (2013); (Hasan and Nasir, 2009) and numerous other studies on the macroeconomic factors – capital markets nexus. Moreover, the APT is mostly preferred by scholars to the simple period capital asset pricing model (CAPM) proposed by Sharpe (1964) and Lintner (1965) owing to the latter's numerous unrealistic assumptions and failure to account for factor risk premia of assets in a portfolio (Reinganum, 1981). Hence, the APT is a more flexible model since it allows for the inclusion of numerous significant macroeconomic variables that have explanatory power over expected portfolio returns.

### **3.3. DESCRIPTION OF VARIABLES**

The systematic risk factors that were found to have significant influence on asset prices and as a result are relevant inclusion to the econometric model of this study are interest rates, inflation rate, exchange rates, real GDP and money supply. These variables were chosen based on previous studies by Karuiku (2014); Marfo (2016); Makau (2016); Kumar and Dash (2008); Yadav et al. (2016) and Ansong (2013) who have argued that the selected macroeconomic variables have a strong explanatory power over the mutual fund performance across different economies. Moreover, using a Sequential Forward Selection Algorithm model, Altinbas et al. (2015) found strong evidence that supports the hypothesis that the most significant macroeconomic determinants of the capital markets performance are interest rates, industry production index, oil prices and gold prices. Also, these variables are preferred to other variables due to their suitability for a study in a frontier market like Ghana. The selected variables are expounded below:

#### **3.3.1. INTEREST RATES**

Interest rates are expected to be negatively related to mutual fund prices. This is due to several theoretical models propounded by finance researchers. Notable among them is the cash flow discounting model (Panda, 2008). Using the cash flow discounting model, intrinsic values of stocks are computed using interest rates as the discount rate (Panda, 2008). Hence, an increase in interest rate lowers present values of stocks and vice versa (Panda, 2008). This in turn reduces net asset values of mutual funds and consequently prices fall. Also, rising interest rates also hurt the returns of fixed-income and money-market mutual funds. As interest rates surge, the yields on newly issued

bonds also surge, and prices fall pushing down the net asset values of bond and money market mutual funds (Brendan, Henry & Williams, 1999).

Moreover, changes in interest rates affects mutual fund prices through its negative impact on corporate profitability and company fundamentals (Panda, 2008). Company earnings fall when interest rates are rising as the cost of capital of firms increase. Also, consumers' demand for products decreases since the cost of borrowing has increased, this depresses company revenues further (Brendan, Henry & Williams, 1999). This culminates in lower stock prices on the back of weak company profitability and net asset value per share (prices) of mutual funds decline. Therefore, it is expected that the relationship between interest rates and mutual fund prices is negative. Hence, as interest rates rise, prices of mutual funds decline and vice versa.

The 91-day Treasury bill is used as a proxy for the interest rates in Ghana since it represents the required rate of return as it is often used as a discount rate in equity and debt valuations. Quarterly interest rates data from 2007 to 2017 will be obtained from the Bank of Ghana website for the purpose of this study.

### **3.3.2. INFLATION RATE**

Inflation refers to sustained increases in the overall price levels of goods and services (Arnold, 2009). Moderate inflation is usually associated with stable economic growth, whereas high inflation often signals an overheated economy. The Inflation-mutual fund price nexus has been proven on both theoretical and empirical grounds. Levine (1997) argues that during high inflationary periods, capital market frictions are intensified due to emergence of an endogenous volatility in all systematic variables.

Feldstein (1980) proposes a simple tax-neutrality model to explain the relationship between that inflation and capital market performance. He opines that inflation adversely affects capital market returns in two ways: (1) taxable profit of companies increase due to higher prices during inflationary periods; (2) Due to the nature of the tax system, there is no distinction between real and nominal capital gains, hence nominal capital gains are adversely impacted by taxes and net asset values of equity mutual funds decline. Also, when there is a significant surge in inflation rate, it can increase the risks and uncertainty about an economy, culminating in a gloomy outlook and lower earnings forecasts for companies and poor performance of equity, bond and balanced open-end mutual funds (Homer, 1969).

Therefore, it is expected that there is a negative relationship between inflation rate and prices of open-end mutual funds. In this study, inflation rate is measured by changes in the Consumer Price Index (CPI). Quarter-on-quarter inflation rate data spanning the period between 2007 and 2017 was obtained from BOG website for the purpose of conducting this study.

### **3.3.3. EXCHANGE RATE (USD/GHS)**

The USD/GHS rate is also one of the major macroeconomic factors that are assumed to be correlated with mutual fund prices. The USD/GHS exchange rate is very critical in the sense that it is a strong determinant of imports and export activities and cross-border transactions in an economy. The inclusion of exchange rates is consistent with Elton et al.'s (1995) conclusion that exchange rates have explanatory power over variations in bond fund returns. The theoretical basis of the relationship between the capital markets and macroeconomic factors is inconclusive (Farooq, Keung and Kazmi,

2005). Proponents of the portfolio balance approach argue that the relationship is positive with causality running from stock prices to exchange rates. Based on other theoretical models, a negative relationship between stock prices and the capital markets can also be established. Ansong (2013) confirms this theory by revealing that stock prices are correlated with exchange with causality running from exchange rates to stock prices. This is because a depreciation of the local currency makes indigenous firms more competitive, which increases their stocks of exports and drive revenues and equity prices of companies up (Ansong, 2013). This leads to an increase in the net asset values of equity and bond mutual funds.

Therefore, it is expected that there is a negative relationship between exchange rates (USD/GHS rate) and mutual fund prices. Essentially, a depreciation of the cedi against the dollar increases mutual fund prices and vice versa. Quarterly data on USD/GHS rates from 2007 to 2017 was obtained from the BOG.

### **3.3.4. GROSS DOMESTIC PRODUCT (GDP)**

Real Gross Domestic Product is the traditional measure of economic prosperity in an economy (Anielski, 2002). It is the total of all the monetary transactions of households, businesses, and governments in the economy – the total monetary value of all final goods and services exchanged and consumed in an economy in a period (Anielski, 2002). The link between real GDP growth and capital market returns is established by the conventional valuation model. Essentially, stock prices are the “present discounted value” of future dividends (. Therefore, a strong economic performance indicated by increases in real GDP growth increase corporate earnings and eventually increase payouts to shareholders (Shapiro, 1988). As dividends surge, stock prices also

increase (Shapiro, 1988). As confirmed by Zervos (1996) and Fama & French, (1992), capital market returns are positively correlated with industrial production (real GDP). As real GDP rises, the profitability of companies improve leading to increases in the net asset values of equity and bond mutual funds, which culminates in increased prices.

Therefore, it is expected that there is a positive effect of real GDP on mutual fund prices in Ghana. Essentially, as real GDP increases, prices of open-end mutual funds fall and vice versa. Ghana's quarterly real GDP data was obtained from Ghana Statistical Service (GSS).

### **3.3.5. MONEY SUPPLY**

I include money supply due to its significant effect on capital market performance. The impact of money supply on the equity markets has been explored extensively by economists (Husain & Mahmood, 1999). Based on the real wealth effect theory proposed by several studies, a change in money supply changes the real wealth held by households and business entities (Laidler, 1969). As a result, the level of aggregate demand changes which has a ripple effect on employment, incomes, prices and subsequently stock market returns (Laidler, 1969). Moreover, money supply alters the holdings of mutual fund portfolios and the rate of returns of the assets under management (Husain & Mahmood, 1999). With an increase in money supply, mutual fund flows surge, leading to significant investments in the capital markets which increases the net asset values of mutual funds.

Therefore, it is expected that there is a positive relationship between mutual fund prices and money supply. Essentially, as money supply increases, prices of mutual funds

also increase. There are varied measures of money supply, which include M0, M1, M2, M3, and M4 (Mankiw, 2016). For the purpose of this study, M2 – which includes M1 and short-term time deposits and deposit in money market funds – obtained from the Bank of Ghana website is used as a measure of money supply. Quarterly data on M2 money supply was obtained from the BOG.

### **3.3.6. MUTUAL FUND PRICES**

Open-end mutual funds are purchased on demand at the fund's public offering price (POP), also referred to as the offer or the asked price (Hall, 2000). All sales or redemptions are made on demand at the fund's net asset value (NAV). The POP is usually higher than the NAV due to an incorporation of sales charges in computing the POPs (Hall, 2000). NAVs or the bid price is used as the mutual fund price for this study. The NAV is computed as follows:

$$\text{NAV} = \frac{\text{Total fund assets} - \text{Total fund liabilities}}{\text{Number of shares outstanding}}$$

As shown above, NAVs are the market values of all the AUMs less the funds' financial liabilities during the period and divided by the shares outstanding (Sharpe, 1966). In this study, the quarterly NAVs of the mutual funds considered are the response variables. Hence, the regression analysis will determine the impact of the macroeconomic factors on the NAVs of the mutual funds. Quarterly NAV per share values of the 10 licensed open-end mutual funds were obtained from the database of the Research Divisions of the respective companies.

### 3.4. EMPIRICAL MODEL

A time series regression model is used to test the relationship between macroeconomic factors and mutual fund prices. A time series regression model is more appropriate for estimating the relationship because the sample data consists of a set of random variables indexed by time (Wooldridge, 2014). All open-end mutual funds in Ghana face the same degree of systematic risks emanating from macroeconomic factors like interest rates, inflation rate, exchange rate etc., hence using a time-series model will suffice. The generalized static time series model can be expressed as

$$y_{it} = \beta_0 + \beta_1 x_t + u_{it}, \quad t = 1, 2, \dots, n. \quad (4)$$

where  $t$  denotes the time period.  $\beta_0$  is the intercept of the model and  $\beta_1$  represents the coefficient of the explanatory variables (Wooldridge, 2014). The variable  $u_{it}$  captures the idiosyncratic error which represents all the unobserved factors that vary with time and have an impact on the response variable,  $y_t$ .

Based on the APT model (Ross, 1984), I employ a time-series econometric model that can equally be represented by a  $k$ -factor model of the form:

$$P_t = \beta_0 INT_t + \beta_1 INF_t + \beta_2 EXCHR_t + \beta_3 MS_t + \beta_4 RGDP_t + u_{it}, \quad (5)$$

where  $P_t$  denotes the average quarterly prices of all the mutual funds in the sample at time period  $t$ ;  $\beta_0$  is the intercept of the model representing the minimum price of a share in an open-end mutual fund. The variables  $\beta_1$  to  $\beta_5$  represent the beta of the risk factors for all the mutual funds at time  $t$ .  $INT_t$  denotes the quarterly interest rate over the time period;  $EXCHR_t$  is the quarterly exchange rate measured by the USD/GHS rates.  $INF_t$  represents the quarterly inflation rate measured by the quarterly changes in the



Consumer Price Index (CPI);  $RGDP_t$ , is the quarter-on-quarter real GDP measured in billions of U.S dollars. The variable  $\mu_{it}$  captures all the unobservable individual-specific effects including market timing ability, corporate governance structures, total assets under management, fund flows, sales charges, management expenses etc. which could affect mutual fund prices (Wooldridge, 2014).

### 3.5. DATA DESCRIPTION

This study adopts secondary time-series data covering the period from 2007 to 2017. This study period is appropriate because it captures the period within which the open-end mutual fund industry in Ghana saw an influx of new entrants. Moreover, within this period, the macroeconomic variables like interest rates, exchange rates and money supply saw significant movements since Ghana re-denominated and most of the major economies of the world were recovering from the 2007/08 financial crisis. To cater for the relatively short time frame (11 years), quarterly data is used to increase the frequency of the data points. Ten (10) actively managed open-end mutual funds licensed and regulated by the Securities and Exchanges Commission were considered for this study. The sample size, which represents the number of periods over which the variables were observed is 44 (four quarters over a 11-year time frame). Quarterly data on macroeconomic factors such as interest rates, inflation rates, exchange rate (USD/GHS), real GDP growth rate and money supply are considered for this study. Quarterly data on interest rates, inflation rate, exchange rate (USD/GHS) and money supply were obtained from the Bank of Ghana. Quarterly data on real GDP were obtained from Ghana Statistical Service. Data on mutual fund prices (NAVs) were obtained from databases of the Research departments of the sampled open-end mutual funds.

### 3.6. TIME SERIES REGRESSION ASSUMPTIONS

Time series data models are based on a set of assumptions which allow the model to have the Best Linear Unbiased Estimators (BLUE) as opined by Wooldridge (2014). Therefore, the following assumptions are tested to detect possible violations or otherwise in order to provide the necessary corrections to enable hypothesis testing to be conducted and inferences to be drawn.

**i. Assumption TS.1 (Linear in Parameters)**

The parameters of a time series model are linear and follow the linear model

$$y_{i,t} = \beta_0 + \beta_1 x_{t1} + \beta_2 x_{t2} + \dots + \beta_k x_{tk} + u_t, t = 1, \dots, T \quad (6)$$

where the  $\beta_j$  are the parameters to be estimated and  $u_t$  is the idiosyncratic error term (Wooldridge, 2014).

**ii. Assumption TS.2 (No perfect Collinearity)**

In the sample, no explanatory variable is constant and there is no perfect linear relationships between the any of the explanatory variables (Wooldridge, 2014).

**iii. Assumption TS.3 (Zero Conditional Mean)**

For each time period  $t$ , the expected value of each idiosyncratic error given the explanatory variables in all time periods is zero. This is expressed mathematically as:

$$E(u_t|X) = 0, t = 1, 2, \dots, N. \text{ (Wooldridge, 2014).}$$

**iv. Assumption TS.4 (Homoskedasticity)**

The conditional and unconditional variance of the error term  $u_t$  should be constant for all values of the explanatory variables and the different time periods. This is

expressed mathematically as  $\text{Var}(u_t|X) = \text{Var}(u_t) = \sigma^2$ , for all  $t = 1, 2, \dots, N$ .

(Wooldridge, 2014).

**v. Assumption TS.5 (No Serial Correlation)**

The idiosyncratic errors in two different time periods are not correlated conditional on  $X$ . This can be expressed mathematically as:  $\text{Corr}(u_i, u_s|X_i) = 0$ .

(Wooldridge, 2014).

**vi. Assumption TS.6 (Normality)**

The idiosyncratic errors  $u_t$  are independent and normally distributed.

(Wooldridge, 2014).

## CHAPTER FOUR: RESULTS

### INTRODUCTION

In this chapter, I present the results of statistical analysis of the data. A detailed discussion of the findings of this study is also provided to facilitate an understanding of the results in the context of the empirical literature.

### 4.1. DESCRIPTIVE STATISTICS

*Table 1.0.* Summary statistics of mutual fund returns and macroeconomic variables

<i>Variables</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Median</i>	<i>Min</i>	<i>Max</i>
Mutual fund prices (GHS)	0.54	0.64	0.32	0.00	3.45
Interest rate (GHS)	18.58	0.06	21.65	9.40	25.86
Inflation rate (GHS)	13.58	0.04	13.06	8.40	20.74
Exchange rate (USD/GHS)	2.35	1.21	1.89	0.93	4.42
Money supply (in billion GHS)	18.14	12.81	15.00	3.42	45.79
Real GDP (in billions USD)	6.68	1.64	7.11	3.93	10.10

*Notes:* The figures shown are quarterly data for mutual fund prices and the macroeconomic variables gathered from 10 mutual fund companies, Ghana Statistical Service and the Bank of Ghana.

*Source:* Author's estimations using R statistical software.

The results of the descriptive statistics presented in Table 1.0 above suggest that the ten mutual open-end mutual funds considered for the study over the period 2007 to 2017 had an average quarterly price of GHS 0.54. This indicates that on average, investors incurred less than GHS 1.00 to invest in a share of open-end mutual fund. Interest rates as measured by the 91-day T-bill rate averaged 18.58 percent during the period with a standard deviation of 6 percent pointing to weakness in Bank of Ghana's efforts to reduce interest rates and to boost real economic activity. Over the period, the quarterly inflation rate as measured by the Consumer Price Index averaged 13.58 percent

with a standard deviation of 4 percent. This shows that the Bank of Ghana was not successful at achieving its targeted single digit headline and core inflation between 2007 and 2017. Within the same period, the Ghanaian cedi (GHS) was under pressure with its minimum value at GHS 0.93/USD and its highest in late 2017 at approximately GHS 4.4/USD. Overall the USD/GHS rate averaged 2.35 on the back of a strong US economy spurring a rally in the dollar. Broad money supply as measured by M2 averaged approximately 6.5 percent over the period as demand pressures remained high. Real GDP averaged 6.68 billion U.S dollars recording a record low of 3.9 billion U.S dollars and a high of 10.1 billion U.S dollars.

#### **4.2. TEST FOR TIME SERIES REGRESSION ASSUMPTIONS**

In this section, I run a set of tests to investigate possible violations of the time series (TS) assumptions enumerated in section 3.6 above. Other post-estimation tests will be conducted to test for robustness and efficiency of the panel data model employed in this study.

##### **4.2.1. SHAPIRO-WILK (1965) TEST**

Time series regressions assume normality with regards to the distribution of the errors. Therefore, a normality test is run to assess whether the distributions of the response and explanatory variables are consistent with the normality assumption. The Shapiro-Wilk Test developed by Shapiro and Wilk in 1965 provides a test statistic:  $W$ , which is “obtained by dividing the square of an appropriate linear combination of the sample order statistics by the usual symmetric estimate of variance” (Shapiro and Wilk,

1965). In testing for normality with the Shapiro-Wilk Test, the following hypotheses were tested:

$H_0$ : Sample is normally distributed

$H_a$ : Sample is not normally distributed

The results of the Shapiro-Wilk (1965) Test are as follows:

*Table 2.0.* Results of the Shapiro-Wilk (1965) Test for normality

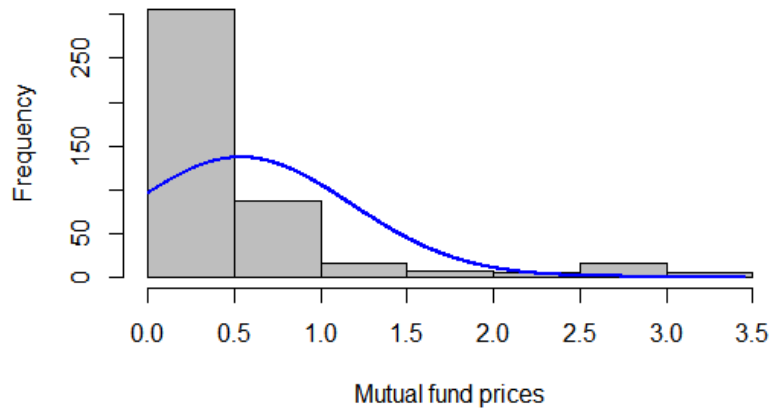
<i>Variables</i>	<i>W</i>	<i>P-value</i>
P	0.66	0.00
INTR	0.88	0.00
INFR	0.92	0.00
EXCHR	0.85	0.00
MS	0.89	0.00
RGDP	0.97	0.00

*Source:* Author's estimations using Stata.

The results of the Shapiro-Wilk Test presented in Table 2.0. above suggest that all the variables (mutual fund prices, interest rates, inflation rates, exchange rates, money supply and real GDP) are significant at 5% significance level given that their p-values are well below 0.05. Therefore, I reject the null hypothesis and conclude that their distributions are non-normal. This is not surprising since this dataset is a small sample size case. In order to transform the distribution of the variables to follow a normal distribution, log-transformations were used. Therefore, quarterly average mutual fund prices, interest rates, inflation rate, exchange rate, money supply and real GDP were transformed using the log base 10 function in R.

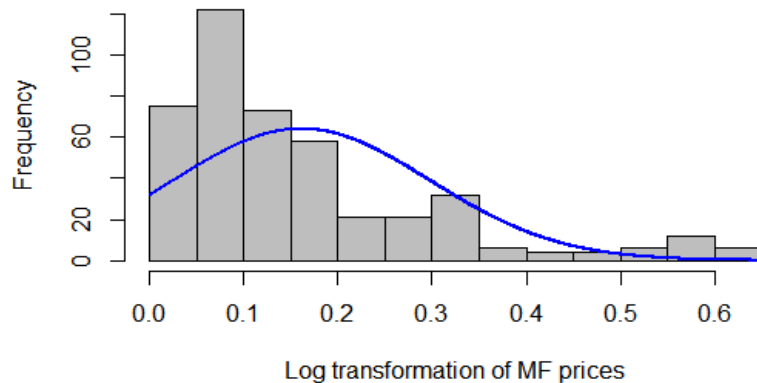
As shown in Fig. 1 below, the distribution of average quarterly mutual fund prices is skewed to the right. Hence mutual fund prices were transformed using the *log*

function in R. Before log transforming the average mutual fund prices there was a copious number of average fund prices ranging between 0 and GHS 0.35 which rendered the distribution right skewed as shown Fig.1 below. The distribution of mutual fund prices after the log transformation is shown in fig. 2.



*Source:* Author's plot using Stata.

*Figure 1: Graph showing the distribution of quarterly mutual fund prices*



*Source:* Author's plot using Stata.

*Figure 2: Graph showing the distribution of log transformed mutual fund prices*

Money supply (M2) had means and medians with a significant gap as shown in fig. 3. To correct for the skewness in the distribution of money supply, log transformation

of quarterly money supply was applied. The log transformation reduced the right skewness and normalized the distribution of money supply as shown in fig. 4 below:

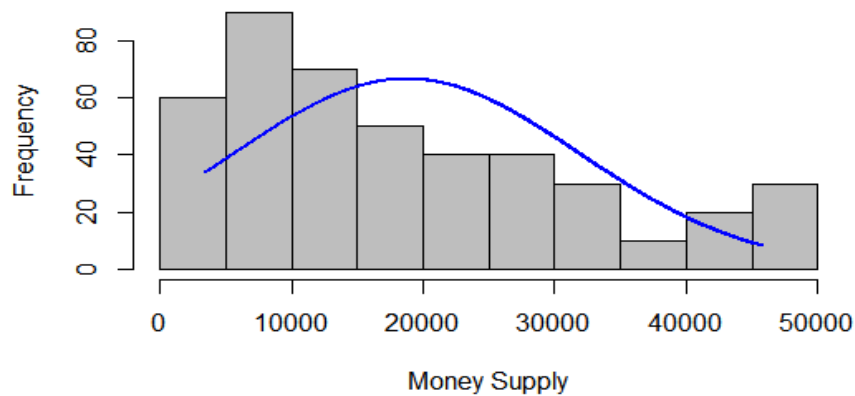


Figure 3: Graph showing the distribution of broad money supply (M2)

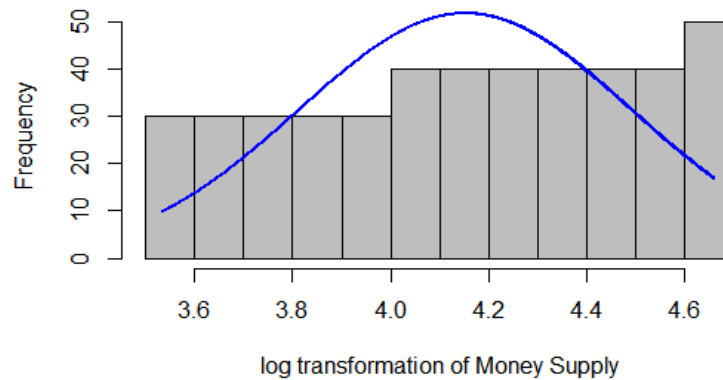


Figure 4: Graph showing the distribution of log transformed broad money supply (M2)

The log transformations of inflation, exchange rate and real GDP were conducted as well to reduce the skewness in the distribution and to establish elasticity relationship between mutual fund prices, exchange rates and inflation rate.



### 4.3. TEST FOR ZERO CONDITIONAL MEAN

To test for the validity of the zero-conditional mean, the mean of the all the residuals given all the values of the independent variables were computed. The expected value of the error terms was  $6.37373\text{e-}18$ , which is essentially zero. Hence, the time series data employed in this study satisfies the zero-conditional mean assumption.

#### 4.3.1. A TEST FOR MULTICOLLINEARITY

A key assumption for time-series regression is presence of no perfect correlation between the explanatory variables (Wooldridge, 2014). While some level of correlation between the regressors is not problematic, a perfect correlation between any pair of the explanatory variables is completely ruled out as it inflates the variance of the coefficients of the explanatory variables (Stock and Watson, 2003). This leads to biased estimators of the panel regression model. The problem of multicollinearity can be detected by either computing a correlation matrix of all the independent variables or using the Variance Inflation Factor ((VIF). I use the latter to test for the presence of the problem of perfect collinearity in the model. Using the *car* package in R, the results of the VIF is as follows:

*Table 3.0: Summary of the Variance Inflation Factor (VIF) Test*

<i>VIF</i>				
<i>INTR</i>	<i>INFR</i>	<i>EXCHR</i>	<i>MS</i>	<i>RGDP</i>
2.20	2.35	5.41	1.15	5.00

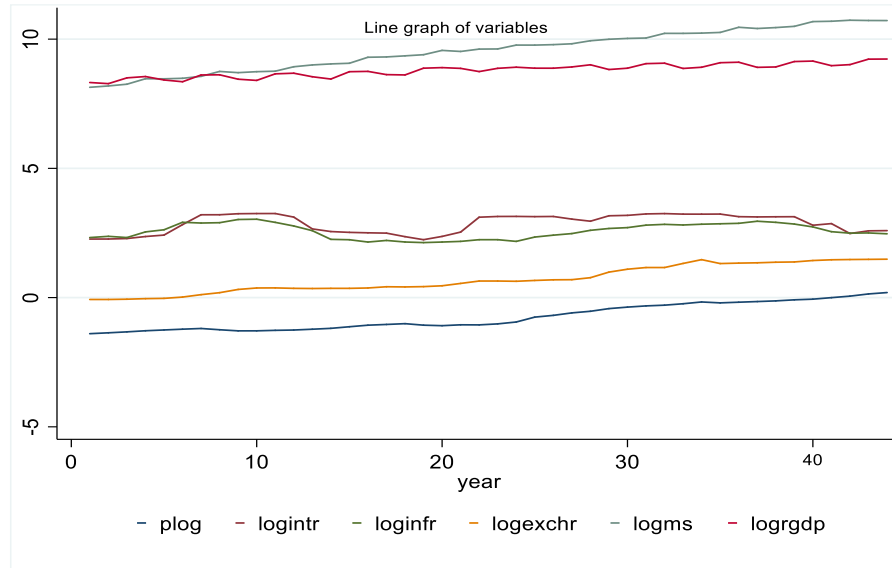
*Source:* The author's estimates from R statistical software.

As conceded by Hair, Black, Babin and Anderson (1995), VIF that exceeds 10 indicates a severe problem of multicollinearity. From Table 3.0. above, all the explanatory variables have a VIF score well below the critical value of 10. This indicates

that there is no problem of multicollinearity amongst the explanatory variables, hence all the variables can be included in the model.

#### 4.3.2. TEST FOR STATIONARITY

A crucial assumption for dynamic time series regression is the stationarity of variables. The probability distributions of the time series process must be constant over different time periods (Wooldridge, 2014). Therefore, if a set of random variables are collected in the sequence and shifted ahead  $n$  time periods, the probability distribution of the random variables should collectively remain stable. In the absence of stationarity, hypothesis testing cannot be efficiently conducted, and robust inferences cannot be drawn from the time series dataset. In testing for stationarity in the series, a preliminary graphical analysis is conducted.



Source: Author's plot using Stata

Figure 5: Graph showing the line distribution of the response and explanatory variables

Fig.5 shows that there seem to be a trend in the distribution of the log transformations of average fund prices, interest rate, inflation, exchange rate, money supply and real GDP. Particularly, there is an upward trend in the distribution of exchange rates and fund prices. The upward trend in distribution of exchange rates and fund prices seem to be constant over the period from Q1 2007 to Q4 2017 and it suggests that the mean of the series has been changing with time (Nkoro and Uko, 2016). Inflation rate and real GDP also seem to exhibit a trend with a constant term widening the gap between the two variables over the period. This suggests that a constant and a trend specification must be included in the test for stationarity (Nkoro and Uko, 2016).

#### 4.3.3. THE DURBIN-WATSON TEST

The Durbin-Watson (D-W) test is used as a preliminary test for the presence of non-stationarity even though it could provide unreliable results (Nkoro and Uko, 2016). As a rule of thumb, a D-W value that is significantly different from zero presents an evidence against the alternative that the series is stationary (Nkoro and Uko, 2016). A simple OLS time series regression and a Durbin-Watson (1951) test are combined to further validate the test for stationarity and to determine if the regression is spurious or otherwise.

*Table 4.0. Results of OLS Time Series Regression*

Number of Observations	44
F-statistic	192.72
R-squared	0.9621

Adjusted R-squared	0.9571
Sum of Squared Residuals	0.4266

---

*Note:* Only relevant aspects of the simple OLS regression output are reported

*Source:* Author's estimation from Stata

From table 4.0, the reported R-squared is 0.9621. The D-W statistic after running the Durbin-Watson (1951) test is 0.4160. As a rule of thumb, when the R-squared is greater than the d-statistic from the Durbin-Watson test, there is an evidence of non-stationarity in the series and the reverse is true (Granger and Newbold, 1974). It can be noted that the D-W statistic from the Durbin-Watson test (0.4160) is well below the R-squared (0.9621). Hence it can be concluded that the series is spurious and hence cannot be used for hypothesis testing and drawing inferences (Granger and Newbold, 1974).

#### **4.3.4. THE PHILLIPS-PERRON (1988) TEST**

To further corroborate the presence of non-stationarity and correct for problems of unit roots in the series, a more robust test (Phillips-Perron Test for Stationarity) is conducted. The Phillips-Perron test based on the seminal work of Phillips and Perron (1988), extends the Dickey-Fuller (1979) test to cases where there are drifts and linear trends in the specification for the unit root test (Phillips and Perron, 1988). The null and alternative hypothesis for the Phillips-Perron test are as follows:

$H_0$ : Series contain unit roots

$H_a$ : Series is stationary

The results of the Phillips-Perron test for stationary is presented below:

Table 5.0. Results of the Phillips-Perron Stationarity Test

	<i>Level</i>		<i>First difference</i>		<i>Order of Integration</i>
	Without Trend	With Trend	Without Trend	With Trend	
LogP	0.90	-1.56	-3.76***	-3.98***	I(1)
LogINTR	-2.31	-1.98	-4.89***	-4.97***	I(1)
LogINFR	-1.85	-1.75	-4.3***	-4.3***	I(1)
LogEXCHR	-0.42	-2.11	-4.9***	-4.82	I(1)
LogMS	-2.42	-3.37	-11.7	-13.55***	I(1)
LogRGDP	-1.25	-5.73***	-	-	I(0)

Source: Author's estimates from Stata.

Note: '\*\*\*', '\*\*' and '\*' mean statistically significant at 1%, 5% and 10% respectively.

The Phillips-Perron (PP) test was conducted under two conditions: (1) when the series includes a constant and a trend; (2) when the series contains a constant and no trend. The results of PP test in table 4.0. indicates that all the variables had unit roots at levels with the exception of real GDP. Average fund prices, interest rate, inflation rate, exchange rate and money supply were found to be non-stationary at levels. After taking the first differences, average fund prices, interest rate and inflation rate were found to be stationary with and without trend at 1%, 5% and 10% significance levels. Therefore, interest rates, inflation rates, exchange rate and money supply are integrated at order one (first differencing)  $I(1)$  and real GDP has level integration  $I(0)$ .

It is worthy to note that all the series are integrated at different orders ( $I(0)$  and  $I(1)$ ). This is because some of the variables were stationary at level while majority were integrated after first differencing and hence presents an  $I(0)$  and  $I(1)$  case. As proposed by Pesaran, Shin and Smith (2001), when the series is integrated of different orders of this form, a Johannsen cointegration test is no longer valid. Since the series contains a

combination of  $I(0)$  and  $I(1)$  integration, the Bounds test developed by Pesaran et al. (2001) is the most appropriate technique in estimating cointegration.

#### 4.3.5. COINTEGRATION TEST

Granger (1981) and Engle and Granger (1987) were the pioneers of cointegration tests to assess the existence of long-run relationships between variables (Nkoro and Uko, 2016). At a fundamental level, cointegration tests determines how time series which are likely to be non-stationary and contain drifts can be combined in such a way that they do not drift too wide apart (Nkoro and Uko, 2016). Cointegration essentially involves some form of stationary linear combination of variables which are inherently non-stationary individually but are integrated to an order of  $I(d)$  (Nkoro and Uko, 2016). Pesaran et al. (2001) developed the Bounds test as a new approach to estimating the existence of a nexus between response and explanatory variables in levels which apply when (1) the regressors are purely  $I(0)$ ; (2) the regressors are purely  $I(1)$  and (3) when the regressors exhibit both  $I(0)$  and  $I(1)$  (Pesaran et al., 2001). The statistic used in the Bounds test is the familiar  $F$ -statistic coupled with a generalized Dickey-Fuller Type regression (Pesaran et al., 2001). Pesaran et al. (2001) propose two critical values for the upper and the lower bound assuming that all regressors are purely  $I(0)$  and purely  $I(1)$  or cointegrated. The null and alternative hypothesis of the Bounds test can be specified as:

$H_0$ : There is no cointegrating equation

$H_a$ : There is a cointegrating equation

The decision criteria are such that the null hypothesis can be rejected at 1%, 5% or 10% significance levels if the computed  $F$ -statistic is greater than the critical value for

the upper bound  $I(1)$ . In such a case we reject the null hypothesis and conclude that co-integration is present, hence there is a long-run relationship. As a result, the long-run model (Error-correction model) is estimated (Pesaran et al., 2001). If the computed  $F$ -statistic is lower than the critical value for the lower bound  $I(0)$ , then we fail to reject the null hypothesis and conclude that there is no co-integration, hence there is no long-run relationship between the variables. As a result, the short-run Autoregressive distributed lag (ARDL) model (Pesaran et al., 2001) is estimated. If the  $F$ -statistic falls between the lower bound  $I(0)$  and upper bound  $I(1)$ , the test is deemed inconclusive (Pesaran et al., 2001). Also, the case where some regressors have order two integration  $I(2)$  is completely ruled out (Pesaran et al., 2001). The  $F$ -statistics computed with the Pesaran et al. (2001) test becomes invalid when the regressors are integrated of order above  $I(1)$  like  $I(2)$ ,  $I(3)$  etc. (Hasan and Nasir, 2009).

In order to determine whether there exists a short-run or long-run relationship between mutual fund prices and macroeconomic variables, an optimal lag must be selected. Numerous studies have employed the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC) and Hannan-Quinn (HQ) criterion due to their suitability to determine the optimal lags for their ARDL models (Hasan and Nasir, 2009). For the sake of simplicity, the AIC developed by Akaike (1974) is used to determine the optimal number of lags. Below are the results of the AIC estimation.

*Table 6.0.* Results of the Akaike Information criteria (AIC) estimation

<i>Variables</i>	<i>LogP</i>	<i>LogINTR</i>	<i>LogINFR</i>	<i>LogEXCHR</i>	<i>LogMS</i>	<i>LogRGDP</i>
Number of lags	2	0	0	2	0	0

*Source:* Author's estimates from Stata.

The results of the AIC estimation in Table 6.0. above suggests that the optimal lag length for fund prices is 2 quarters, while that of exchange rate is equally 2 quarters. However, interest rate, inflation, money supply and real GDP will not be lagged. The implies that the historical values of interest rate, inflation, money supply and real GDP will not be relevant in estimating the relationship using an ARDL model.

After computing for the optimal lags, the Pesaran et al. (2001) Bounds test is estimated. The results of the Bounds test are reported below:

*Table 7.0. Results of the Bounds Test*

<i>Lower Bound</i>	<i>Upper Bound</i>	<i>Lower Bound</i>	<i>Upper Bound</i>
2.26	3.35	-2.57	-3.86
2.26	3.79	-2.86	-4.19
2.96	4.18	-3.13	4.46
3.41	4.68	-3.43	-4.79
F-statistic	0.023	t-statistic	-0.012

Source: *Author's estimates from Stata.*

Table 7.0. suggests that  $F$ -statistic (0.923) is well below the critical values of all the upper and lower bounds. This is corroborated by the absolute value of the  $t$  statistic as well. The absolute value of the  $t$  statistic (-0.012) is well below all the critical values of the upper and lower bound. Based on the rule of thumb stated above, we fail to reject the null hypothesis and conclude that there is no presence of co-integration. This also implies that there is no long-run relationship between the variables.

As the Bounds test suggests, there is no long-run relationship between the variables, hence, I estimate the short-run Autoregressive Distributed Lag (ADRL) model only instead of both the ADRL and the Error Correction Model (ECM) or the Vector Error Correction Model (VECM) (Pesaran et al., 2001).



#### 4.4. AUTOREGRESSIVE DISTRIBUTED LAG (ADRL) MODEL

The purpose of this study is to empirically assess the relationship between mutual fund prices and macroeconomic variables (interest rate, exchange rate, inflation rate, money supply and real GDP) in Ghana. Based on the APT model, the following hypothesis are tested:

$H_0$ : There is no relationship between mutual fund prices and macroeconomic factors

$H_a$ : There is a relationship between mutual fund prices and macroeconomic variables

A dynamic time series model (ARDL) is more appropriate in estimating the relationship because of the widely documented evidence on the influence of past performance in the mutual fund industry. Bellando and Tran-Dieu (2011), Zhao (2005), Hu, Kale, Pagai and Subramarian (2011) maintain that past performance is positively correlated with mutual fund flows. Essentially, mutual funds that are known to have outperformed the market in the past tend to receive increased flows compared poor past performers. Due to the understanding that history matters in the mutual fund industry, a static model cannot be specified for the nexus between macroeconomic factors and mutual fund prices since it does not consider lagged values of the variables.

Based on the results of the Bounds test (no co-integration) and since the regressors were integrated of order  $I(0)$  and  $I(1)$ , a short-run ADRL model is specified to examine the relationship between fund prices and macroeconomic variables. The Autoregressive Distributed Lag (ADRL) is a dynamic time series model that contain the lagged value (s) of the dependent variable and the current and lagged values of the regressors as explanatory variables (Pesaran and Shin, 1995). The ADRL model uses a combination of endogenous and exogenous variables as opposed to the Vector

Autoregressive (VAR) model that is strictly for endogenous variables (Pesaran and Shin, 1995). The generalized ARDL ( $p, q$ ) model is specified as:

$$Y_t = \gamma_0 + \sum_{i=0}^p \delta_i Y_{t-i} + \sum_{i=0}^q \beta_i^t X_{t-i} + \varepsilon_{it} \quad (7)$$

where  $Y_t$  is a vector and the variables in  $X_t$  are allowed to be purely  $I(0)$  or  $I(1)$  or co-integrated;  $\beta$  and  $\delta$  are parameters to be estimated;  $\gamma$  is the constant;  $i = 1, \dots, k$ ;  $p, q$  are optimal lag orders;  $\varepsilon_{it}$  is a vector of the error terms (unobservable zero mean white noise) which are independent and serially uncorrelated) (Pesaran and Shin, 1995). The response variable is a function of its lagged values and the current and lagged values of the explanatory variables in the model. The  $p$  lags are the optimal number of lags for the dependent variable and  $q$  lags are the optimal lags for the exogenous variables (Pesaran and Shin, 1995).

As an extension of Marfo (2017) and Ansong's (2013) studies and based on the work of Hassan and Nasir (2009), a short-run ARDL model of the following form is estimated to test the relationship between mutual fund prices and macroeconomic factors.

$$\begin{aligned} \Delta \log P_t = & a_0 + \sum_{i=1}^p a_{1i} \Delta \log P_{t-i} + \sum_{i=1}^q a_{2i} \Delta \log INTR_{t-i} + \sum_{i=1}^q a_{3i} \Delta \log INFR_{t-i} + \\ & \sum_{i=1}^q a_{4i} \Delta \log EXCHR_{t-i} + \sum_{i=1}^q a_{5i} \Delta \log MS_{t-i} + \sum_{i=1}^q a_{6i} \Delta \log RGDP_{t-i} + \varepsilon_t \end{aligned} \quad (8)$$

where  $P_t$  denotes the average quarterly prices of the mutual funds in the sample;  $a_i$  are the coefficients representing the short-run impact of the macroeconomic factors on mutual fund prices.  $p$  and  $q$  are the optimal lags of the dependent and independent variables respectively.  $i = 1, \dots, k$ ;  $p, q$  are optimal lag orders and  $\varepsilon_{it}$  is a vector of the error terms (Pesaran and Shin, 1995). As noted above, the optimal lag of fund prices is 2 while that of exchange rates is 2 as well. Based on the results of the AIC, interest rate, inflation rate,

money supply and real GDP are not lagged. The results of the short-run ARDL model based on the AIC is reported below:

*Table 8.0. Results of the Estimated Short-run ADRL*

<i>Variables</i>	<i>Coefficients</i>
Log(P <sub>t-1</sub> )	1.4746*** (0.1511)
Log(P <sub>t-2</sub> )	-0.4758*** (0.1976)
Log(INTR)	0.0418 (0.0424)
Log(INFR)	-0.0704 (0.0644)
Log(EXCHR)	0.2108 (0.1429)
Log(EXCHR <sub>t-1</sub> )	-0.4128*** (0.1683)
Log(EXCHR <sub>t-2</sub> )	0.2644*** (0.1212)
Log(MS)	-0.0212 (0.0633)
Log(RGDP)	-0.0414 (0.0672)
R-squared	0.9962
Adjusted R-squared	0.9945
F-statistic	566.79
Sum of Squared	
Residuals	0.0432

*Note:* Standard Errors are in the Parenthesis beneath the estimates of the coefficients. Significant codes: ‘\*’ p < 0.05, ‘\*\*’ p < 0.01, ‘\*\*\*’ p < 0.001.

*Source:* Author’s estimations from Stata.

The general rule of thumb is that independent variables are significant at a 0.05 significance level if their p-values are well below 0.05. If the coefficients have a p-value higher than 0.05, they are not significant at the 95 percent significance level. The results of the short-run ARDL presented in table 8.0. indicates the a positive short-run relationship between price and its lagged values since they are statistically significant at a 95% confidence level. Essentially, current values of fund prices are positively correlated with their lagged values. More specifically, prices of mutual funds one and two quarters in the past influences current fund prices.

Quarterly interest rates and inflation rates are not statistically significant (p-value  $> 0.05$ ). Hence, interest rates and inflation rates have no short-run relationship with prices of open-end mutual funds. The results also reveal that current values of exchange rates are not statistically significant (P-value  $> 0$ ), however, lagged values of exchange rates are statistically significant at a 95% significance level since their p-values (0.02 and 0.03) are well below the 0.05 critical value. One-quarter lagged values of exchange rates are negatively correlated with mutual fund prices while two-quarter lagged values of exchange rates are positively correlated with mutual fund prices. More specifically, one-quarter lagged values of exchange rates positively forecasts mutual fund prices while two-quarter lagged values of exchange rates negatively forecasts mutual fund prices.

Table 8.0 also reveals that quarterly money supply and real GDP are not statistically significant (p-value  $> 0.05$ ). Moreover, the t-values for all these variables are well above 1.96 (using a 95% significance level). Hence, money supply and real GDP have no short-run relationship with prices of open-end mutual funds.

It is noteworthy to state that the R-squared of the short-run ARDL model estimated is 0.9962. This implies that explanatory variables jointly explain 99.62 percent of the variations in mutual fund prices. This shows that there is a high degree of correlation between mutual fund prices and macroeconomic variables. The  $F$ -statistic (566.79) is also statistically significant at 5% which indicates overall goodness of fit (Hasan and Nasir, 2009).

The results from the short-run ADRL model is used to construct a mathematical formula that establishes functional relationship between mutual fund prices and macroeconomic factors. Only the statistically significant parameters are included in the model. By substituting the significant coefficients into the econometric model stated in 4.3.4 above, the mathematical equation is given as:

$$P_t = 1.4746 \log P_{t-1} - 0.4758 \log P_{t-2} - 0.4128 \log EXCHR_{t-1} + 0.2644 \log EXCHR_{t-2} + u_{it},$$

$$\begin{array}{cccc} [0.1511] & [0.1970] & [0.1083] & [0.1200] \end{array} \quad (9)$$

$$n = 44, R^2 = 0.9662.$$

The standard errors of the estimated parameters are given in the parentheses [ ]. According to the equation, a percentage point increase in one-quarter lagged values of mutual fund prices increase current fund prices by 1.47 percent, while two-quarter lagged values of mutual fund prices decrease current mutual fund prices by 0.46 percent. It is important to note that based on the results of the short-run ARDL, tightening monetary policies by the central bank that leads to gradual increases in the benchmark rate does not have any significant impact on mutual fund prices. The risk-adjusted returns of both retail and institutional investors are not affected by fluctuations in interest rates. Also, the

absence of any statistically significant relationship between inflation rate and mutual fund prices imply that inflationary periods characterized by accelerating economic growth, rising income levels and low unemployment does not affect the net asset values of open-end mutual funds in any significant way.

It is observed from the equation that a percentage point increase in one-quarter lagged values of exchange rate (USD/GHS) decrease current mutual fund prices by 0.41 percent, while a one percentage point increase in two-quarter lagged values of exchange rate (USD/GHS) increase current mutual fund prices by 0.26 percent. Therefore, the significant determinants of open-end mutual fund prices are historical prices of mutual funds and historical exchange rates (USD/GHS).

#### **4.5. POST ESTIMATION TESTS**

In this section, I perform some tests on serial correlation (Lagrange Multiplier Test); function form (Ramsey's RESET Test); Heteroscedasticity (White Test) and Stability Test to determine and correct for potential problems that limits the ability of the equation estimated above to model the relationship without bias.

##### **4.5.1. WHITE (1980) TEST FOR HETEROSKEDASTICITY**

White's (1980) test for heteroskedasticity is estimated to determine whether in the disturbances in the short-run ADRL are homoscedastic. The assumption is that they have the same variance across entities and time (White, 1980; Baltagi, 2005). When homoskedasticity is assumed in the presence of heteroskedasticity, it does not affect the estimators, however, the standard errors are invalid to for constructing confidence intervals and  $t$  statistics (Wooldridge, 2004). White (1980) proposes that in the presence

of heteroskedasticity, a robust covariance matrix can be estimated to compute standard errors that are heteroskedasticity-consistent. The null and alternative hypothesis for the white (1980) test for heteroskedasticity is specified below:

$H_0$ : assumption of homoskedasticity

$H_a$ : presence of unrestricted heteroskedasticity

*Table 9.0. Summary of White Test for Heteroskedasticity*

<i>Source</i>	<i>CHSQ</i>	<i>Probability</i>
Heteroskedasticity	42.00	0.43
Skewness	8.62	0.47
Kurtosis	2.24	0.13

*Source*: Author's estimates from Stata.

The above table shows a CHSQ of 42.00 for heteroskedasticity and a p-value of 0.4274. The p-value of the heteroskedasticity is well above the significance level of 0.05. Therefore, I fail to reject the null hypothesis and conclude that the idiosyncratic errors are homoscedastic. This is corroborated by the probability values of skewness (0.4729) and kurtosis (0.1349) since they are above 5% significance level.

#### **4.5.2. BREUSCH-GODFREY (1978) TEST FOR SERIAL CORRELATION**

In this section, I conduct a test for the existence of serial correlation in the time series. I employ the Breusch-Godfrey (1978) test for serial correlation to determine if there is a nexus between the error term and its lagged values. The following hypothesis were tested:

$H_0$ : There is no serial correlation in idiosyncratic errors

$H_a$ : There is serial correlation in idiosyncratic errors

The results of the Breusch-Godfrey (1978) test for autocorrelation is reported below:

*Table 10.0.* Results of the Breusch-Godfrey test for serial correlation

<i>CHSQ</i>	<i>df</i>	<i>P-value</i>
4.70	1.00	0.03

*Source:* Author's estimates from Stata statistical software

From table 10.0. the p-value is 0.03, which is well below the critical value of 0.05. Therefore, I reject the null hypothesis and conclude that there is a problem of autocorrelation in idiosyncratic errors. However, as opined by Persaran and Shin (2001), serial correlation is not a problem in ARDL if the optimal lags have been specified with the appropriate test. The problem of autocorrelation can be eliminated by changing the optimal lags, but since they have properly been specified by the AIC, serial correlation is not significant problem in this short-run ARDL model.

#### 4.5.3. TEST FOR FUNCTIONAL FORM AND STABILITY

The Ramsey (1969) Regression Equation Specification Error Test (RESET) is conducted to determine whether non-linear combinations of explanatory variables better help explain the variations in the response variable compared to linear combinations. The following hypotheses are tested in that regard.

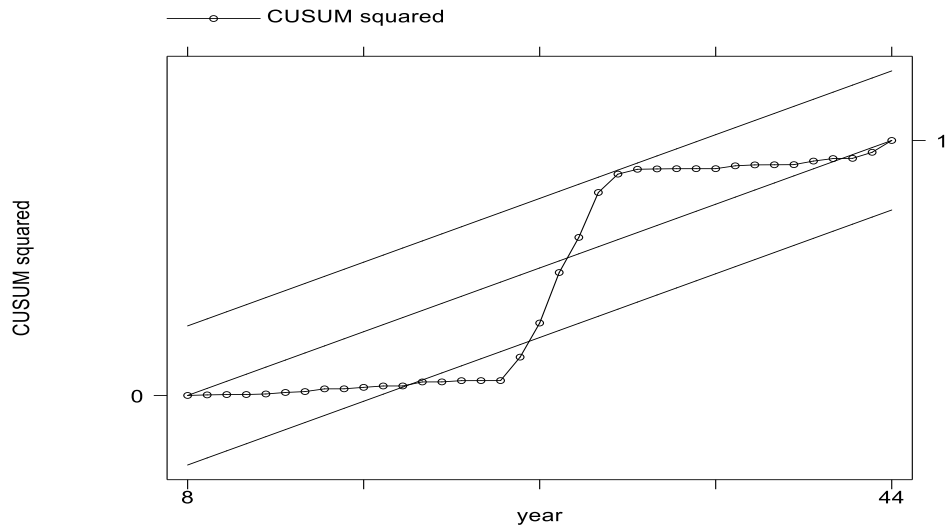
$H_0$ : Model has no omitted variables

$H_a$ : Model has omitted variables

The results of the Ramsey (1969) RESET reported an F-statistic of 1.37 and a p-value of 0.2726. The p-value is well above the 0.05 level; hence we fail to reject the null hypothesis and conclude that the functional form of the model has been correctly specified.



To assess whether the regression relationship estimated with the short-run ARDL model is stable over time and does not vary significantly, the Cumulative Sum (CUSUM) of squares of recursive residuals are generated as recommended by Brown, Durbin and Evans (1975). They opine that if the estimated model should be constant over time and should not significantly depart from its constant value over the period (Brown et al., 1975). The CUSUM of squares plot passes the stability test if a substantial section of the recursive residual lines lies within the 5 percent significance line over time. The plot of the CUSUM of squares is shown below:



*Figure 6. Graph showing the CUSUM of squares of recursive residuals*

Figure 6 above provides an indication of evidence of stability in the model (Brown et al., 1975). A substantial part of the CUSUM of squares residual line within the 5 percent significance lines (the upper and lower lines in the graph). Therefore, it can be concluded that the model is stable, and the parameter estimates can be used for drawing reliable inferences (Marfo, 2017).

#### 4.6. DISCUSSION OF RESULTS

Some aspects of the findings in this study are consistent with the extant literature although there are some surprises. Based on the results of the short-run ARDL estimations, interest rates, inflation rate and real GDP do not have any explanatory power over the variations in mutual fund prices. The determinants of mutual fund prices are the lagged values of mutual fund prices and the lagged values of exchange rates (USD/GHS).

The insignificance of interest rates and inflation rate in determining mutual fund prices is in sharp contrast to the evidence presented by Marfo (2017). He found that inflation has a positive impact on the performance of open-end mutual funds in Ghana in the long-run and a short-run negative impact on mutual fund prices. Moreover, Marfo (2017) discovered that interest rate has a statistically significant negative relationship with mutual fund performance in the long-run and short-run. This is also corroborated by Ansong (2013). He found a positive relationship between mutual fund prices and inflation rate. However, Ansong (2013) also found that exchange rates have no significant relationship with mutual fund prices, which is in sharp contrast with the evidence presented in this study.

Peiro (2016), Ludvigson and Ng (2009), Yadav et al. (2016) and Karuiki (2014) however, find a statistically significant relationship between mutual fund performance and interest rates. The negative relationship between mutual fund prices and interest rates is consistent with the theory and Rashid's (2008) argument that as real interest rates rise as a result of higher demand for loanable funds, the present values of firms' cash flows declines which consequently causes a slump in share prices and reduces the returns and prices of mutual funds. Panda (2008) posits that rising interest rates reduces profitability

of firms as it increases the cost of capital. Moreover, due to an increase in cost of capital for consumers as well, demand for products decline reducing profitability further. This culminates in a lower share price and a subsequent decline in prices of mutual funds. Therefore, the absence of a relationship between mutual fund prices in this study's short-run is surprising.

Elton et al. (1995), Karuiki (2014) and Makau (2016) found a conflicting evidence of a significant relationship between inflation rate and capital market performance. The results of their studies suggest that inflation rates are positively correlated with mutual fund prices. This is inconsistent with Feldstein's (1980) observation that high rates of inflation work to reduce the ratio of share prices to real earnings and an increase in the effective tax rates of firms. These events put corporate earnings under pressure leading to underperformance in the equity market and a subsequent decline in performance of funds that are underweight in equities.

However, Branch (1974), Cagan (1974) and Bodie (1976) also report a positive link between the stock markets and inflation rates. They concluded that equities are used as a partial hedge against during inflationary periods apart from hyperinflation. Hence stock prices surge during when inflation pressures are high culminating in an increase in prices of equity mutual funds. As investors hedge their returns in the equity markets, flow of funds out of the debt markets reduces prices of debt securities and increases yields leading to increases in prices of money market and fixed-income mutual funds. Therefore, it is evident that mutual fund investors are not pricing in inflationary risks in the mutual fund industry.

The evidence that mutual fund prices are significantly related to the lagged values of exchange rates is consistent with the joint consensus that exchange rate appreciation and depreciation creates significant alpha generating opportunities for mutual funds. The evidence is consistent with Farooq, Keung and Kazmi 's (2005) position that the positive nexus between the capital markets and exchange rates is due to the underlying theory that an appreciation of the domestic currency against a basket of currencies makes local firms more competitive leading to an increase in their stock prices. This in turn increases prices of mutual funds. Azman-Saini, Habibullah and Azali (2003) found that the data supports the evidence of a positive relationship between equity markets and inflation rates for Thailand. More recently, Adam and Tweneboah (2008) equally found compelling evidence of the positive interaction between movement of stock prices and exchange rates in Ghana.

The results also suggest that money supply is insignificant and hence does not have any significant short-run explanatory power over mutual fund prices which is inconsistent with the results obtained by Karuiki (2014), Makau (2016) and Bulmash and Trivoli (1991). The absence of an explanatory power of money supply over mutual funds prices in Ghana is somewhat surprising because changes in money supply directs the flow of funds to mutual funds. With increased fund flows, mutual funds are able to increase their positions in the equity and money markets, thereby enhancing returns and prices. Therefore, it is evident the Ghanaian capital markets are not pricing in variations in broad money supply in Ghana.

The absence of short-run relationship between mutual fund prices and real GDP in Ghana is inconsistent with classical economic theory. A plethora of studies including Al-

Sharkas (2004), Fama (1990), Gheske and Roll (1983) have corroborated a link between GDP and capital market performance. As opined by Ross, Roll and Chen (1986) an increase in production or real GDP is an indication of labor market performance, rising consumption and increased corporate earnings, hence, the equity and capital markets surge in response to improved real economic activity leading to an increase in performance of mutual funds. Chen et al. (1986) equally confirmed that industrial production (real GDP) is adequately priced in capital market prices. Therefore, the lack of evidence to support the hypothesis that mutual prices move in tandem with real GDP is surprising. A possible reason is the lack of participation of some of the key companies driving a substantial part of Ghana's GDP growth in the capital markets.

#### **4.7. LIMITATIONS**

The sample size of 10 open-end mutual funds used for this study presents a limitation. As conventional knowledge holds, small sample sizes pose a challenge for statistical inference. The actively managed open-end mutual fund industry is still an emerging industry in Ghana, hence obtaining substantial longitudinal data of mutual funds that have been in operation for the past 10 years is implausible. This is because there were less than 6 open-end mutual funds before 2007, hence, the study limited the sample size to only 10 actively managed open-end mutual funds licensed by the Securities and Exchanges Commission.

Although a sample size of this study reflects a case of a small sample size in relative terms, in absolute terms, it is a good representative of the mutual fund industry in Ghana since there were only 35 open-end mutual funds in operation as at the fourth quarter of 2018 (Securities and Exchanges Commission, 2018). Moreover, the sample

used represented some of the largest, oldest, smallest (in terms of market capitalization); best performing and worst performing funds. Hence, it is reflective of the overall mutual fund industry in Ghana. Therefore, inferences can reliably be drawn based and analysis can be conducted with the sample.

## CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

This section recapitulates the results of the study and draws appropriate conclusions based on the findings. Recommendations will equally be provided to aid in addressing some of the concerns in the Ghanaian mutual fund industry highlighted by the study.

### 5.1. SUMMARY OF FINDINGS

This paper explores the importance fluctuations in macroeconomic variables (interest rate, inflation rate, exchange rate, money supply and real GDP) for the open-end mutual fund industry in Ghana. The study employed a multifactor-model based on the APT model to empirically assess the relationship between the variables using a short-run Autoregressive Distributed Lag (ADRL) model. Based on the Bounds Test proposed by Pesaran et al. (2001), a long-run relationship between fund prices and macroeconomic factors was ruled out since they are not cointegrated.

The study employed the average quarterly prices of 10 open-end mutual funds and quarterly data of macroeconomic variables – interest rates (T-bill rate); inflation rate (Changes in CPI); exchange rate (USD/GHS), money supply (M2) and real GDP – spanning the period from 2007 to 2017. This time period captures an era of significant growth in the collective open-end mutual fund industry in Ghana and the massive fluctuations in the macroeconomic variables. Based on the Arbitrage Pricing Theory (APT) model, the following hypotheses were tested:

$H_0$ : There is no linear relationship between mutual fund prices and macroeconomic factors in Ghana

*H<sub>a</sub>*: There is a linear relationship between mutual fund prices and macroeconomic variables in Ghana.

The results of the short-run ARDL model revealed that macroeconomic factors are significant determinants of mutual fund prices in Ghana based on the reported Adjusted R-square value of 0.966. Essentially macroeconomic factors are short-run determinants of a substantial 96.62 percent of the variations in the prices of open-end mutual funds in Ghana. With regards to the statistical significance of the individual macroeconomic variables, interest rate, inflation, money supply and real GDP were found not be significant short-run determinants of prices of open-end mutual funds in Ghana. The variables with an explanatory power over mutual fund prices in Ghana are the lagged values of fund prices (historical prices) and the lagged values of exchange rates (one and two previous quarter rates) as they were found to be statistically significant at the 5 percent significance level.

Essentially, current values of fund prices are positively correlated with their lagged values. Prices of mutual funds one and two quarters in the past influences current fund prices. Also, one-quarter lagged values of exchange rates are negatively correlated with mutual fund prices while two-quarter lagged values of exchange rates are positively correlated with mutual fund prices. More specifically, one-quarter lagged values of exchange rates positively affects mutual fund prices while two-quarter lagged values of exchange rates negatively affects mutual fund prices.

In terms of magnitude, a percentage point increase in one-quarter lagged values of mutual fund prices increase current fund prices by 1.47 percent, while the past two



quarter values of mutual fund prices decrease current mutual fund prices by 0.46 percent. It was also observed that a percentage point increase in one-quarter lagged values of exchange rate (USD/GHS) decrease current mutual fund prices by 0.41 percent, while a one percentage point increase in two-quarter lagged values of exchange rate (USD/GHS) increase current mutual fund prices by 0.26 percent.

The insignificance of interest rates, inflation rate, money supply (M2) and real GDP in determining mutual fund prices is in sharp contrast to the evidence presented by Marfo (2017), Peiro (2016), Ludvigson and Ng (2009), Yadav et al. (2016), Karuiki (2014), Elton et al. (1995) etc. Marfo(2017) found inflation and interest to exhibit a long-run and short-run positive impact on the performance of open-end mutual funds in Ghana. Ansong (2013) corroborated this evidence with his discovery of a positive relationship between mutual fund prices and inflation rate. Peiro (2016), Ludvigson and Ng (2009), Yadav et al. (2016) and Karuiki (2014) also find a similar evidence. Branch (1974), Cagan (1974) and Bodie (1976) also report a positive link between the stock markets and inflation rates. They concluded that equities are used as a partial hedge against during inflationary periods apart from hyperinflation. Hence stock prices surge during when inflation pressures are high culminating in an increase in prices of equity mutual funds. As investors hedge their returns in the equity markets, flow of funds out of the debt markets reduces prices of debt securities and increases yields leading to increases in prices of money market and fixed-income mutual funds.

The statistical insignificance of money supply (M2) in explaining the short-run variations in mutual fund prices in this study is inconsistent with the results obtained by Karuiki (2014), Makau (2016) and Bulmash and Trivoli (1991). The absence of an

explanatory power of money supply over mutual funds prices in Ghana is somewhat surprising because changes in money supply directs the flow of funds to mutual funds. With increased fund flows, mutual funds are able to increase their positions in the equity and money markets, thereby enhancing returns and prices.

The absence of short-run relationship between mutual fund prices and real GDP in Ghana is inconsistent with classical finance theory. A plethora of studies including Al-Sharkas (2004), Fama (1990), Gheske and Roll (1983) have corroborated a link between GDP and capital market performance. As opined by Ross, Roll and Chen (1986) an increase in production or real GDP is an indication of labor market performance, rising consumption and increased corporate earnings, hence, the equity and capital markets surge in response to improved real economic activity leading to an increase in performance of mutual funds. Chen et al. (1986) equally confirmed that industrial production (real GDP) is adequately priced in capital market prices. Therefore, the lack of evidence to support the hypothesis that mutual prices move in tandem with real GDP is surprising. A possible reason is the lack of participation of some of the key companies driving a substantial part of Ghana's GDP growth in the capital markets.

The evidence that mutual fund prices are significantly related to the lagged values of exchange rates is consistent with the joint consensus that exchange rate appreciation and depreciation create significant alpha generating opportunities for mutual funds. The evidence is consistent with Farooq, Keung and Kazmi 's (2005) position that the positive nexus between the capital markets and exchange rates is due to the underlying theory that an appreciation of the domestic currency against a basket of currencies makes local firms more competitive leading to an increase in their earnings and subsequently their stock

prices. This in turn increases prices of mutual funds. Azman-Saini, Habibullah and Azali (2003) found that the data supports the evidence of a positive relationship between equity markets and inflation rates for Thailand. More recently, Adam and Tweneboah (2008) equally found compelling evidence of the positive interaction between movement of stock prices and exchange rates in Ghana. However, Ansong (2013) also found that exchange rates have no significant relationship with mutual fund prices, which is in sharp contrast with the evidence presented in this study.

The lack of evidence in this study to establish a short-run relationship between mutual fund prices and interest rate, inflation, money supply and real GDP is surprising owing to the copious evidence from both theoretical and empirical literature presented above. It is evident that mutual fund investors are not pricing in interest rates, inflation, money supply and economic growth risk factors in the capital markets. This is not prudent as mutual fund prices in Ghana should ideally reflect movements in these variables given their impact on capital market returns in frontier economies like Ghana.

## **5.2. CONCLUSION**

Based on the results of short-run ADRL model, it can be concluded that systematic factors have a significant bearing on the prices of open-end mutual funds in Ghana. Macroeconomic factors jointly explain 96.6 percent of the variations in prices of open-end mutual funds in Ghana. The key determinants of mutual prices in the open-end mutual fund industry in Ghana are historical prices of funds and the USD/GHS exchange rate. Interest rates, inflation, money supply and real GDP are insignificant determinants of mutual fund prices in Ghana. Therefore, the data supports the hypothesis that exchange rates have an impact on mutual fund prices in Ghana.

### **5.3. RECOMMENDATIONS**

The results of this study suggest that exchange rates have a moderating impact on prices of open-end mutual fund in Ghana. Against this backdrop, I recommend that the following measures be implemented to enhance boost returns and enhance continued growth and trust in the collective investment scheme industry and the overall financial sector of Ghana

#### **5.3.1. POLICY MAKERS**

Bank of Ghana and the government have fiscal and monetary policy tools at their disposal that can be used to control movements in exchange rates to a large extent. Hence, they must endeavor to keep exchange rates at appreciable levels to prevent divestment by foreign and some local investors in the bond fixed-income market, which has the potential to widen yields and hamper the performance of open-end mutual funds. Fiscal policies regarding the use of government expenditure and taxes should equally be used to cautiously to regulate economic activity and keep exchange rates in check to improve the performance of assets under management of mutual funds and consequently their prices.

#### **5.3.2. ACTIVE FUND MANAGERS**

Active fund managers also have a responsibility to implement portfolio management strategies that can mitigate macroeconomic shocks on fund prices. Essentially, asset allocation and security selection by fund managers should give preference to asset classes and securities that are immune to exchange rate shocks based on the portfolios sensitivity to changes in the USD/GHS rate. Derivative instruments like options and futures and other hedging techniques should also be employed by fund

managers to hedge against exchange rate risk that will stem from volatility in the USD/GHS rate.

#### **5.4. SUGGESTIONS FOR FUTURE STUDIES**

Further studies on the nexus between mutual fund prices and macroeconomic factors are likely to encounter problems with small sample sizes owing to the fact that the open-end mutual fund industry in Ghana is still in its early cycle stages, hence substantial data is almost an implausible task. Nonetheless, improvements can be made to the frequency of the data. Monthly data could rather be considered for the dependent and independent variables as opposed to quarterly data. Moreover, other firm-specific variables, including assets under management (AUMs), sales loads, management fees etc. which I assumed are diversified away leaving only systematic risk factors (based on the APT) can be incorporated in the regression model to assess their impact on the portfolio NAVs. Other more qualitative factors like asset allocation, market timing, security selection skills of the fund manager and corporate government structures in mutual fund companies can be incorporated in the model as well to determine their explanatory power.

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