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**INFLUENCE OF INFLATION ON BOND
PRICES: A SURVEY OF BONDS LISTED AT
THE NAIROBI SECURITIES**

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INFLUENCE OF INFLATION ON BOND PRICES: A SURVEY OF BONDS LISTED AT THE NAIROBI SECURITIES

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Abstract

Purpose: The purpose of this study was to establish the influence of inflation on bond price.

Methodology: The research used an explanatory research design. 65 bonds listed in 23 categories at the NSE. The study used secondary data collected from NSE and the (KNBS) Kenya National Bureau of Statistics. A sample of 10 bonds was selected as these bonds were issued in the January 2008 and were still not mature by the 31st December 2012. Standard deviations were calculated for all the variables in the study. Further statistical analysis was carried out by use of correlation and regression analysis where bond prices were regressed against inflation, exchange rates and economic growth measured using the Kenya's Gross Domestic Product growth. The Statistical Package for Social Sciences (SPSS) version 17 was used to conduct the analysis. The findings were presented in form of tables and figures.

Results: The study found out that inflation had negative and significant relationship on the bond prices.

Unique contribution to theory, practice and policy: This study recommends that investors who are looking to buy into bonds should factor in inflation as this determines the bond prices. Since inflation has a negative impact on bond prices, the government policy making organ mandated with the control of inflation should pursue measures to reduce the inflation rate. These measures should include monetary policies such as reduce the interest rates, open market operations geared at reducing the amount of money supply in the economy. The government may also pursue contractionary fiscal policy aimed at reducing inflation. These policies would include reducing government spending.

Keywords: *Inflation, bond price. Nairobi Securities Exchange.*

1.0 INTRODUCTION

1.1 Background of the Study

Macro-economic factors such as inflation, GDP growth, interest rates on alternative financial instruments and exchange rates were employed as control variables across most studies. However, Birchwood (2004) explicitly examined the impact of macroeconomic influences on nominal and real interest spreads in the Caribbean region. He concluded that differences in interest rate spreads across the region may be due to differences in economic cycles, inflation and liquidity conditions, while the differences in the exchange rate regime affected the magnitude of the spreads. The study also found that countries with fixed exchange rates exhibited lower inflation rates and the highest real spreads (Birchwood, 2004).

The exchange rate risk occurs when the amount being paid in currency is worth less in real term where bond yield will be influenced (Hilscher & Nosbusch, 2010). Hence, the existence of exchange rate risk is positive correlation with world market bond portfolio. Also, Purchasing Power Parity theoretically can be used to hedge the exchange rate risk of UK government in purchasing and selling of government bonds. Investors can gain returns by hedging government bonds and therefore his paper concludes that the exchange rate has an impact in influencing government bond yields (Hilscher & Nosbusch, 2010).

Research has been made in examined the effect of market value of privately held U.S and Canadian government debt on the real Canadian dollar/U.S dollar exchange rate by Mcmillan and Koray (1990). In the paper, a model allowing small autoregression to find out if there is any relationship between debt and six other variables - exchange rate, output, price level, interest rate, nominal money and government purchases for both U.S and Canadian. They find that debt shock tend to have a negative relationship on both interest rate and exchange rate, which matched with the Ricardian Equivalence framework.

Research that explains the relationship between the yield curve and macroeconomic variables are important for public policy, bond valuation and investment decisions. This significance has recently induced many other papers in studying this issue. To construct a fine yield curve model, Duffie and Kan (2002) have considered models in which quite a number of unobserved factors explain the whole set of yield curves. There are many term structure models using latent factor models in which the factors are giving indirect comparisons to macroeconomic variables. In the other way around, there are other studies trying to clarify the relationships between bond yields and macro variables in direct model by using vector autoregressive (VAR) models. In a study done by Evans & Marshall (1998), they used VAR models in seeing the relationship of yields of various maturities together with macro variables.

1.2 Problem Statement

The environment of the stock market in Kenya changed considerably in the late 1970s and especially in the 1980s & 90s when it moved from over reliance on the T-bills as the only vehicle of investment to the stock market when the Kenyan Government realized and embraced the need to design and implement policy reforms to foster sustainable economic development with an efficient and stable financial system (NSE, 2011).

This spurred increased activity at the NSE leading to a dramatic increase towards more active stock portfolio management, encouraging substantially more dispersed performance by stock portfolio managers and investors. The dispersion in turn created a demand for techniques that would help investors evaluate the performance of stocks and bonds. The question now is what models are to be used for the above purpose? What are the factors for inclusion on estimating the bond prices? And how will this model be subsequently used to evaluate future bond prices in Kenya. The problem is that despite the increased activity and size of the stock market, the bond market still remains small with majority of the bonds issued by the government and a handful of others by private sector organizations (NSE, 2011). The NSE handbook (2011) indicates that the highest market activity is experienced in the stock market and the bond market only contributes to a very small percentage of the total market activity.

The problem of low participation and size of the bonds market may have been caused by the failure of investors to understand the factors that drive the bond prices. Many models on the factors affecting bond prices have been advanced. For instance, Bhole and Mahakud (2009), Chau (2012) advocate for the use of the Capital Asset pricing Model (CAPM) in estimating the price of bonds. Merton (1973) & Riley (2003) suggest that the Inter Temporal Capital Asset Pricing Model (ICAMP) is superior to the Capital Asset Pricing Model (CAPM) in estimating bond prices. Bai & Green (2008); Eita, (2011); Chau (2012) have advanced the Arbitrage Pricing Model (APT) as a superior approach to selecting the factors that influence bond prices.

However, none of the models are conclusive enough. While some models used in various studies show that the government debt, exchange rate and inflation rate have a positive relationship with bond prices, others show that they have a negative relationship while others don't show any relationship at all. In addition, there are scarce studies on the factors that influence bond prices in Kenya. Majority of the studies focus on developed economies eg Bhole & Mahakud (2009); Bai & Green (2008) & Chau, (2012) and fail to focus on Kenya which is a developing economy. The lack of conclusiveness of the studies and the scarcity of studies in Kenya on factors affecting bond prices forms the knowledge gap. It is for this research gap that this study seeks to close.

1.3 Research Objective

The objective of this study was to determine the influence of inflation on bond prices.

2.0 LITERATURE REVIEW

Inflation reflects erosion in the purchasing power of money – a loss of real value in the internal medium of exchange and unit of account within the economy (Central Bank of Iceland 2008). A chief measure of price inflation is the inflation rate, the annualized percentage change in a general price index (normally the Consumer Price Index) over time (Mankiw, 2005).

Inflation's effects on an economy are various and can be simultaneously positive and negative. Negative effects of inflation include an increase in the opportunity cost of holding money, uncertainty over future inflation which may discourage investment and savings, and if inflation is rapid enough, shortages of goods as consumers begin hoarding out of concern that prices will increase in the future. Positive effects include ensuring that central banks can adjust real interest rates (intended to mitigate recessions), and encouraging investment in non-monetary capital projects (Mankiw, 2005).

2.1 Causes of Inflation

Causes of inflation are divided into two broad areas: quality theories of inflation and quantity theories of inflation. The quality theory of inflation rests on the expectation of a seller accepting currency to be able to exchange that currency at a later time for goods that are desirable as a buyer. The quantity theory of inflation rests on the quantity equation of money, that relates the money supply, its velocity, and the nominal value of exchanges. Smith and Hume (2009) proposed a quantity theory of inflation for money, and a quality theory of inflation for production.

2. 1.1 Cost Push Inflation

This is also called "supply shock inflation," is caused by a drop in aggregate supply (potential output) (Beckerman, 1992). This may be due to natural disasters, or increased prices of inputs. For example, a sudden decrease in the supply of oil, leading to increased oil prices, can cause cost-push inflation. Producers for whom oil is a part of their costs could then pass this on to consumers in the form of increased prices. Another example stems from unexpectedly high Insured Losses, either legitimate (catastrophes) or fraudulent (which might be particularly prevalent in times of recession (Mankiw 2002).

Cost-push inflation is a type of inflation caused by substantial increases in the cost of important goods or services where no suitable alternative is available. A situation that has been often cited of this was the oil crisis of the 1970s, which some economists see as a major cause of the inflation experienced in the Western world in that decade. It is argued that this inflation resulted from increases in the cost of petroleum imposed by the member states of OPEC. Since petroleum is so important to industrialised economies, a large increase in its price can lead to the increase in the price of most products, raising the inflation rate. This can raise the normal or built-in inflation rate, reflecting adaptive expectations and the price/wage spiral, so that a supply shock can have persistent effects (Moffat, 2013).

2. 1.2 Demand Pull Inflation

Demand pull inflation occurs when aggregate demand and output is growing at an unsustainable rate leading to increased pressure on scarce resources and a positive output gap. When there is excess demand in the economy, producers are able to raise prices and achieve bigger profit margins because they know that demand is running ahead of supply. Typically, demand-pull inflation becomes a threat when an economy has experienced a strong boom with GDP rising faster than the long run trend growth of potential GDP. The last time this happened to any great extent in the UK economy was in the late 1980s (Keynes 1936).

Possible causes of demand pull inflation include: A depreciation of the exchange rate which makes exports more competitive in overseas markets leading to an injection of fresh demand into the circular flow and a rise in national and demand for factor resources – there may also be a positive multiplier effect on the level of demand and output arising from the initial boost to export sales (Oomes & Ohnsorge, 2005).

2.2 Types of Inflation

Underlying Inflation is Inflation caused by a reduction in the value of money rather than price changes in volatile products. For example, rising gasoline prices may reduce the spending power of one's income, but this may be due to factors external to money such as excessive speculation. Underlying inflation measures changes to the supply and demand for money itself (Qfinance, 2009). Nominal Inflation is an unadjusted rate, value or change in value. This type of measure often reflects the current situation, such as the current price of a car, and doesn't make

adjustments to reflect factors such as seasonality or inflation, which provide a more accurate measure in real terms (Qfinance, 2009).

Hyper inflation is extremely rapid or out of control inflation. There is no precise numerical definition to hyperinflation. Hyperinflation is a situation where the price increases are so out of control that the concept of inflation is meaningless. In economics, hyperinflation occurs when a country experiences very high, accelerating, and perceptibly "unstoppable" rates of inflation. In such a condition, the general price level within an economy rapidly increases as the currency quickly loses real value. Meanwhile, the real values of specific economic items generally stay the same with respect to each other, and in terms of other relatively stable foreign currencies. This includes the economic items that generally constitute the government's expenses (Sheffrin, 2003).

2.2.1 General Effects of Inflation

If the interest paid on savings account is more than the level of inflation the purchasing power will grow although less than it would have without the loss due to inflation. For instance, if inflation is 3% and the account pays 5% interest there is a net gain of 2%. This is known as the Real interest rate. However, if the inflation rate is 5% and the account pays 3%, the account will lose purchasing power (Taylor, 2008).

During periods of high inflation if companies cannot pass their increased costs on to consumers, businesses suffer financial losses. This causes the value of the stocks to go down. Therefore, the investor who invested in the stock of that company will also suffer a financial setback. As profits of the company go down this affects the company, the employees and the shareholders (Bernholz, 2003).

2.2.2 Specific Effects of Inflation on Bonds

Dewane (2010) investigated Bonds, Interest Rates, and the Impact of Inflation. Inflation and interest rate changes don't affect all bonds equally. Under normal conditions, short-term interest rates may feel the effects of any Fed action almost immediately, but longer-term bonds likely will see the greatest price changes. Also, a bond mutual fund may be affected somewhat differently than an individual bond. For example, a bond fund's manager may be able to alter the fund's holdings to minimize the impact of rate changes. With less demand for goods and services, inflation levels off or fall. With lower inflation, bond investors are less worried about the future purchasing power of the interest they receive. Therefore, they may be willing to accept lower interest rates on bonds, and prices of older bonds with higher interest rates tend to rise. Interest rates in general fall, fueling economic growth and potentially a new round of inflation.

Duff (2013) assessed the effects of Inflation on the supply and demand Curve for bonds and concluded that when the economy is booming the Monetary Authority adopts a restrictive monetary policy to keep inflation in check, which includes raising interest rates and removing money from the system. High interest rates discourage borrowing, but encourage the buying of bonds as investments rise. Increased demand for bond investments tends to lower interest rates -- the economy moves into recession, the money supply contracts and inflation diminishes. To

recover from recession, the Monetary Authority lowers interest rates to induce corporate borrowing, which results in an increased supply of bonds.

Pimco (2012) reviewed the effect of inflation on bond prices by focusing on inflation linked bonds. Inflation-linked bonds, or ILBs, are securities designed to help protect investors from inflation. Primarily issued by sovereign governments, such as the U.S. and the U.K., ILBs are indexed to inflation so that the principal and interest payments rise and fall with the rate of inflation. Inflation can significantly erode investors' purchasing power, and ILBs can potentially provide protection from inflation's effects. ILBs may also offer additional benefits in a broader portfolio context. The author seems to argue that there is negative effect of inflation on bond prices; hence the need to link bonds to inflation.

Kenny (2013) reviewed the Impact of Inflation on Bonds. The author noted that Inflation, or rising price levels for goods and services, can have two negative impacts for bond investors. One is obvious, while the other is more subtle – and therefore much more insidious. The first effect is that rising inflation can cause the U.S. Federal Reserve – or any country's central bank for that matter – to raise short-term interest rates in order to reduce the demand for credit and help prevent the economy from overheating. When the Fed raises short-term rates – or when it is expected to in the future – intermediate and longer-term rates also tend to go up. Since bond prices and yields move in opposite directions, rising yields mean falling prices – and a lower principal value for your fixed-income investment. The second impact of inflation is less obvious, but it can take a major bite out of your portfolio returns over time. This important effect is the difference between the “nominal” return – or the return a bond or bond fund provides on paper – and the “real,” or inflation-adjusted, return. To understand this concept, consider a shopping cart of food that a person buys at the supermarket. If the items in the cart cost \$100 this year, inflation of 3% means that the same group of items cost \$103 a year later. That same person has a short-term bond fund with a yield of 1%. Over the course of the year, the value of a \$100 investment rises to only \$101. On paper, the investor made 1%. But in real world money, he or she actually lost \$2 worth of purchasing power. Their “real” return was therefore -2%.

McMahon (2012) notes that bond prices are derived from the prevailing market interest rates. Market rates are partially controlled by the Federal Reserve (“the Fed”). When the economy slows down, the FED has several tools at its disposal to stimulate the economy. The FED can expand the money supply which makes everyone feel richer and spend more money. But this causes inflation. Unfortunately, if the rate of inflation outpaces the return paid on the bond, then the bond investor effectively loses money on the deal even though there is interest being paid. For example, if a bond pays 4 percent annually, but inflation runs at 5 percent, then the investor is losing 1 percent in terms of the value of the dollars he is being paid even though he is actually earning money and paying taxes on the interest. The FED can lower interest rates. This encourages borrowing by consumers because it is cheaper to borrow money thus increasing economic activity and stimulating the economy. As we saw lowering interest rates is good for bonds. Unfortunately, nothing the FED does is in a vacuum and every action has its consequences. If the FED increases the money supply too much and the inflation rate gets out of hand just like a runaway nuclear reactor the FED has to slow the reaction down. To do this it has to raise interest rates which as we saw is also bad for bonds.

Nielsen (2012) on Understanding Interest Rates, Inflation and the Bond Market notes that to understand how interest rates affect a bond's price, you must understand the concept of yield. While there are several different types of yield calculations, the yield-to-maturity (YTM) calculation is considered here. A bond's YTM is simply the discount rate that can be used to make the present value of all of a bond's cash flows equal to its price. In other words, a bond's price is the sum of the present value of each cash flow where the present value of each cash flow is calculated using the same discount factor. This discount factor is the yield. When a bond's yield rises, by definition, its price falls, and when a bond's yield falls, by definition, its price increases. Inflation is a bond's worst enemy. Inflation erodes the purchasing power of a bond's future cash flows. Put simply, the higher the current rate of inflation and the higher the (expected) future rates of inflation, the higher the yields will rise across the yield curve, as investors will demand this higher yield to compensate for inflation risk. The timing of a bond's cash flows is important. This includes the bond's term to maturity. If market participants believe that there is higher inflation on the horizon, interest rates and bond yields will rise (and prices will decrease) to compensate for the loss of the purchasing power of future cash flows. Those bonds with the longest cash flows will see their yields rise and prices fall the most. This should be intuitive if one thinks about a present value calculation - when an economic agent changes the discount rate used on a stream of future cash flows, the longer until a cash flow is received, the more its present value is affected.

Global Investor (2013) notes that inflation has a major influence on bonds. Rising inflation is damaging to bond prices, because, unless the bonds are index-linked, the income they generate will fail to maintain its buying power. To compensate for this dwindling buying power, prices of the bonds typically fall. Therefore, when inflation is on the increase, bond prices fall, and yields rise and when inflation is decreasing, bond prices rise, and yields fall. Global Investor (2013) further notes that the threat which inflation poses to bond prices was evident in the 1970s. A £1,000 investment in gilts in 1970 was worth only £682 in real terms by the end of the decade, even with all income reinvested tax-free.

3.0 RESEARCH METHODOLOGY

The research used an explanatory research design. 65 bonds listed in 23 categories at the NSE. The study used secondary data collected from NSE and the (KNBS) Kenya National Bureau of Statistics. A sample of 10 bonds was selected as these bonds were issued in the January 2008 and were still not mature by the 31st December 2012. Standard deviations were calculated for all the variables in the study. Further statistical analysis was carried out by use of correlation and regression analysis where bond prices were regressed against inflation, exchange rates and economic growth measured using the Kenya's Gross Domestic Product growth. The Statistical Package for Social Sciences (SPSS) version 17 was used to conduct the analysis. The findings were presented in form of tables and figures.

4.0 RESULTS AND DISCUSSIONS

4.1 Bond Prices

The study sought to establish the effect of bond prices. The results are presented as follows.

4.1.1 10 Year Bond (FXD1/2003/10Yr)

The study sought to establish the bond prices for FXD1/2003/10yr.

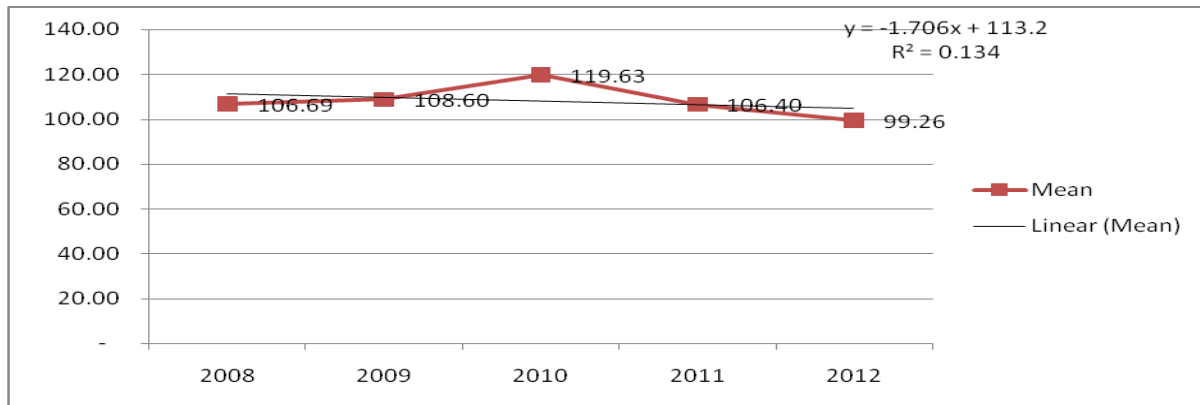


Figure 1: FXD1/2003/10Yr

Results in Figure 1 indicates that the prices for the bond increased to reach to a peak of 119.63 in the year 2010, however the prices declined the following years to a low of 99.26 in the year 2012. The findings implied that the prices of the ten year bond generally declined over the five year period. This also implied that the bond yield went up as there existed negative relationship between bond prices and yields.

4.1.2 10 Year Bond (FXD2/2003/10Yr)

The study sought to establish the bond prices for FXD2/2003/10yr

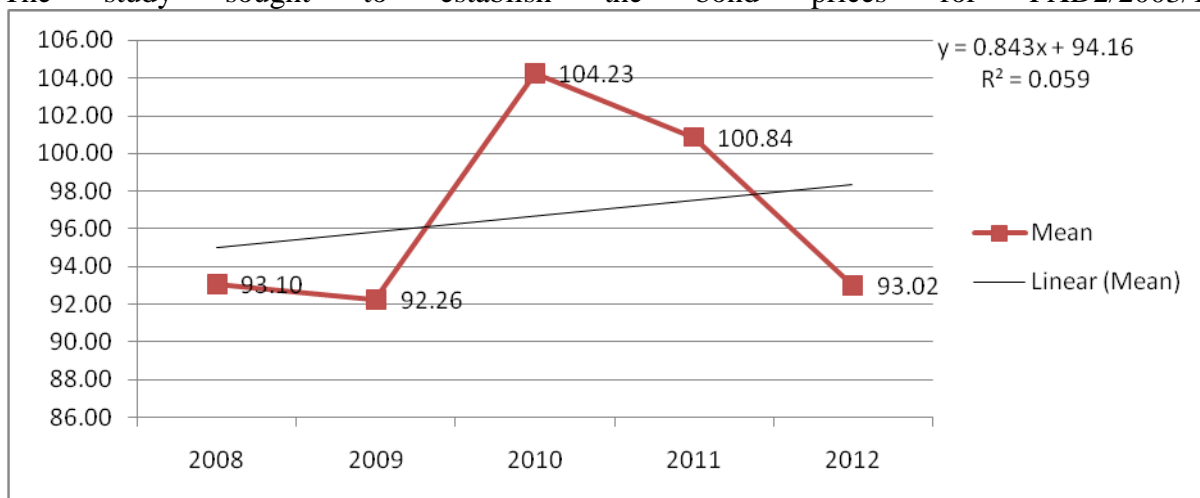


Figure 2:FXD2/2003/10Yr

Results in Figure 2 indicates that the prices for the bond increased to reach to a peak of 104.23 in the year 2010; however the prices declined the following years to a low of 93.02 in the year 2012. The findings implied that the prices of the ten year bond generally increased over the five

year period. This also implied that the bond yield went down as there existed negative relationship between bond prices and yields.

4.1.3 10 Year Bond (FXD1/2006/10Yr)

The study sought to establish the bond prices for FXD1/2006/10yr.

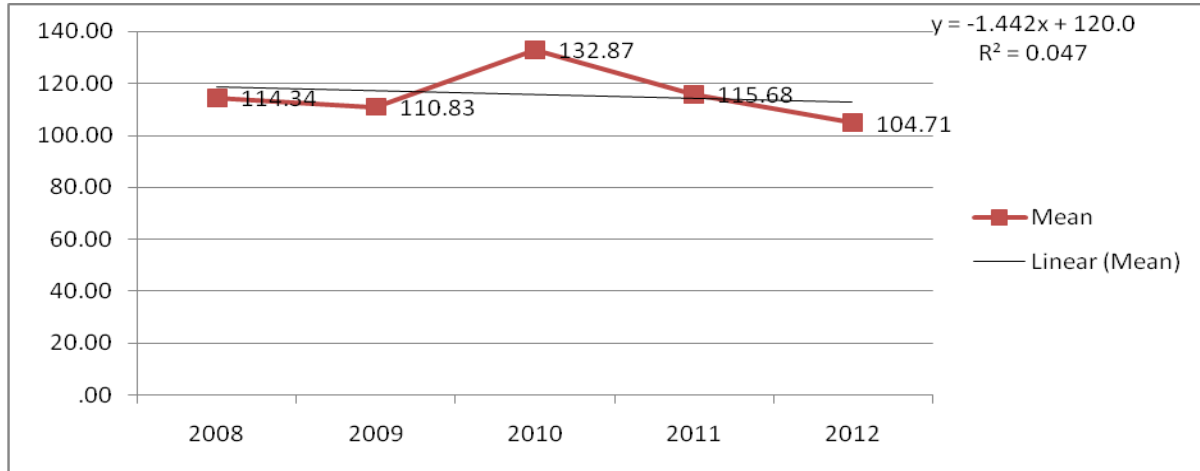


Figure 3:FXD1/2006/10Yr

Results in Figure 3 indicates that the prices for the bond increased to reach to a peak of 32.87 in the year 2010, however the prices declined the following years to a low of 104.71 in the year 2012. The findings implied that the prices of the ten year bond generally declined over the five year period. This also implied that the bond yield went up as there existed negative relationship between bond prices and yields.

4.2 Effect of Inflation on Bond Price

4.2.1 Descriptive Results

The study sought to establish the effect of inflation on bond price.

Table 1: Descriptive Results for Inflation

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
2008	12	15.10	3.08	0.89	13.14	17.06	7.93	18.70
2009	12	10.62	2.46	0.71	9.06	12.18	7.14	14.62
2010	12	4.10	1.22	0.35	3.32	4.88	3.18	7.52

2011	12	13.98	4.85	1.40	10.89	17.06	5.42	19.72
2012	12	9.64	5.45	1.57	6.18	13.10	3.20	18.31
Total	60	10.69	5.32	0.69	9.31	12.06	3.18	19.72

Results in Table 1 revealed that inflation had a mean of 15.10% in 2008 and in the year 2009 the mean reduced to 10.62% and in 2010 the mean declined further to 4.10 and in the year 2011 the mean increased effectively from 4.10 to 13.97 and declined to 9.6 in the following year. The results implied that the inflation rate has generally declined over the 5 year period. Perhaps, this could be attributed to the macroeconomic policies being instituted by the government to combat inflationary pressures.

4.2.2 Correlation between Inflation and Bond Prices

The study sought to establish whether inflation influences bond price.

Table 2: Correlation between Inflation and Bond Prices

		Average Bond prices	Inflation
Average Bond prices	Pearson Correlation	1	-.489**
	Sig. (2-tailed)		.000
	N	60	60
Inflation	Pearson Correlation	-.489**	1
	Sig. (2-tailed)	.000	
	N	60	60

** . Correlation is significant at the 0.01 level (2-tailed).

Results in Table 2 revealed that there was a negative and significant relationship between inflation and the bond price ($r = -0.489$, p value < 0.01). The results were interpreted to imply that a rise in inflation is associated by a decline in bond prices and this further implied that rise in inflation may have led to low bond yields as it is an established fact that bond prices and yields are negatively correlated.

4.2.3 Regression Analysis of Inflation and Bond Prices

Regression analysis was conducted to empirically to determine the relationship between the effects of inflation on bond price.

Table 4. 3: Regression Coefficients

Estimate	Value	T-Statistic	P value
(Constant)	123.151	37.137	.000
Inflation	-1.188	-4.270	.000
F	18.237		.000 ^a
R	.489 ^a		
R square	.239		
Dependent variable	Average Bond prices		
Independent variable	Inflation		

Result in Table 3 indicates that the goodness of fit of the model was satisfactory. This finding was supported by an r squared of 0.239. An r squared of 0.239 indicates that 23.9% of variation in bond price is explained by inflation rate.

Regression results indicate that the inflation is negatively related to bond prices. This was evidence by a regression coefficient of -1.188 (p value = 0.000). The relationship was significant at 0.05 critical value since the reported p value 0.000 was less than the critical value of 0.05. An increase in inflation by one unit leads to a decrease in bond price by -1.188 units.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Results led to the conclusion that the inflation rate has generally declined since year 2008. This indicated that the government may be using macroeconomic policies aimed at reducing the inflation in Kenya. The findings revealed that there was negative correlation between inflation

and bond prices. This implies that an increase in inflation was associated with a decrease in bond prices. The findings were supported by regression results. It was concluded from the regression results that inflation had negative and significant relationship on bond prices. It was noted that an increase in inflation by one unit leads to a decrease in bond prices of 1.188 units.

5.2 Recommendations

This study recommends that investors who are looking to buy into bonds should factor in inflation as this determines the bond prices. Since inflation has a negative impact on bond prices, the government policy making organ mandated with the control of inflation should pursue measures to reduce the inflation rate. These measures should include monetary policies such as reduce the interest rates, open market operations geared at reducing the amount of money supply in the economy. The government may also pursue contractionary fiscal policy aimed at reducing inflation. These polices would include reducing government spending.

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