THE LONGRUN RELATIONSHIP BETWEEN INTEREST RATES AND INFLATION IN KENYA

BY

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DECLARATION

This Research Project is my original work and has not been presented for a degree in any other University.

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DEDICATION

This research project is dedicated to my loving parents and to all my brothers and sisters. All that I wish to become is in the hands of God who has enabled me through this research project.

ABSTRACT

This thesis investigates the relationship between expected inflation and nominal interest rates in Kenya and the extent to which the Fisher effect hypothesis holds. The hypothesis, proposed by Fisher (1930), which stipulates that the nominal rate of interest reflect movements in the expected rate of inflation has been the subject of much empirical research in many industrialised countries. This wealth of literature can be attributed to various factors including the pivotal role that the nominal rate of interest and, perhaps more importantly, the real rate of interest plays in the economy. Secondary data was collected from the published reports for the period of thirteen years between 1999-2011.

Regression analysis was used in this in this study because it is widely used for prediction and forecasting. The study derived the nominal interest rate from the T bill rate, inflation rate from CPI and finally the actual real rate from GDP. Computed Real interest rates and actual Real interest rates were compared over a period of 13 years (1999 to 2011) to determine if the fisher hypothesis holds in Kenyan Economy.

The findings and analysis support to the existence of partial fisher effect in Kenya because both interest rates and inflation rate do not move with one on-one over the period under study. The average of interest rate obtained from expected rate of interest on facilities has a long run relationship with inflation rate, but as the results showed, this relation is very weak, and it can be ignored. The most likely explanation for this weak relationship is because expected rate of interest on facilities are not formed by market forces, but are artificially determined by monetary authorities as part of the monetary policy framework.

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ABBREVIATIONS

ARFIMA	-	Auto-Regressive Fractionally Integrated Moving Average Model
ARIMA	-	Auto-Regressive Integrated Moving Average Model
ARDL	-	Autoregressive Distributed Lag
CBK	-	Central Bank of Kenya
CPI	-	Consumer Price Index
DWT	-	Discrete Wavelet Transformation
FE	-	Fisher Effect
GDP	-	Gross Domestic Product
IMF	-	International Monetary Fund
IR	-	Inflation Rate
KNBS	-	Kenya National Bureau of Statistics
NBFIs	-	Non Banking Financial Institution
NIR	-	Nominal Interest Rate
OECD	-	Organisation for Economic Cooperation and Development
RIR	-	Real Interest Rate
USA	-	United States of America
VAR	-	Vector Autoregression

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The relationship between interest rates and inflation as hypothesized by Fisher has generated debate among economists. Fisher (1930) related a percentage increase in inflation to a percentage increase in nominal interest rate. Tobin (1965) argued that real interest rate decreases with inflation. More recent arguments like Evans (1998) and Juntilla (2001) were unable to confirm any relationship between interest rates and inflation.

1.1.1 Interest Rates, Nominal Interest Rates and Inflation Rates

Interest rate refers to the price a borrower pays for temporary usage of capital. It also implies the returns a lender expects by postponing and parting with his/her liquidity. The interest rate is a double-edge sword in that if it is high, holders of surplus funds will part with some since they expect high returns in the future. On the other hand, higher interest rates discourage borrowing. In a state of equilibrium, interest rate equates demand, investment, and supply, saving, in the capital market, (Duetsche Bundesbank2001).

In Kenya, interest rates decisions are taken by The Monetary Policy Committee (MPC) of The Central Bank of Kenya. The official interest rate since August 2005 is the Central Bank Rate (CBR), which replaced the 91-day Treasury Bill (TB) rate. The nominal rate is the rate without taking inflation into account. It can refer to interest earned, capital gains returns, or economic measures like GDP (Gross Domestic Product) Real interest rates are measured as the difference between nominal interest

rates and the rate of inflation. The expected real interest rate is the nominal interest rate minus the inflation rate expected over the term of the loan. The realized (ex post) real interest rate has the actual inflation rate subtracted from the nominal interest rate.

Real interest rate is an important determinant of saving and investment behaviour of households and businesses, and therefore crucial in the growth and development of an economy, Duetsche Bundesbank (2001). Both households and firms are mainly concerned with the real returns, interest, on their assets holding. Even though they know the nominal return, interest, on their assets holding, they are not certain about the direction of inflation in the current period, Hakan and Kamuran (1999). Given their expectations about the future real interest rates, they decide which assets to hold. If the uncertainty surrounding expected inflation is very high, they will expect the return on their investment to be higher.

Inflation on the other hand refers to persistent increase in general prices. The rate of inflation has far-reaching implications for the performance of the economy. For instance, higher rates of inflation will reduce aggregate demand, production, unemployment, trade deficits, and balance of payment to mention just few. On the other hand, a low and moderate inflation will encourage economic activity, particularly production. This in turn will raise gross domestic product (GDP), reduce unemployment, and eases the balance of payment problems.

1.1.2 The Fisher Effect Hypothesis

Irving Fisher developed a relationship known as the Fisher Effect which is a relationship between market rates of interest and inflation rates, as well as the effect

that inflation has on the minimum required returns and how they affect market interest rates (Johnson 2005).

The Fisher Effect is utilized while calculating the real interest rate, which is the rate at which current goods are converted into future goods. The formal expression of the Fisher Effect interest rate is: 1 + Nominal Interest rate = (1 + Real interest rate) (1 + Expected inflation rate).

The Fisher Effect does predict that real interest rates are in no way to be affected by expected inflation rate changes as it will result to nominal interest rate changes. The Fisher Effect suggests that the nominal interest rate contains only two components, the expected inflation rate and the real rate of interest rate.

1.1.3 Interest Rates in Kenya

Since Kenya gained independence, and like many other developing countries, it followed a policy of low interest rates, adjusting for inflation to maintain positive real rates. The main aim of this policy was to keep the costs of funds low, with the belief that cheap credit promoted development through increased investment. The use of interest rates to manage monetary conditions and mobilize and allocate financial resources in an efficient manner was neglected (Odhiambo, 2009).

Interest rates remained under the administration of the government through a regime of fixing minimum savings rates for all deposit-taking institutions and maximum lending rates for commercial banks, Non-Banking Financial Institution (NBFIs), and building societies. Interest rates are calculated on a reducing balance method and

levying of extra charges on loans was not allowed. Deposit savings rates were too low compared with the lending rates, widening the spread between the two.

In the 1974–1978 Development Plan. the government saw the need to review the interest rates to encourage savings through the banks and to create a disincentive to forestall speculation and uneconomic use of savings by borrowers. In the 1980s. the interest rate policy was reviewed with the following objectives: (1) to keep the general level of interest rates positive in real terms in order to encourage savings and to contribute to the maintenance of financial stability; (2) to allow greater flexibility and encourage greater competition among the banks and non-bank financial institutions to enhance efficient allocation of financial resources – in particular. the policy strove to ensure that funds flowed into those areas that are most productive, with the biases against long term lending and lending to small business eliminated; and (3) to reduce the differential to maximize lending for banks and NBFIs (Odhiambo. 2009).

With liberalization, the interest rate policy aimed to harmonize the competitiveness among the commercial banks and NBFIs by removing the differential that had existed for maximum lending rates to allow greater flexibility and encourage greater competition in interest rate determination so that the needs of both borrowers and lenders could be better met through the cooperation of market forces and to maintain the general positive levels of interest rates in real terms in order to encourage the mobilization of savings and contribute to the maintenance of financial stability.

The first review of interest rates in the post independent period was in June 1974. a decade after independence. Further reviews were made in the 1980s to allow

commercial banks more room to compete and have flexibility in meeting the needs of customers, narrowing further the difference between NBFI and commercial bank rates. Also, it was aimed at making interest rates responsive to changes in international markets to provide protection against adverse movements of funds internationally. In 1989 the ceilings on savings deposit rates for both commercial banks and NBFIs were progressively raised, while the ceilings on long-term bank loans were brought to the same level with the ceiling for NBFI lending Kipngetich (2011). These moves harmonized interest rates across the institutions, allowing banks greater flexibility in varying rates according to loan maturities. However, the gap between the lending and deposit rate was not narrowed.

In 1990 institutions were allowed to include all lending related charges and fees, so that the effective rates on loans could exceed stipulated ceilings. Treasury bill rates were fully liberalized in mid November 1990. This made it possible for the central bank to use the bill rate to influence the level of other short-term interest rates.

Interest rates were finally liberalized in July 1991. The immediate experience with interest rates was very promising, as they recorded positive real rates and the spread between the lending and the deposit rates narrowed. This was short lived, however, with the high inflationary conditions. A tight monetary policy was adopted to mop up the excess liquidity. Treasury bill rates increased, pushing up the interest rates. Commercial banks increased their deposit rates as they competed for deposits from the non-banking sector. The depreciation of the exchange rate and the increasing Treasury bill rates worsened the inflationary condition Commission (2011). The interest rates became negative in real terms and the spread between the lending and

deposit rates widened. With liberalization it is expected that the financial sector will grow and become efficient as information flows improve, while the low cost of intermediation leads to a closing gap between the lending and deposit rates. As efficiency improves and competition increases, then the spread is expected to narrow. So far, the results demonstrate a non-achievement of efficiency in banking intermediation. At the same time, the short-term deposit rates have continued to increase at a faster rate compared with the longer deposit rates so that the yield curve assumed a negative slope.

Despite the efforts to introduce competitiveness, the banking sector seemed to gain an oligopolistic structure, with only a few institutions controlling the sector. Four major commercial banks continued to dominate, with more than 70% of the total deposit liabilities and a similar share of the loans market. With such a structure it was even difficult for the banking system to respond to changes in other price indicators, e.g. the improved exchange rate condition. As the country experienced exchange rate appreciation in 1994, banking institutions failed to reflect this in their lending rates. The Central Bank responded by calling upon the banking institutions to reduce lending rates so as to increase the demand for imports and allow for absorption of available foreign exchange. The central bank felt that it was only logical for the lending rates to come down to reflect change in inflation and the downward trend in Treasury bill rates. And so, up to the present time the Central Bank remains in a cat and mouse game with commercial banks about interest rates (Commission, 2011).

1.2 Statement of the Problem

Fisher (1930) hypothesis postulates that there is a one-to-one relationship between nominal interest rate and inflation assuming a constant real rate of interest over the

long term. However, this does not mean that real interest rate is stable over time. The implication of the Fisher hypothesis is that the real rate of interest, the difference between nominal interest rate and the inflation rate, is basically determined by the real factors of the economy.

The study intends to empirically investigate the relationship between interest rate and inflation with respect to the fisher hypothesis in the liberated interest regime in Kenya being the years 1991 – 2011. Naomi (2011) in her study of determinants of interest rates identifies that a relationship between interest and inflation exists.

Kihara (2002) carried out another study on inflation and identifies some years of high inflationary activity. It is expected therefore that this years' show equal change in interest rates. Fridah (2011) agreed that inflation is the main determinants of interest rates in Kenya. In her study of determinants of lending rates of Commercial banks in Kenya she expounded on how the two variables come hand in hand in determining the lending rates.

Globally there have been other studies carried out to support the fisher hypothesis, while others were unable to link the variables in the hypothesis. Mundell (1963), in an attempt to explain Fisher's (1930) empirical results, argued that inflationary pressures cause the real rate of interest to decrease. This is because inflation reduces real money balance and consequently wealth. A decline in wealth therefore stimulates savings, which Mundell suggested could take various forms including equities and bonds. Tobin (1965) similarly argued that inflation causes people to increase their holding of real capital. Mundelland Tobin's shared view of the lagging re'ationship between

interest rates and expected inflation is known as the Mundell-Tobin effect, or the so called wealth effect.

Cargill (1977) on the other hand cannot verify the existence of such a relationship. Engsted (1996:886, however, found support for the tax-adjusted long-term Fisher effect for thirteen OECD countries. This suggests that nominal interest rates will adjust more than one-for-one to changes in expected inflation. Carr, Pesandoand Smith (1976) tested the relationship between expected inflation, income tax and nominal rates of interest in Canada from 1959-1971. Applying various interest rate models, they failed to find conclusive results as to whether income tax would cause nominal interest rates to rise more than the rise in expected inflation. Shome, Smith and Pinkerton (1988) argued that when investors are risk averse they will require a premium to compensate them for any risks involved in holding the assets. According to them, the strong form Fisher hypothesis has not held empirically because expected inflation measures used in the literature only capture total variability in prices and do not consider the covariance of real output and future prices.

The study will investigate to what extent the Fisher effect hypothesis holds in the Kenyan economy. The study will seek to investigate whether a one-to-one relationship between nominal interest rate and the expected inflation exists and which would in turn imply that real interest rate is determined by real factors and that the monetary policy measures cannot influence the real interest rate.

1.3 Objectives of the Study

The objective of the study is to examine the nature of the relationship between nominal interest rates, real interest rate and inflation in Kenya.

1.4 Importance of the Study

The study is expected to give an insight in the relationship between interest and inflation in the Kenyan economy. This is crucial in Kenya where the need of rapid economic development is paramount. Interest rate plays an important role in the economy as it is not only the price of money borrowed /lent and returns on investment but also an important instrument of monetary policy. Thus the result of this study will provide a better guide to policy makers in policy formulation initiatives that are more appropriate for financial sectors.

Scholars in finance will also benefit from this study. It will be an addition to the existing knowledge on the relationship between the two variables (Interest rates and Inflation) and will be used by researchers as a basis to stimulate further research in order to develop a better understanding of the concept of the fisher hypothesis.

Financial Institutions will be able to understand the relationship between interest rates and other variables such as inflation so as to enable them expect high returns in the future. Jegadeesh & Pennachi (1996) observes that management of interests risk is critical factor for the success of Financial Institution.

An individual will be able to organize themselves on the changes on the rates by relating it to other variables such as inflation. Higher interest rates discourage borrowing and vice versa

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter presents critical review concerning the study of fisher hypothesis in Kenya. This is done by discussing the fisherian findings, the relevant theories and a review of the literature from both developed and emerging markets. Finally the chapter explores various alternative interpretations put forward in an attempt to explain why Fisher's hypothesis lacks empirical consistency.

2.2 Theoretical Studies

2.2.1 Fisher's Theory

Fisher (1930), analyzed price changes and nominal interest rate data from Great Britain and the United States for the periods 1820-1924 and 1890-1927 respectively, and found "no apparent relationship" between price changes and interest rates in these countries in the short-run, where a correlation coefficient of -0.459 was obtained for the British data and -0.289 for the United States data without lagging the data. In contrast, when a distributed lag of past inflation was used as a proxy of expected inflation, the correlation coefficients increased substantially. Here Fisher (1930:423) obtained correlation coefficients of 0.98 and 0.857 for Great Britain and the United States, when price changes were spread over 28 years and 20 years respectively. From these findings Fisher (1930) concluded: that price changes do, generally and perceptibly affect the interest rate in the direction indicated by a prior theory. But since forethought is imperfect, the effects are smaller than the theory requires and

lagged behind price movements, in some periods, greatly. When the effects of price changes upon interest rates are distributed over several years, remarkably high coefficients of correlation is noted, thus indicating that interest rates follow price changes closely in degree, though rather distantly in time.

Fisher concluded that though nominal interest rates do follow expected inflation, they did so less than his initial hypothesis suggested and only over the long-run. Since Fisher's work, there has been a significant amount of empirical research done to confirm the hypothesis, especially in developed countries, all with modest consistency. The next two sections review the empirical literature, first starting with studies in developed countries, then developing countries.

2.2.2 Mundell-Tobin Effect

While Fisher (1930) proposed that nominal interest rates should be directly related to expected inflation, he did not empirically prove a one-for-one relationship; instead, he found a less than one-for-one relationship. Mundell (1963), in an attempt to explain Fisher's (1930) empirical results, argued that inflationary pressures cause the real rate of interest to decrease. This is because inflation reduces real money balance and consequently wealth. A decline in wealth therefore stimulates savings, which Mundell suggested could take various forms including equities and bonds. Tobin (1965) similarly argued that inflation causes people to increase their holding of real capital. Mundell and Tobin's shared view of the lagging relationship between interest rates and expected inflation is known as the Mundell-Tobin effect, or the so called wealth effect.

2.2.3 Darby-Feldstein Effect

Darby (1975) and Feldstein (1976) both argue that the tax structure influences the Fisher relationship. According to Darby (1975): "nominal interest rates must rise by $1/(1-\tau)$ basis point for each basis point increase in the expected rate of inflation, where τ is the marginal income tax rate, in order to leave borrowers' and lenders' expected payments and receipts unaffected in real terms." Thus the Fisher equation becomes: $(1-\tau)\ it = rt - \pi te$. This suggests that nominal interest rates will adjust more than one-for-one to changes in expected inflation. Carr, Pesando and Smith (1976) tested the relationship between expected inflation, income tax and nominal rates of interest in Canada from 1959-1971. Applying various interest rate models, they failed to find conclusive results as to whether income tax would cause nominal interest rates to rise more than the rise in expected inflation.

Cargill (1977) likewise cannot verify the existence of such a relationship. Engsted (1996:886, however, found support for the tax-adjusted long-term Fisher effect for thirteen OECD countries. Crowder and Hoffman (1996) also found evidence in support of the "tax-adjusted" Fisher equation, using quarterly United States data from 1952 to 1991. Tanzi (1980) suggested in contrast that analysis of the rise in nominal interest rates must take into consideration the "fiscal illusion" suffered by economic agents, that is, the effect that income tax has on the profits of a particular asset, resulting in a less than one-for-one adjustment of nominal interest rates to inflation expectations. However, Crowder and Wohar (1999) argued that Tanzi's theory does not accurately explain why the Fisher effect does not hold empirically, saying it represents a "bizarre violation of rational expectations".

2.2.4 The Inverted Fisher Effect

Carmichael and Stebbing (1983) suggested a different relationship between inflation, nominal interest rates and real interest rates to that of Fisher (1930). Assuming money and financial assets to be substitutable, they hypothesized that nominal interest rates on financial assets can be considered constant over time and that the real rate of interest moves inversely with inflation. They argued that this is the reason for many empirical studies failing to find evidence for the Fisher effect in its strictest form. This so-called inverted Fisher effect, or Fisher paradox, has had little empirical support. Testing the same dataset as used by Carmichael and Stebbing (1983), Moazzami (1991) could not find the same long run inverse relationship between the real rate of interest and expected inflation. Likewise both Choudhry (1997), using data from Belgium, France and Germany from 1955-1994, and Woodward (1992), studying British data from1982-1990, were unable to find evidence of the inverted Fisher effect.

2.2.5 Risk Aversion Effect

Shome, Smith and Pinkerton (1988) argued that when investors are risk averse they will require a premium to compensate them for any risks involved in holding the assets. According to them, the strong form Fisher hypothesis has not held empirically because expected inflation measures used in the literature only capture total variability in prices and do not consider the covariance of real output and future prices. They developed a model of the Fisher equation that incorporated this additional covariance risk by assuming that investors have power utility functions. Thus in an uncertain environment they showed that the long-run coefficient between nominal interest rates and expected inflation is unlikely to be unity.

2.2.6 Modelling Assumptions and Considerations

Sahu, Jha and Meyer (1990) demonstrated that the magnitude of the adjustment of nominal interest rates to expected inflation is primarily dependent on the assumptions that researchers have had to make about the underlying parameter values. In empirical econometric studies of any nature assumptions generally need to be made, however, because expected inflation is not directly observable researchers have had to employ a variety of stringent assumptions in order to derive a testable proxy. Hsing (1997) found, by contrasting three different expected inflation proxies - the Livingston survey, rational expectations hypothesis and the adaptive expectations model - that the strength of the Fisher effect changes. His results showed that the coefficient capturing the adjustment of nominal interest rates to changes in expected inflation varies depending on what assumption is used to measure inflation expectations, for example a coefficient of 1.070 was obtained between AAA bond yields and an expected inflation proxy derived from the adaptive expectations model. However, when an expected inflation measure derived from Livingston survey data was utilised the coefficient was substantially lower, at only 0.016.

Once expected inflation has been estimated, an econometric technique is need to measure the strength of the relationship between expected inflation and nominal interest rates. There have been a number of econometric time series developments since Fisher first proposed the hypothesis in 1930. Consequently, empirical researchers have utilised a wide variety of econometric models to test the hypothesis. Weidmann (1997:3) argues that the majority of these models are unable to properly analyse the stochastic properties of inflation and interest rates and therefore incorrectly reject the strong form Fisher hypothesis. Ghazali and Ramlee (2003) found

support for this argument by implementing an Auto-regressive Fractionally Integrated Moving Average (ARFIMA) model. This ARFIMA model allows fractional differencing to be employed and is therefore able to capture a long-memory process. Conventional unit root tests that utilise the standard ARIMA equation are only able capture a short memory process. They find no evidence of a long-run relationship between inflation and nominal interest rates for all the G7 countries when using the ARFIMA model. This prompted them to conclude that the Fisher relationship is "not robust to choice of statistical test employed" Ghazali and Ramlee (2003).

2.2.7 Influence of Monetary Policy

Soderlind (2001) used a dynamic rational expectations model with staggered price setting to study the affects of monetary policy on the relation between nominal interest rates, inflation expectations, and real interest rates. Soderlind (2001) found that stricter inflation-targeting and a more active monetary policy decrease the strength of adjustment of nominal interest rates to changes in expected inflation. Studies by Huizinga and Mishkin (1984), Mishkin (1992) and Hawtrey (1997) have also shown that different monetary regimes have had varying impacts on the strength of the Fisher effect. This may be expected considering that interest rates form the central tool used in many monetary policy regimes and inflation, the main target variable. However, though these studies find that monetary policy does influence the Fisher effect, there is no research available that presents reasons as to why monetary policy affects the strength of the Fisher equation.

2.3 Empirical Studies in Developed Markets

The Fisher effect has been extensively investigated in the USA. Fama (1975) studied the United States Government Treasury bill market and found evidence to support his

efficient market hypothesis. Fama (1975) concluded that, during the period 1953-1971, nominal interest rates correctly incorporated "all information about future inflation rates. He also found evidence to support the hypothesis that the expected real returns on one- to six- months' bills are constant for the period under study.

Various authors including Carlson (1977), Joines (1977), Tanzi (1980) and Nelson and Schwert (1977) all find evidence against Fama's joint hypothesis, while Levi and Makin (1979) argue that the level of anticipated inflation is a function of various factors including changes in employment, output and the amount of uncertainty about future inflation movements. This could result in the real rate of interest not being constant, explaining why these aforementioned authors find contradictory results to (Fama, 1975).

Mishkin (1992) explained why there is a high correlation between the level of interest rates and inflation in certain periods and not in others. Using monthly data from January 1953 to December 1990, he found no support for a short-run Fisher effect, but did find evidence in support of a long-run Fisher effect. The study made a distinction between a short-run Fisher effect, where a change in expected inflation was associated with an immediate change in short term interest rates and a long-run Fisher effect where inflation and interest rates have similar trend in the long-run. The study concludes that the Fisher relationship would only hold in periods when inflation and interest rates display stochastic trends.

Later studies of the Fisher effect in the United States generally concluded in favour of the proposed relationship. Crowder and Hoffman (1996) found evidence of nominal

interest rates adjusting by more than one-for-one to changes in expected inflation, using quarterly United States data from 1952 to 1991. Crowder and Hoffman found that a 1 percent increase in inflation caused the nominal interest rate to increase by 1.34 percent. Tillmann (2004), taking into account regime shifts, also found evidence of the Fisher relation using post-war data.

Canadian results are mixed, with Crowder (1997) found evidence to support the Fisher equation from 1960 to 1991, whilst Dutt and Ghosh (1995) found no evidence to support the Fisher hypothesis under both fixed and floating exchange rate regimes in Canada. Empirical studies using Australian data done in the late 1990s have been to some extent supportive of the Fisher effect. For instance, Mishkin and Simon (1995) found support for a long-run Fisher effect, but not a short-run Fisher effect, prompting the conclusion that short-run changes in interest rates indicate the stance of monetary policy, while longer-term levels are primarily driven by inflation expectations.

Two later studies, one by Hawtrey (1997) and the other by Olekalns (1996), both found evidence of the Fisher effect only in the period 1984-1994, the period after full deregulation of the financial system in Australia. Olekalns (1996) was only able to establish a partial adjustment of nominal interest rates to expected inflation when he studied data from both before and after financial deregulation (1969 to 1993). Inder and Silvapulle's (1993) results disagreed with the other Australian studies. Investigating the period from 1964-1990, they rejected the hypothesis that nominal interest rates adjusted to changes in expected inflation.

Empirical studies conducted in Finland, the United Kindom and Italy have had limited success in verifying the Fisher effect. Junttila (2001) found no substantial evidence of the Fisher effect in Finland. Evans (1998) could not prove that a Fisherian link existed between expected inflation and interest rates for the United Kingdom. Muscatelli ands pinelli (2000) used Italian data for the period 1948-1990 and found that expected inflation and nominal interest rates trended together the long-run. Esteve, Bajo-Rubio and Diaz-Roldan (2004), using Spanish data for the period 1962-1996, found evidence that suggested that nominal interest rates only partially adjust to shifts in expected inflation.

Atkins and Serletis (2002) used the Pesaran, Shin and Smith (2001) autoregressive distributed lag (ARDL) bounds testing methodology to test for the Fisher effect in six countries: Norway, Sweden, Italy, Canada, the United Kingdom, and the United States. Their findings suggested little evidence in support of the Fisher effect. Atkins and Coe (2002), using the same methodology on post-war United States and Canadian data, found evidence of a long-run relationship of interest rates and inflation. However they, found no evidence supporting the tax-adjusted Fisher effect for Canada. The results for the United States were also inconclusive. An empirical study by Atkins and Sun (2003) found similar results, for Canada and the United States, using data from 1959 to 2002. This study applied a discrete wavelet transformation (DWT) to the series of data as an alternative for the more commonly used differencing approach. Like Mishkin (1992), they only found evidence of a long-run relationship between nominal interest rates and inflation but no short-run relationship.

An empirical study by Koustas and Serletis (1999) revealed little in support of the Fisher effect using post war data from Belgium, Canada, Demark, France, Germany, Greece, Ireland, Japan, the Netherlands, the United Kingdom and the United States. Miyagawa and Morita (2003) also rejected the presence of a one-for-one relationship between nominal interest rates and expected inflation for Japan, Sweden and Italy. Yuhn (1996) was able to verify the existence of the Fisher effect in the United States, Germany and Japan, but could not find enough evidence to validate the Fisher effect for Canada and the United Kingdom for the period (1973) to (1993). Lardic and Mignon (2003) were able to positively validate the Fisher effect for all the G7 countries except for Germany for the period (1970) to (2001).

As is evident from the above, there has been a large amount of empirical research done in developed countries, all with modest consistency. However, little has been done to explore this relationship in developing countries that, in contrast to the developed countries studied, tend to have high and more volatile levels of inflation. The next section explores the empirical studies in developing countries including South Africa.

2.4 Empirical Studies in Emerging Market

Locally few studies have been conducted in Kenya to validate this importance hypothesis. Naomi (2011) in her study of Determinants of Interest Rates spreads in Kenya concurs that there is a relationship between the rate of Interest and inflation. Kihara (2002) carried out another study on Inflation and related the effect of Liberalization on Interest rate and thereby confirming that inflationary process was mainly due to liberalization.

Garcia (1993) tested the Fisher effect using Brazilian interest rate data on non-indexed certificates of deposit for the period 1973 to 1990 and found that, even though the inflation data used was extremely high and volatile, *ex post* real interest rates varied greatly, and there was sufficient evidence to validate the Fisher model. Two studies, one by Carneiro, Divino and Rocha (2002) and the other by Phylaktis and Blake (1993), investigated the Fisher hypothesis for three high inflation countries: Brazil, Mexico and Argentina. Phylaktis and Blake (1993) found for all three economies, "strong evidence for a long-run unit proportional relationship between nominal interest rates and anticipated inflation".

Carneiro, Divino and Rocha (2002), on the other hand, only confirmed the Fisher hypothesis for Argentina and Brazil. Their Mexican results showed that the inflation rate adjusted to changes in interest rates. Thornton (1996) found strong evidence of the Fisher hypothesis between post-tax nominal interest rates on 91-day treasury bills and quarterly inflation between 1978 and 1974 in Mexico.

Jorgensen and Terra (2003) used a four-variable VAR model to test for the Fisherian link between interest rates and inflation in seven major Latin American economies (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela). They only confirmed the relationship in Mexico and Argentina. Cooray (2002-2003) examined the Fisher hypothesis using Sri Lankan data for the period 1952 to 1998. Sri Lanka, like South Africa, experienced high inflation during the 1970sand1980s, reaching a high of 26.1 percent by 1980. Using 3-month Treasury bill rates and an inflation-forecasting model that follows the monetarist view of inflation, he found that interest rates reacted slowly to inflation expectation in Sri Lanka, and concluded that monetary policy could have an impact on real interest rates over the short-term.

There has been very little empirical research that investigated the Fisher hypothesis using the Kenyan data. The relationship between expected inflation and nominal bond yields for the period

2.5 Summary

In 1930 Irving Fisher argued that lenders would demand an inflation premium above the real rate of interest so as to be compensated for an inflationary induced erosion of their nominal money balances. This idea is formally known as the Fisher hypothesis/effect, which asserts that nominal interest rates adjust on a one-for-one basis to expected changes in the inflation rate. The Fisher hypothesis has been extensively researched in developed countries but very little research has been done to prove it empirically in developing countries. Though theoretically sound, the hypothesis in its strictest form has shown very little consistency.

Empirically, a positive long-run relationship is generally verified; however, studies either find nominal interest rates to adjust by less than one-for-one to expected inflation or, alternatively, by more than one-for-one. This has prompted researchers to put forward a variety of explanations to justify why the one-for-one relationship proposed by Fisher (1930) has not held.

Mundel (1963) and Tobin (1965) both argue that inflation reduces wealth and therefore prompts economic agents to increase their holdings of real capital, bonds and equity, resulting in a less than one-for-one adjustment of nominal interest rates to expected inflation. Darby (1975) and Feldstein (1976) suggest that a premium needs to be incorporated in the adjustment of nominal interest rates to more accurately capture taxation.

Similarly, Shome, Smith and Pinkerton (1988) propose a premium for the covariance between real output and future prices. Carmichael and Stebbing (1983) argue that it is the nominal interest rate that is constant over time and that the real rate of interest moves inversely with inflation. The inconsistencies in the literature can partly be attributed to the wide variety of econometric assumptions and models used to test the hypothesis. Finally, because short-term interest and inflation are largely controlled by the central bank as part of a monetary policy framework, monetary policy is also likely to have some influence on the strength of adjustment.

Empirical studies conducted in both developing and developed countries have yielded inconsistent results. Although many of the studies found a positive long run relationship between nominal interest rates and expected inflation, very few have been

able to establish the one-for-one relationship hypothesised by Fisher (1930). Subsequently, some empirical Fisherian studies distinguish between two forms of the Fisher effect. The weak form or partial Fisher effect portrays a less than unity long-run coefficient. This form is the most prevalent in the literature and is the relationship Fisher was able to empirically verify.

The second form, referred to as the strong form Fisher effect, is characterised by a long-run coefficient that equals one or greater than one, suggesting a full adjustment (one-for-one) or over adjustment of nominal interest rates to changes in expected inflation. Various authors offer alternative explanations as to why so few empirical studies are able to find the theoretical one-for-one relationship proposed by Fisher (1930).

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines how the study will be conducted to show the relation between RIR, NIR and IR. This section presents the research methodology by giving a description about the source data, method that will be used to conduct the research, the design, target population data, the collection procedure to be used and data analysis method and the technique of analysing the data.

3.2 Research Design

This research is an empirical study carried out from statistical bulletins of the Central Bank of Kenya and KNBS that are relevant to the issue under investigation between the periods 1999-2011. The study investigates the relationship between the interest rates and the inflation rate in Kenya. The study will ascertain if the nominal rate of interest reflects movements in the expected rate of inflation on a one-to-one basis.

3.3 Population and Sample

The target population of the study is the RIR, NIR and IR listed in statistical bulletins of the Central bank of Kenya, KNBS from 1999-2011.The research data for the real rates, nominal rates and inflation rates will be obtained directly from the CBK database. CBK database will give a better result that can be analyzed.

3.4 Data Collection Procedure

This study will use secondary data available from the statistical bulletins of the Central Bank of Kenya and KNBS for 13 year's period between 1999-2011. The rates

will be obtained from the CBK database while the inflation rate will be obtained from CPI.

The data may be supplemented with data from various government publications. IMF's International Financial statistics and KNBS that are relevant to the issue under investigation.

The following measures will be used Treasury bill rate as the NIR (n), Consumer Price Index as the inflation rate (I). Treasury bill rate is generally viewed as an indicator of interest rate policy pursued by the government and a benchmark to the rates changed by the Financial Institution.GDP is selected as data is available for a longer period than other measures likewise; Consumer Price index data is readily available for a longer period than other measures of inflation.

3.5 Data Analysis

The research will cover a period from 1999-2011, Econometrics models will be used in the study to analyse the collected data so as to get accurate results. Regression analysis will be used in this in this study because it is widely used for prediction and forecasting. Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. The data will be analyzed values listed from the CBK database over a period of 13years between 1999-2011. The program used for analyzing that will be Microsoft excel 2007. steps will be as follows:

The first step will be to develop a simple linear regression that will be used to determine the relationship between interest rates and inflation rates. The equation

giving the relationship is in the form of 1+x= (1+b) (1+y) where (x) Real interest rate (b) Expected inflation rate and (y) is Nominal Interest rate.

The second step entails incorporating the ratios of the NIR and IR per year into the regression model. The data will be entered into the excel sheet and the output obtained automatically.

The last step will be to compare the automated output RIR and the GDP real rate given on the database.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the research findings to determine the long run relationship between interest rates and inflation. The study was conducted between the periods 1999- 2011, this period was chosen because of the availability of the data. The study conducted simple linear regression in order to determine the model in chapter three.

The study derived the nominal interest rate from the T bill rate, inflation rate from CPI and finally the actual real rate from GDP. Computed Real interest rates and actual Real interest rates were compared over a period of 13 years (1999 to 2011) to determine if the fisher effect hypothesis holds.

4.2 Descriptive Statistics for the Nominal Rate, Real Interest Rates and Inflation Rate

Table 1 below provides some descriptive statistics, namely Average nominal rate (T bill rates), Average inflation rate (CPI) and the Average actual real rate (GDP). From the above data the ratios of real interest rates derived from the regression equation and the ratio of real interest rates based on actual real rate (GDP) were compared using Microsoft excel to establish if the difference between the two is equal or ± 2 to be able to agree with the fisher hypothesis.

Table 1 Source: CBK database

Year	Average nominal rate (y)	Average inflation rate(b)	Average Real rate (x)
1999	13.3	5.6	1.5
2000	12.1	10.0	0.4
2001	12.7	6.0	1.0
2002	8.9	2.0	0.8
2003	3.7	9.8	1.5
2004	3.0	11.7	2.2
2005	8.4	10.5	5.8
2006	6.8	14.5	5.7
2007	6.8	9.8	7
2008	7.7	26.2	1.7
2009	7.4	18.4	2.6
2010	3.6	5.6	5
2011	8.7	8.0	5

4.2.1 Annual Data Regression Analysis for Real Interest Rate using the Nominal Rates and Inflation Rates

To further examine the relationship between real interest rate in relation to inflation and nominal rates regression analysis of the form $1+x= (1+b) (1+y)$ was fitted to the data where (x) Real interest rate (b) Expected inflation rate and (y) is Nominal Interest rate. The table below shows the results.

Table 2 Calculation for the predicted Real Rate

Year	Average nominal rate %(y)	Average inflation rate% (b)	1+y	1+b	1+x=(1+b)/(1+y)	Average real interest rate %(x-1)
1999	13.3	5.6	14.3	6.6	0.5	-0.5
2000	12.1	10	13.1	11	0.8	-0.2
2001	12.7	6	13.7	7	0.5	-0.5
2002	8.9	2	9.9	3	0.3	-0.7
2003	3.7	9.8	4.7	10.8	2.3	1.3
2004	3	11.7	4	12.7	3.2	2.2
2005	8.4	10.5	9.4	11.5	1.2	0.2
2006	6.8	14.5	7.8	15.5	2	1
2007	6.8	9.8	7.8	10.8	1.4	0.4
2008	7.7	26.2	8.7	27.2	3.1	2.1
2009	7.4	18.4	8.4	19.4	2.3	1.3
2010	3.6	5.6	4.6	6.6	1.4	0.4
2011	8.7	8	9.7	9	0.9	-0.1

From table 2 we were able to get the predicted real rate from the equation. The predicted real was compared with the actual real rate to confirm if there is a one on one relationship or the hypothesis does not hold in Kenyan economy.

4.3 Findings

The study sought to examine the relation between the interest rates and inflation using fishers' hypothesis. The table below shows the assessment between the predicted real interest rate gotten from the fisher equation and the actual real interest from the CBK database being the GDP. The computation for the comparison is as summarised as the table below.

Table 3 Comparison between Predicted Real Rate and the Actual Real Rate

Year	predicted real interest rate %	Actual real rate%(GDP)	Difference
1999	**-0.5**	**1.5**	**2.0**
2000	**-0.2**	**0.4**	**0.6**
2001	**-0.5**	**1**	**1.5**
2002	**-0.7**	**0.8**	**1.5**
2003	**1.3**	**1.5**	**0.2**
2004	**2.2**	**2.2**	**0.0**
2005	0.2	5.8	5.6
2006	1.0	5.7	4.7
2007	0.4	7	6.6
2008	**2.1**	**1.7**	**-0.4**
2009	**1.3**	**2.6**	**1.3**
2010	0.4	5	4.6
2011	-0.1	5	5.1

As shown in table 3we found that relationship for some years were positive and would agree with the Fisher's hypothesis (see results in bold) while others were not. At this point the result does not have a significant relationship between the interest rate and inflation rates in the long term periods unlike for the short term periods. We would agree that Kenya agrees partially with the Fisher hypothesis.

4.4 Interpretation

This implies that there is a significant difference between the data sets. It can be indirectly assumed that while there is an effect on interest rates caused by inflation, the effect may not be to the extent hypothesised by the fisher hypothesis.

The findings and analysis support to the existence of partial fisher effect in Kenya because both interest rates and inflation rate do not move with one on-one over the period under study. The average of interest rate obtained from expected rate of interest on facilities has a long run relationship with inflation rate, but as the results showed, this relation is very weak, and it can be ignored.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigates the relationship between nominal interest rate and inflation in Kenyan economy, an important implication of the Fisher Hypothesis. In order to examine whether the hypothesis holds in the Kenyan economy, the average annual data Predicted Real Interest Rate and actual Real Rate (GDP) were used in the analysis. The chapter also presents the limitations that were encountered in the study with suggestions for further research.

5.2 Summary of Findings and Conclusions

5.2.1 Summary of Findings

The aim of the study was to establish the long run relationship between interest rates and inflation rates in Kenya. In order to achieve this objective secondary data on average Nominal rates (Treasury bill rate), Inflation rates (CPI) and real interest rates (GDP) was obtained from CBK database. The average Nominal rates and Inflation rates data collected was used to find the predicted average Real rate which was then compared to the actual average Real rate obtained from CBK database.

The results show that there is partial fisher effect support in Kenya because the actual and the predicted real interest rate from the calculation differ with different margin some are closer while others have a bigger margin thus disputing the fisher hypothesis. The regression analysis between the average Nominal rates (Treasury bill rate), Inflation rates (CPI) and predicted real interest rates (GDP) and actual Real rate

showed unconvincing findings. A positive relationship is noted in short term period however not statistically significant in the long term relationship.

5.2.2 Conclusions

The statistical result shows that the relationships between interest rates and inflation are not conclusive. Although inflation is one of the key determinants as discussed by Fridah (2011) there are other variables like taxation this was brought up by Cargill (1977) and Tanzi (1980).

This leads the study to accept the fisher's hypothesis partially being that one on one relationship as the hypothesis assumes could not be established all through the period under study. The results suggested that the Kenyan interest rate had enormous capacity that inflation announcement did not have any effect on it or it is not relied on to determine the interest rates. As noted above, it is impossible to say with complete confidence how forecastable inflation rate being that some years the rates had more variance hence disputing the hypothesis.

Although this period under study cannot provide significant evidence against Fisher's hypothesis, neither can it tell us what would have happened if expected inflation had varied widely. It would be wrong to conclude that the early period provides positive evidence in favor of Fisher.

5.3 Limitations

Limitations to this study are that GDP is an indicator of economic activity that is measurable in money terms: the availability of this data in emerging economies may

not be as efficient and thus GDP may not fully reflect the accuracy GDP may not have the effects of money terms in the informal sector.

There lacked enough local studies on the long run relationship between interest rate and inflation in Kenya which is a key sector in Kenyan Financial market. The study relied heavily on international studies which provided insightful data and knowledge on relationship of the two variables.

The other limitation was the fact that the average Nominal rates (Treasury bill rate), Inflation rates (CPI) and real interest rates (GDP) data was derived from secondary data. Such data has got some limitation since it is subject to manipulations by the analyst or capturer to suit their needs.

The data could be collected from many government and private entities in reference to the same variable having totally different figures hence giving different results.

5.4 Suggestions for Further Studies

Based on the study we did not find evidence of a long-run Fisher effect in the relationship. Our study recommends the adoption of potent policies by the monetary authorities aimed at checking inflation so as to help reduce high interest rates in order to stimulate growth in the economy.

As a suggestion further studies should also be conducted to identify other variables that could be causing interest rate increase or decrease through the model predictability power.

The perception behind the fisher hypothesis is that the nominal interest rate reflects the changes in the expected rate of inflation. while the real rate stays constant. In Kenyan economy none of the rates are constant.

The study covered the recent years in Kenyan economy; it would be prudent to carry out further studies on the relationship far back i.e. year 1980s to establish if the Kenyan historical data adopted the hypothesis fully.

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APPENDICES

APPENDIX I Monthly Nominal and Inflation Rates

Workings from the monthly data received from CBK database that was converted to get the averageannual nominal rates and the Average annual inflation rates.

Monthly	nominal rate% (y)	Inflation rate % (b)	Monthly	nominal rate% (y)	Inflation rate % (b)
1991-1	17.29	24.12	**2001-7**	12.87	4.39
1991-2	16.61	24.12	**2001-8**	12.84	4.15
1991-3	17.17	20.82	**2001-9**	12.39	3.14
1991-4	17.77	19.49	**2001-10**	11.63	3.28
1991-5	16.96	22.34	**2001-11**	11.50	2.19
1991-6	17.45	20.79	**2001-12**	11.01	1.57
1991-7	17.14	22.22	**2002-1**	10.85	0.47
1991-8	16.70	21.28	**2002-2**	10.61	1.14
1991-9	17.18	21.03	**2002-3**	10.14	2.00
1991-10	17.78	18.58	**2002-4**	10.01	0.85
1991-11	16.95	15.74	**2002-5**	9.04	1.68
1991-12	17.31	14.52	**2002-6**	7.34	2.84
1992-1	18.20	16.40	**2002-7**	8.63	2.10
1992-2	17.19	14.42	**2002-8**	8.34	1.81
1992-3	17.90	22.15	**2002-9**	7.60	1.79
1992-4	18.05	23.08	**2002-10**	8.07	1.90
1992-5	18.32	23.65	**2002-11**	8.30	2.59
1992-6	18.76	35.31	**2002-12**	8.38	4.27
1992-7	17.67	32.26	**2003-1**	8.38	6.37
1992-8	17.76	32.16	**2003-2**	7.77	7.45
1992-9	18.43	31.05	**2003-3**	6.24	10.12
1992-10	19.41	29.34	**2003-4**	6.25	11.62
1992-11	18.01	30.88	**2003-5**	5.84	14.91
1992-12	18.14	33.80	**2003-6**	3.00	13.74
1993-1	17.85	32.04	**2003-7**	1.54	10.92
1993-2	17.85	41.37	**2003-8**	1.18	8.27
1993-3	24.94	34.26	**2003-9**	0.83	7.89
1993-4	45.81	42.25	**2003-10**	1.00	9.08
1993-5	68.01	42.86	**2003-11**	1.28	8.97
1993-6	84.31	39.04	**2003-12**	1.46	8.35
1993-7	84.60	43.24	**2004-1**	1.58	9.14
1993-8	80.20	47.79	**2004-2**	1.57	9.85
1993-9	75.69	53.91	**2004-3**	1.59	8.32

1993-10	70.73	57.49	**2004-4**	2.11	7.58
1993-11	55.24	56.49	**2004-5**	2.87	4.65
1993-12	43.47	54.74	**2004-6**	2.01	5.94
1994-1	33.55	61.51	**2004-7**	1.71	8.54
1994-2	23.93	54.46	**2004-8**	2.27	15.80
1994-3	27.66	53.66	**2004-9**	2.75	18.96
1994-4	30.85	47.80	**2004-10**	3.95	18.29
1994-5	31.24	41.02	**2004-11**	5.06	16.64
1994-6	32.38	28.86	**2004-12**	8.04	16.25
1994-7	29.78	27.24	**2005-1**	8.26	14.87
1994-8	23.60	21.56	**2005-2**	8.59	13.94
1994-9	23.37	12.85	**2005-3**	8.63	14.15
1994-10	16.72	12.31	**2005-4**	8.68	16.02
1994-11	15.63	8.44	**2005-5**	8.66	14.78
1994-12	18.64	6.53	**2005-6**	8.50	11.92
1995-1	18.09	3.63	**2005-7**	8.59	11.76
1995-2	17.63	1.38	**2005-8**	8.66	6.87
1995-3	16.84	-0.73	**2005-9**	8.58	4.27
1995-4	15.16	-3.69	**2005-10**	8.19	3.72
1995-5	15.09	-1.80	**2005-11**	7.84	6.05
1995-6	16.39	0.12	**2005-12**	8.07	7.57
1995-7	18.48	-0.49	**2006-1**	8.23	15.39
1995-8	19.65	1.23	**2006-2**	8.02	18.87
1995-9	21.16	4.01	**2006-3**	7.60	19.14
1995-10	24.07	3.36	**2006-4**	7.02	14.85
1995-11	24.87	5.48	**2006-5**	7.01	13.09
1995-12	21.67	6.90	**2006-6**	6.60	10.92
1996-1	21.25	5.88	**2006-7**	5.89	10.15
1996-2	25.96	5.32	**2006-8**	5.96	11.51
1996-3	26.68	6.40	**2006-9**	6.45	13.85
1996-4	24.16	7.16	**2006-10**	6.83	15.68
1996-5	21.96	6.98	**2006-11**	6.41	14.64
1996-6	21.85	9.54	**2006-12**	5.73	15.59
1996-7	21.76	11.00	**2007-1**	6.00	9.67
1996-8	21.63	10.96	**2007-2**	6.22	6.81
1996-9	23.10	10.34	**2007-3**	6.32	5.87
1996-10	24.08	10.68	**2007-4**	6.65	5.66
1996-11	22.09	11.40	**2007-5**	6.77	6.33
1996-12	21.53	10.75	**2007-6**	6.53	11.11
1997-1	21.61	10.98	**2007-7**	6.52	13.56
1997-2	21.44	12.10	**2007-8**	7.30	12.37
1997-3	21.42	15.84	**2007-9**	7.35	11.72
1997-4	21.02	16.24	**2007-10**	7.55	10.55
1997-5	20.35	17.39	**2007-11**	7.52	11.83

1997-6	19.44	12.95	**2007-12**	6.87	12.03
1997-7	18.45	9.14	**2008-1**	6.95	18.22
1997-8	19.69	7.88	**2008-2**	7.28	19.13
1997-9	26.20	8.95	**2008-3**	6.90	21.83
1997-10	27.15	8.85	**2008-4**	7.35	26.63
1997-11	26.78	11.15	**2008-5**	7.76	31.54
1997-12	26.36	11.97	**2008-6**	7.73	29.26
1998-1	26.28	13.30	**2008-7**	8.03	26.50
1998-2	26.33	12.73	**2008-8**	8.02	27.58
1998-3	26.74	7.42	**2008-9**	7.69	28.23
1998-4	26.98	6.58	**2008-10**	7.75	28.43
1998-5	26.38	4.30	**2008-11**	8.39	29.36
1998-6	25.48	6.41	**2008-12**	8.59	27.72
1998-7	24.67	8.80	**2009-1**	8.46	21.87
1998-8	23.74	8.75	**2009-2**	7.55	25.09
1998-9	22.47	5.83	**2009-3**	7.31	25.86
1998-10	20.59	4.97	**2009-4**	7.34	26.07
1998-11	17.66	1.83	**2009-5**	7.45	19.53
1998-12	12.56	0.64	**2009-6**	7.33	17.76
1999-1	10.70	-0.44	**2009-7**	7.24	17.79
1999-2	8.95	1.39	**2009-8**	7.25	18.44
1999-3	8.84	2.83	**2009-9**	7.29	17.95
1999-4	9.03	3.65	**2009-10**	7.26	11.4
1999-5	9.63	5.56	**2009-11**	7.22	10.2
1999-6	11.44	4.82	**2009-12**	6.82	9.2
1999-7	14.47	5.06	**2010-1**	6.56	8.6
1999-8	14.84	6.41	**2010-2**	6.21	7.9
1999-9	15.78	8.10	**2010-3**	5.98	7.0
1999-10	17.63	9.21	**2010-4**	5.17	6.3
1999-11	18.14	10.56	**2010-5**	4.21	5.9
1999-12	19.97	10.41	**2010-6**	2.98	5.4
2000-1	20.30	9.54	**2010-7**	1.63	5.0
2000-2	14.84	7.58	**2010-8**	1.83	4.7
2000-3	11.28	5.99	**2010-9**	2.04	4.4
2000-4	12.44	7.14	**2010-10**	2.12	4.1
2000-5	11.22	8.64	**2010-11**	2.21	4.0
2000-6	10.47	11.28	**2010-12**	2.28	4.0
2000-7	9.90	11.51	**2011-1**	2.46	3.9
2000-8	9.25	11.38	**2011-2**	2.59	4.0
2000-9	10.36	11.71	**2011-3**	2.77	4.5
2000-10	10.65	11.38	**2011-4**	3.26	5.2
2000-11	11.17	11.69	**2011-5**	5.35	6.0
2000-12	12.90	11.89	**2011-6**	8.95	6.9
2001-1	14.76	12.07	**2011-7**	8.99	7.9

2001-2	15.30	10.36	**2011-8**	9.23	9.0
2001-3	14.97	9.62	**2011-9**	11.93	10.2
2001-4	12.90	9.33	**2011-10**	14.80	11.5
2001-5	10.52	7.11	**2011-11**	16.14	12.8
2001-6	12.07	4.76	**2011-12**	18.30	14.0

APPENDIX II Average Nominal and Inflation Rates

The average annual nominal rates and inflation rates gotten from the above data

Year	Average nominal rate (y)	Average inflation rate(b)
1999	13.3	5.6
2000	12.1	10
2001	12.7	6
2002	8.9	2
2003	3.7	9.8
2004	3	11.7
2005	8.4	10.5
2006	6.8	14.5
2007	6.8	9.8
2008	7.7	26.2
2009	7.4	18.4
2010	3.6	5.6
2011	8.7	8

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Year	Average nominal rate (y)	Average inflation rate(b)
1999	13.3	5.6
2000	12.1	10
2001	12.7	6
2002	8.9	2
2003	3.7	9.8
2004	3	11.7
2005	8.4	10.5
2006	6.8	14.5
2007	6.8	9.8
2008	7.7	26.2
2009	7.4	18.4
2010	3.6	5.6
2011	8.7	8