INTEREST RATES DETERMINATION IN KENYA: IMPLICATIONS FOR THE FINANCIAL LIBERALIZATION POLICY

NYANGENA, N. W.

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DECLARATION

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

W.N. NYANGENA

This Research Paper has been submitted for examination with our approval as University supervisors.

DR. A. B. AYAKO

MR. S. O. ODIDI

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ABSTRACT

The study evaluated the relative contribution of domestic and international factors in the determination of the Treasury bill rate in Kenya under a liberalized regime. The evaluation was based on a modified version of the Edwards and Khan (1985) model using time series data for the period 1969 to 1989.

The empirical findings of the study were that the effects of expected exchange rate, lagged Treasury bill rate and portfolio variables on the level of interest rate in Kenya are statistically significant from zero at five percent level of significance.

The results confirmed that domestic money supply influences interest rates largely through the liquidity effect. An increase in the stock of money, leads to a short-term increase of interest rates.

Further the domestic interest rate responds to monetary changes in international money markets. These had the implication that approximate equilibrium lending and deposit rates may be achieved easily through careful manipulation of exchange rate and domestic money supply.

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It is needless to say I am responsible for any errors and shortcomings of this research paper.

CHAPTER ONE

1.1 BACKGROUND TO THE STUDY

Kenya has a diversified and well developed financial system in comparison to most Sub-Saharan African (SSA) countries. Institutionally, the financial sector includes commercial banks, Near bank financial institutions (NBFIs), Building Societies, Development Finance Institutions (DFIs), the Nairobi Stock Exchange (NSE), Insurance companies, and a National Social Security Fund (NSSF). Despite this range of institutions and the rapid growth in numbers, during the early 1980s financialization of savings in the Kenyan economy is still at a low level. The share of domestic savings held as financial assets with the formal financial system averaged 30 percent in 1984-87, almost similar to the 26 percent in the late 1970s. Financial assets as a share of GDP averaged about 6 percent, significantly higher than other SSA countries but below the levels of other developing countries in Asia and Latin America.

There is institutional diversity that is associated with financial markets, and a fair amount of competition across institutional types and between institutions in each category. While the monetary authorities have allowed market forces to play a relatively influential role in the financial system the government continues a formidable presence in the financial market place. The most important facets of government intervention in the financial system include: ownership of commercial banks, finance companies, the largest pension fund, an insurance company. This has provided the government with extensive direct control over credit allocation and control on setting minimum interest rates on deposits and maximum lending rates.

Since independence till 1982 official policy followed a " low pegged interest rate policy." The policy was justified on a number of grounds. First the Central Bank held the view that stability in interest rates was an important factor in promoting development. It was felt that frequent changes in interest rates would lead to uncertainty in repayments which could discourage new investment and add confusion to the credit market. Further justification for the policy derives from the Keynesian paradigm that a low interest rate is conducive to investment, especially in a non-inflationary environment. investment. Hence changes in interest rates are made at appropriate times for purposes of monetary control and also to protect savers and borrowers alike. Trends in selected general deposit interest rates in Kenya during the 1970s and the 1980s are summarized in table 1 below.

Table 1: Trends in selected nominal and ex-post real interest rates in Kenya, 1970-82

End of	1970	1972	1974	1976	1978	1980	1982
Deposits, minimum rates							
COMMERCIAL BANKS							
Demand							
Nominal (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ex-post real(%)	-3.3	-9.3	-22.2	-21.2	-5.7	-11.2	-9.5
Savings							
Nominal (%)	3.0	3.0	5.0	5.0	5.0	6.0	12.5
Ex-post real (%)	0.4	-6.6	-18.3	-17.2	-0.9	-5.8	1.9
PRIVATE FINANCIAL INSTITUTIONS							
Demand							
Nominal (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ex-post real (%)	-3.3	-9.3	-22.2	-21.2	-5.7	-11.2	-9.5
Savings							
Nominal (%)	3.0	3.0	5.0	5.0	5.0	8.0	12.5
Ex-post real (%)	-0.4	-6.6	-18.3	-17.2	-0.9	-4.0	1.9
TERM, CATEGORY							
Ex-post (%)	2.5	-3.9	-16.4	-14.9	2.6	-1.4	5.2
POST OFFICE SAVINGS BANK							
Nominal (%)	3.0	3.0	3.0	5.0	5.0	6.0	10.0
Ex-post real (%)	-0.4	-6.6	-19.9	-17.2	-0.9	-5.8	-0.4
Inflation (CPI)(%)	1.5	3.3	16.0	7.6	13.7	13.1	13.3

Sources: Economic and Financial Review (various issues).
IMF: International Financial Statistics (various issues).
Economic Survey (various issues).

The low ceilings on lending rates provided little incentive to raise deposit rates well above the minimum set by the government. These minimums, displayed in table 1 above were predominantly negative in real terms ex-post.

A comparison between the rates on loans for land purchases from the Agricultural Finance Corporation and the ceiling rates on general from the commercial banks shows that the land

purchase loans were only a couple of percentage points lower than the general category. Thus these rates were also only slightly negative in real terms on average, and were not exceptionally concessional. However, the rates on these loans may have been considerably lower than those on general credits in terms of the spread in repayment. Table 2 below is a summary of the lending rates over the period 1970-82.

Table 2: Trends in selected Lending Nominal and Ex-Post Real interest rates in Kenya

End of	1970	1972	1974	1976	1978	1980	1982
LENDING, DOMESTIC COMMERCIAL BANKS							
Maximum (less than 3 Yrs)							
Nominal (%)	—	—	—	—	10.0	11.0	16.0
Ex-post real(%)	—	—	—	—	3.8	-1.4	5.0
Minimum							
Nominal (%)	7.0	7.0	8.0	—	—	—	—
Ex-post real(%)	3.5	-3.0	-16.0	—	—	—	—
AGRICULTURAL FINANCE CORPORATION							
Nominal (%)	7.5	7.5	8.0	9.0	9.0	9.0	12.0
Ex-post real (%)	4.0	-2.5	-16.0	-14.1	2.8	-3.2	1.4
Inflation (CPI)(%)	1.5	3.3	16.0	7.6	13.7	13.1	13.3

Sources: Economic and Financial Review (various issues).
IMF: International Financial Statistics (various issues).
Economic Survey (various issues).

As from 1983 these rates have been positive in real terms. This pattern changed due to the combined effect of declining inflation and higher minimum deposit rates. Table 3 below shows trends in selected real interest rates as from 1985 to 1990.

Table 3. Trends in selected real interest rates, 1985-89

	Year	Nominal Interest	Inflation Rate	Real Interest
Commercial bank savings deposit (min)	1985	11.0	10.7	+0.3
	1986	11.0	5.7	+5.3
	1987	11.0	7.1	+3.9
	1988	10.0	10.7	-0.7
	1989	12.5	10.5	+2.0
Commercial banks loans and advances (max)	1985	14.0	10.7	+3.3
	1986	14.0	5.7	+8.3
	1987	14.0	7.1	+6.9
	1988	15.0	10.7	+4.3
	1989	15.5	10.5	+5.0
Discount rate for treasury bill	1985	12.50	10.7	+1.8
	1986	12.50	5.7	+6.8
	1987	12.50	7.1	+5.4
	1988	16.02	10.7	+5.3
	1989	16.50	10.5	+6.0

Source:IMF: International Financial Statistics (various issues).
Economic Survey (various issues).

By imposing ceilings on the lending rates the authorities reduced the amount of credit that the financial intermediaries could profitably extend by: (i) preventing intermediaries from charging a premium to cover the additional costs and risks of term finance and of lending to smaller borrowers and those with little collateral, thereby reducing such lending and by (ii) limiting the interest rates payable on deposits thereby suppressing the mobilization of financial savings and thereby the pool of loanable funds.

discouraged lending institutions from supporting small-scale business and long-term projects. The high cost of mobilizing deposits has precluded financial institutions from going into developmental lending. This implies that these institutions lend mainly to low risk borrowers, namely established firms and businessmen. Needless to say that these are not the type of economic units , that a developing country like Kenya should give priority or support. Thus we can conclude that the Kenyan Banking system has promoted trade and mercantilism at the expense of value added manufacturing for instance.

Another notable aspect of interest rates in Kenya is the Treasury bill rate. Treasury bills are marketable financial obligations of the Treasury maturing in up to one year from the date of issue, as distinct from Treasury bonds, that mature in more than three years, from date of issue. The Treasury bills provide short-term credit to the government, while the bonds provide long-term credit to finance the Budget and other government desires. These also help to some extent, in the management of money supply in the economy. Relative to the other interest rates this rate is freer and fluctuates according to the money market conditions.

In the determination of this rate the Central Bank invites tenders once a week from those intending to purchase these bills and allots them to the highest bidders. The Treasury gives the Central Bank a range within which the bill rates should lie. This ensures that the government gets short-term finance at the lowest possible cost. This bidding and auctioning process is continuous. In the case of bids being too low or falling short of the Treasury requirements the Central Bank buys the bills. The bills are thus sold at prices determined bids in a competitive auction process. This has the

advantage of allowing investors to determine the effective interest rate on the bills. Those who tender at low prices are disappointed as the total demand is always greater than the supply. However as from November 1990, these rates were further liberalized. The Treasury directs the CBK on how much money they (Treasury) want. This amount has to be collected irrespective of the rates offered. The CBK then lists the rates starting with the lowest offer for the cheapest funds to the highest. Once the required amount has been attained the other offers are rejected. In the case of a tie they discriminate by split decision. The potential bidders are free to offer their bid rates and since the liberalization the bids have not exceeded 19 percent. The major competitors in this bids are the NBFIs, companies, Commercial banks, individuals , the National Social Security Fund (NSSF), insurance companies, Post Office Savings Bank and parastatals.

An important feature of the Kenyan financial system that merits attention is the extensive borrowing by the government. The government borrows to finance its budget deficit and to re-lend to parastatals. This bias towards parastatals has had serious distributional and efficiency implications. Investments undertaken by major firms tend to produce relatively fewer low-skilled employment opportunities than investments by smaller concerns. The volume of borrowing by the government also threatens to hold back Kenya's growth potential by placing a severe strain on the financial system and shifting the allocation of the country's resources excessively towards the public sector. There have been several pledges by the government to reduce the deficit, but instead it has been increasing.

As discussed above these rigid ceilings on interest rates and the budget deficits have hindered the

growth of financial intermediation and reduced the efficiency of investment. With the margins getting smaller, the banking system was headed for the worst. There were few banking institutions coming up. The country was headed up for an oligopolistic market structure, in which a few executives would come up together to make corporate raids on companies and institutions. Naturally something had to done about the margins of the banking institutions if they were to do developmental lending especially the small-scale sector.

The government made some moves towards greater flexibility in interest rate determination by issuing two and five year treasury bonds in June 1986, and allowed the market to determine their effective interest rates.

Further, according to the current development plan 1989-93, there is the policy intention to move toward market determined interest rates. There will be a gradual freeing of interest rates setting to make them more responsive to market forces. This will be the last phase of major reforms that have been undertaken since the banking crisis of 1984-1986 when the banking industry was rocked by a liquidity and confidence crisis. These developments are of course interrelated and date back to 1986. We can refer to these developments as "new competition" in the financial sector. They are so interrelated that the significance of any one cause may only be determined by viewing them as a whole.

Particularly these reforms aim at increasing the efficiency of financial intermediation, removal of distortions in the mobilization and allocation of financial savings, and the development of more

flexible monetary policy instruments. The ceiling on long term bank - loan rates has been brought in line with ceiling for NBFI lending. Since 1989, the ceiling on savings deposit rates (for commercial banks and NBFIS) has been progressively raised from 10.0% to 13.5% ceiling lending rates for banks raised from 15.0% to 17.5% (for loans up to 3 years) and from 18.0% to 19.0% for NBFI loans. This harmonization is meant to increase the flexibility of banks to vary interest rates according to loan maturities.

For the transition to market based rates, the most significant policy has been the removal of the requirement that the ceiling on loan interest rates include all lending related charges and fees. Thus financial institutions now have the flexibility in setting their lending rates to reflect the current market conditions. The sustainability of the reforms, however depends on the governments' success in limiting the budget deficit and domestic borrowing. If the budget deficit remained at levels that require substantial domestic borrowing, the resulting increase in interest rates would crowd out private investment and raise costs of servicing government debt.

There have also been institutional reforms designed to restore public confidence in the financial system and upgrade the skills required to supervise and regulate financial institutions.

These reforms will have implications on financial institutions and financial instruments. CBK has different regulations that apply to commercial banks and NBFIs. Relative to NBFIs, commercial banks have been subject to lower loan rates ceilings, higher capital requirements and limits on private sector credit expansion, and cannot levy non - interest fees and service charges. These

egulatory differences had adverse effects on the financial system and availability of financing t

he private sector.

1.2 THE RESEARCH PROBLEM

As discussed above, Kenya has placed priority on the strategy of financial liberalization as an alternative to the repressive policies practiced in the past. There is a policy shift towards freer market determination of interest rates. This policy is intended to be fully operational as from July 1991. While this policy is derived from credible theory, the actual micro- and macro-economic effects of its implementation remain unknown. In this study, we make a modest attempt to fill the policy data gap by empirically assessing the likely direction and relative contributions of various determinants of the rate of interest in a liberalized regime.

1.3 OBJECTIVES OF THE STUDY

As would be clear from above,the broad objective of the study is an empirical evaluation of the likely sign and the relative contribution domestic and international factors in the determination of interest rates in Kenya under a liberalized interest setting regime. The specific objectives of the study were fourfold and include the following:

(1) Specify an econometric model of interest rate determination in Kenya under liberalized regime.

(2) Estimate the model specified in (1) above using appropriate Econometric techniques.

(3) Analyze the empirical results derived from (2) above and use the results to conduct policy simulations and/or forecasts.

(4) On the basis of the findings in (3) above, derive policy implications for implementation of the new policy on interest rate determination.

1.4 JUSTIFICATION OF THE STUDY

The expected results of the study would enhance public policy on financial liberalization in several ways. First, the findings will aid policy-makers in a smooth, fast and less costly implementation of the financial liberalization policy. The findings will assist them to make appropriate adjustments to the policy before it is implemented. Secondly, the results will assist investors in their shift of funds between securities of different terms or between bonds and equities to minimize losses. Finally, the results of the study should stimulate interest in further studies in the are including socio-economic impacts of the implementation of the new policy.

1.5 ORGANIZATION OF THE REMAINDER OF THE PAPER

The remainder of the paper is organized into four chapters. In chapter two we analyze both theoretical and empirical literature on interest rate determination. In chapter three we describe the methodology of the study including specification of the econometric model and data collection strategies. In chapter four we present and analyze empirical results while in chapter five we summarize the key findings of the study and discuss their implications for implementation of the financial liberalization policy.

CHAPTER TWO

LITERATURE REVIEW

In this chapter paper we present a review of both theoretical and empirical literature on interest rate determination. It is organized into three sections. In the first section we present a review of theoretical literature on interest rate determination. In the second section we present a review of the empirical literature on interest rate determination. In the final section we present an overview of both theoretical and empirical literature reviewed in the previous two sections.

2.1 THEORETICAL LITERATURE

The rate of interest is the price of renting money, a rate paid by the borrower to the lender. It has also been defined as the reward for parting with liquidity for a specified period. (Keynes 1936). Interest rates play a strategic role in modern Economic systems. Interest rates are used for raising deposit rates to encourage savers to place their savings with banks and other institutions. Raising interest rates on bank loans could be used to discourage their use for purposes which have a low return or are contrary to national economic policy. They are used in controlling the growth of money supply as well as in encouraging use of bank loans for purposes of a high priority.

The type of interest rate most relevant for economic analysis, like the "best" definition for money remains an open question. There is considerable disagreement as to how important the effects of interest rates are on different types of spending decisions and which interest rates are the most relevant for economic analysis.

There is a whole host of interest rates, depending upon, term to maturity, type of lender, risk of non-payment and many other features of the loan. On the whole, most interest rates tend to move together far more frequently than not. Differences in both direction and the rate of movement occur, but these are insignificant. Traditional theory views interest rates primarily as a cost that enters importantly into spending decisions. Different types of spending are sensitive to different stimuli, however it follows that not all types off spending acts are affected equally by interest rates. Residential construction, business inventories, capital expenditures by government and Non Bank financial intermediaries are most frequently identified as sectors particularly sensitive to interest rate changes. In some instances, like commercial banks and NBFIs,the impact of interest rates is reinforced by legal restrictions on rates permitted to be charged or paid.

Movements in these rates have some significant influence on the level of investment and therefore the level of employment in the economy. Other things equal, a lowering of the interest rate will induce businessmen to increase their purchases of investment goods, thus stimulating total spending and the volume of employment and vice-versa.

Even for any given national economy at a given point in time there does not exist a unique rate of interest. What exists is a hierarchy of interest rates reflecting a multitude of policy influences and to some extent market forces.

The neo-classical equilibrium framework provides perhaps the best starting point to approach interest rate theory. The first complete statement of the conditions for the neo-classical interest

rate theory is credited to Irving Fisher. Fisher (1930), besides refining the theory underlying the determination of the real rate of interest, delineated the effects of expectations of change in the price level on the nominal rate of interest and Wicksell (1936) introduced financial variables. The market rate of interest was determined by the demand and supply of credit including the effects of the price expectations of borrowers and lenders. Unlike the classical economists, Fisher distinguished sharply between the rate of return on physical assets, the rate of return on financial assets, and the real rate of interest on these assets. The real rate of interest is approximated linearly by the difference between the rate of interest and the rate of inflation, which produces a magnitude comparable to the rate of return to capital. Fisher started with the classical premise that the real rate of interest is an important variable to determine the equilibrium between savings and investment in a monetary economy by the financial intermediation process.

Briefly, Fisher distinguished between full and partial equilibrium and associated these cases with the effects from anticipated and unanticipated inflation. In the first case, the general rise in prices is accompanied by an equivalent rise in the rate of interest, so that the real rate of interest would tend to remain unaffected by inflation. In the other case, the rate of interest would fail to respond fully to the rise in price level as a result of the inability of the suppliers of funds to perceive fully the loss derived from rising prices (money illusion). The fall in the real rate of interest resulting from unanticipated inflation could cause ripples in real investment.

We observe that the state of full Fisherian equilibrium has important implications for the theory of interest rate policy that the equilibrium real rates of interest must be positive as it must equal

the rate of return to capital. Thus the market rate of interest could differ from that rate which would exist in the absence of expectations of price changes. Fisher, provided a simple analysis to show that any rise in the expected rate of inflation leads to an equal rise in the rate of interest: since an X per cent increase in the expected rate of inflation raises the nominal yield on investment by X per cent, investors will continue to bid for debt funds until the nominal interest rate also rises by X per cent. Mundell, R.A. (1963) subsequently attempted to show that, because of the real balance effect, the interest rate will rise by less than the increase in the rate of inflation. The analysis uses a static model to study a dynamic problem; so the result is unsatisfactory at a formal level. However it does suggest that Fisher's precise conclusion of equal change does not hold in an economy with monetary assets. A host of institutional factors could reduce the exact equality of changes in inflation.

Hicks (1939) took a middle course or compromise stand and contends that interest rate is a price which like other prices is determined with them as a mutually interdependent system. It has been accepted that while the liquidity preference and loanable funds theories both generate the same equilibrium interest rate, they both failed to consider price expectations a factor that has become increasingly important in recent years.

Contemporary economists by and large agree on the identity of the forces as to the relative importance of these forces and, thus, on both the ability of monetary authorities to influence rates and the interpretation of rate of movements. For many years after the Keynesian Revolution, economists emphasized the inverse relationship between money and interest rates. By increasing

the stock of money, the Central Bank could within limits, lower market rates of interest. Keynesianism made an important mark in the analysis. However we note from the outset that the contribution is relevant for advanced countries. Firstly, interest rates are mainly determined in the short-run by equilibrium conditions in their respective financial markets, while in the long-run they are determined by the classical factors of thrift and productivity. Secondly, it is possible through monetary policy under normal conditions to affect the rate of interest. Thirdly, interest rate movements can influence the rate of investment in an inverse direction. We challenge the theoretical and practical conclusions of Keynesianism on the following grounds: (i) it lead to the erroneous conclusion that the reduction in the rate of interest is also a reduction in the real rate of interest, in case of no inflation.(a state which does not exist) (ii) the other erroneous conclusion is that an acceleration in the rate of increase in the money supply will tend to lower the rate of interest, when infact it will tend to raise it because the higher increase in money supply will tend to raise the rate of inflation and thereby the rate of interest. More recently, in part and as a result of extended periods of rising interest rates accompanied by increases in the money stock and prices, economists have turned their attention to the effects of income and price expectations on interest rates, both of which tend to reverse the initial negative effects of monetary changes. If the latter influences are empirically significant, the Central Bank's ability to control interest rates would be diminished. Likewise, policy interpretations of interest-rate movements based solely on an assumed negative influence from money are likely to be misleading.

The influences of changes in the stock of money on interest rates have been examined by Eisner, R (1968) and Gibson, W (1971). Both authors argue that interest rates are only moderately affected by the money stock, but for different reasons. Eisner (1968) believes that interest rates

are sensitive to changes in the money stock only within a limited range of interest rates. At low rate levels the liquidity trap checks further reductions in rates resulting from increases in money. At high levels, a "liquidity leak" would encourage shifts to money substitutes and mitigates further increases in rates resulting from decrease in money. In addition Eisner (1968) discounts the strength of price expectations as an important factor influencing nominal rates of interest.

Essentially, then it is argued that interest rates are largely determined by some fairly pervasive forces in the economy, relating to productivity and thrift and risk. Expected future price movements will play a part, but this part can readily be exaggerated, particularly by a confusion between past and current rates of change of prices and these future expectations which alone are relevant. The monetary authority assuredly does play a substantial role since money substitutes are not without additional cost. In the short-run no doubt the monetary authority can raise interest rates significantly or allow them to rise. This is not without effect on the economy, although much more at the non aggregate level involving transfer of resources from those with poorer access to credit to those with better access.

The widespread belief among Economists that increases in money stock lowers interest rates, (Ackley (1961), Gramley and Chase (1965), PP.1391 Trieber (1966)) seems to follow from the liquidity preference relation between the level of interest rates and the quantity of money demanded. In Tobin's (1969) view interest rates will not return to their original levels as a result of money stock effects alone, but will end up higher than immediately after the money stock increase because of shift in the liquidity preference curve in response to an increase in income.

The expected rate of inflation π_t^e is unobservable. The simplest expectational model representing π_t^e is by a distributed lag on past inflation rates, as used by Fisher. In his analysis, the distributed lag weights were constrained to decline linearly. Cagan, P (1965) used adaptive expectations that implied geometrically declining weights. The price variable used to calculate the inflation rates is the price deflator for the consumer expenditure. Quarterly inflation rate is defined as

$\pi_t = 100(p_t - p_{t-1})/p_{t-1}$ where p_t is the price variable.

Despite Fisher's theoretical arguments and the mass evidence, the role of inflation was subsequently ignored in the discussion of interest rates. Friedman's (1959) statement that the rates of inflation experienced in the U.S do not affect the demand for money may have also contributed to the disregard for expected inflation. Only recently have economists Sargent, T. J. (1969) Yohe, W. P and Karnosky, D. S (1969) begun to reassess the impact of inflation on interest rates. Yohe and Karnosky (1969) focus exclusively on the change in anticipated inflation rate implying an almost equal change in the nominal interest rate. Their results indicate that inflation has a very important effect on interest rates.

Sargent (1969) combined the Fisherian analysis with a loanable funds model, in the determination of the real interest rate. By positing that investment is a function of the real interest rate and the current annual change in GNP and that savings is a function of the real interest rate and the level of GNP. He expressed the equilibrium real interest rate (difference between the nominal rate and a distributed lag on past inflation) as a function of the level and the annual change in GNP. He

allowed for differences between the equilibrium and actual real interest rates in response to changes in the rate of growth of the real money supply. He however omitted the liquidity variable and found implausible co-efficients.

Yohe and Karnosky (1969) re-estimated Sargent's equation using quarterly data, and concluded that the loanable funds variables did not improve the explanatory power of their model.

Government debt another variable, is a relatively close substitute in portfolios for bonds, so an increase in the quantity of government debt, that must be absorbed by the public would be expected to raise the Treasury bill interest rate.

Patinkin's (1965) statement of the equilibrium condition provides an explicit rationale for the portfolio balance. The analysis indicates that income, "outside money" and the government debt determine the Treasury bill rate of interest. Patinkin's model suggests the negative sign for the co-efficient of the liquidity variable and a positive sign for the co-efficient of the income variable. The positive co-efficient of the government debt shows that there is some tax payer illusion (Mundell (1960), Patinkin (1965), PP.283 i.e the public treats the government debt as an asset even though all interest and principle payments are financed by taxing the public. However Patinkin's analysis is static, it does not distinguish between real and nominal interest rates. The link between investment and long-term debt issues has been found too loose to cause a direct and significant impact on interest rates as contended by Feldstein and Eckstein (1970). They further suggest the importance of how disturbance variables in the framework of the general inflation -

portfolio balance specification. Their results show that if the lagged interest rate difference is omitted, the government deficit variable becomes significantly positive but the investment variable remains insignificant. The flow disturbances, hence make no meaningful contribution to the analysis of the interest rate movements. They suggest other sensitive measures rather than the national income.

Existing empirical evidence on the presence of exchange risk premium are inconclusive. One set of studies is based on testing the joint null hypothesis that the exchange rate market is efficient and there is no risk premium. Hansen and Hodrick (1980) have rejected the null hypothesis that there is no risk premium while Blejer (1982) could not reject the hypothesis of zero risk premium in a structural portfolio balance model. Frankel (1982a) and Rogoff (1984) have failed to uncover any systematic relationship between risk premiums and variables underlying the portfolio balance effects while Dooley and Isard (1983) have uncovered relatively small estimates on risk premium. Frankel (1982b) has estimated a portfolio balance model in which investors optimize over the mean and variance of expected returns and he could not reject the null hypothesis of risk premium to be a constant plus a normally distributed random term. As for "outside assets" Frankel (1979) and others have shown that these matter in the determination of risk premium. Where every financial asset in the portfolio is matched by a liability the exchange risks faced by owners of foreign currency assets and foreign currency debtors are mutually offsetting. The exchange risk can be traded in the market at a price which will eliminate any risk premium. There is no consensus as to whether outside assets should include both interest bearing debt and non-interest bearing monetary base. Many studies have left out the monetary base, in measurement of outside

assets.

Feldstein and Eckstein (1970) recognize that individual investors are very much influenced by arbitrage opportunities between different maturities, but there is inter-relation in structure of interest rates to the economic forces that cause shifts in the entire level of interest rates. Their estimates show the importance of public debt and the 'investors' expectations of future changes in the interest rate.

2.2 EMPIRICAL LITERATURE

Most attempts to explain interest rate behavior makes use of the Fisher (1930) hypothesis. At its simplest, it postulates that in equilibrium the real rate of return from holding an asset whose returns are given should equal the real rate of return from an asset whose returns are given in real terms. For this equality to hold in a period when inflation is expected, the following must be approximately true:

$$r^n_t = r^r_t + p^e_t + u_t \qquad (1)$$

Where r^n_t is the equilibrium real rate of interest from a real asset and p^e_t is the expected rate of inflation over the period for which the assets are to be held. Equation (1) was tested for U.K data in the Period 1961-73 by Demery (1978). The U.K was an open economy with a fixed exchange rate regime. The results showed that the co-efficients on p^e as positive and apparently highly statistically significant from zero; the explanatory power of the estimates low, and the error terms of the estimates were characterized by first order auto correlation. The presence of auto-correlation meant that the estimates were not efficient and conventional tests of significance were invalid.

From the results the simple Fisher hypothesis was rejected implying that Interest rates do not equal a constant plus expected inflation. Further more, from the results, the pattern of residuals, reflected the failure of interest rates to adjust instantly to changes in expected inflation. To allow for this possibility Demery (1978) relaxed the assumption of instantaneous adjustment, substituting it with one of partial adjustment to equilibrium values. The revised interest rates determination model was represented as:

$$R^n_t=b_0+a_1b_1P_1^e+(1-b_1)R^n_{t-1}+U_t \qquad (2)$$

Where b_o is a positive constant and b_1 is a constant with a value of between 0 and 1, and which is a measure of the speed with which actual interest rates adjust to their equilibrium values. Empirical results on the U.K economy based on the revised model (2) showed improvements on both the explanatory power of the model and on auto-correlation in the model.

However, the inclusion of a lagged interest rate variable in the model biased the DW statistics and consequently we are skeptical about the results.

The Keynesian liquidity preference theory is a model of portfolio choice in an economy with only two assets: money and bonds. Feldstein and Eckstein (1970) introduced Government debt as it is a relatively close substitute in portfolios for bonds. An increase in the quantity of Government debt that must be absorbed by the public would be expected to raise the bond interest rate. They tested their equation, for U.S data,

$$RC_t=\alpha_o-\alpha_2InRMBPC_t+\alpha_2InRPYPC_t+\alpha_3RDEBTPC_t+\alpha_4\pi_t+\Sigma^n_{j=1}\ \alpha_j\pi_{t-1}+U_t \qquad (3)$$

Where RC_t=Interest rate on bonds,$RDEBTPC_t$= Private owned Federal Government debt,

$RMBPC_t$= Real per capita monetary Base, $RPYPC_t$= Per capita real Private Gross National product,π_t= Inflation,π_{t-1}= lagged inflation variable. Liquidity was measured by including both a measure of "outside money" (the monetary base) and private GNP. The impact of inflation was assessed by a polynomial distributed lag on six years of quarterly inflation rates. This was an integration of Keynesian liquidity preference and the Fisherian approach. The expected interest rate change, measured by the lagged change in the long-term rate itself was included to allow for the effect that anticipated capital gains and losses have on current demand for bonds. Their results show that the co-efficients measure only the direct effect of each variable on the interest rate; due to its single equation form. We point out that the indirect effects, could be more important than the direct effects. The monetary base, for example has not only this direct effect but also an indirect effect through its impact on prices and private GNP. It was shown that decreasing liquidity was more important than inflation, and that slow growth of public debt exerted a downward pressure on the rate of interest.

Our study will use an appropriate estimation method, that overcomes the weakness inherent in a single equation form.

Based on Sargent's (1969) loanable funds model; Demery and Duck (1978) constructed and tested the following model of interest rate behavior, that allowed for the openness of the U.K economy and the fixed exchange rate;

$$R^n_t=g_o+g_1VC_t+g_2PB^e_t+g_3P^e_t+g_4m/p_t+g_5R^n_{t-1}+U_t \qquad (4)$$

Where g_o, g_1, etc are co-efficients with the following expected signs; g_o, g_1 >,= or < 0, g_2>0 , g_4<0

,$0<g_3, g_5<1$

R^n_t = nominal interest rate on certain three-monthly assets, VC_t =level of vacancies, a proxy for the level of economic activity, PB_t is public sector borrowing,P^e_t is the series on expected inflation,m/p_t is the rate of change of the real money supply and R^n_{t-1} is the lagged dependent variable.

Using the M_1 (CU+DD), definition of a money supply, the expected inflation variable was highly statistically significant and the new variables introduced, with the exception of the public sector borrowing, were statistically significant and had the expected sign. Empirical results of the model with a M_3 money supply were not as good. First, while the co-efficient on the public sector borrowing was statistically insignificant and of the wrong sign. They offer a number of explanations for the 'correct' sign on the money supply variable when the M_1 definition is used and the "incorrect" sign when the M_3 definition is used. We note that their argument suggest bias in the estimation techniques. Instead of using OLS, they could have employed an instrumental variable (IV) for the money supply variable.

More recently Edwards and Khan (1985) examined interest rate determination in two polar cases, relating to the degree of openness of the economy. They combined the closed and the open economy extremes. They assumed that the equation for the nominal interest rate be specified as a weighted average or a linear combination of the open and closed economy expressions:

$$i_t=\Theta(i^*_t+\hat{e}_t)+(1-\Theta)i_{t-1} \qquad (5)$$

where i_t=nominal rate of interest, i^*_t=the world interest rate for a financial asset, $\hat{e}_t$ is the expected

rate of change of the exchange rate, Θ is the adjustment parameter $0<\Theta<1$ and,

$$i_t=\tau_0+\tau_1 Iny_t+\tau_2 InM_{t-i}+\tau_3 In\pi_t^e+e_t \quad (6)$$

They took a parameter to measure the degree of financial openness of the country. If $\phi=1$, the economy is fully open then we have

$$i_t=i^*_t+\hat{e}_t \quad (7)$$

as the equation to be estimated. In case $\phi=0$, the capital account is closed, and the Fisher equation

$$i_t=rr_t+\pi_t^e \quad (8)$$

holds. Where i_t=nominal rate of interest, rr_t=real rate of interest, π_t^e=the expected rate of inflation. In the intermediate case they contend that the parameter ϕ will lie between zero and unity, that the closer it is to unity, the more open the economy will be. They assume slow adjustment to interest parity and use the equation:

$$i_t=\Theta(i_t^*+\hat{e}_t)+(1-\Theta)i_{t-1} \quad (9)$$

instead of equation (7), the appropriate form for the general case becomes

$$i_t=\phi\Theta(i_t^*+\hat{e}_t)+\phi(1-\Theta)i_{t-1}+(1-\phi)(rr_t+\pi^e_t) \quad (10)$$

They then bring in the argument of excess money supply and the demand for real money function into, equation (10) above to obtain the following final reduced form for the nominal interest rate:

$$i_t=\delta_0+\delta_1(i_t^*+\hat{e}_t)+\delta_2 Iny_t+\delta_3 InM_{t-1}+\delta_4\pi_t^e+\delta_5 i_{t-1}+\Sigma_t \quad (11)$$

This is quite general as it incorporates open and closed economy features, and permits the possibility of adjustment on both the foreign and domestic sides. In case of a completely open economy with instantaneous adjustment ($\phi=\Theta=1$) $\delta_1=1$ and $\delta_0=\delta_2=\delta_3=\delta_4=\delta_5=0$.

However, the model assumes that agents are risk neutral. The model using equation (11) was estimated using quarterly data for Colombia and Singapore. These are countries quite different in

the development of their domestic financial markets and in the extent of capital flow controls. The estimates from the model confirmed that both foreign and domestic factors were important in interest rate determination in Colombia, but only foreign factors appeared to matter in Singapore. The results also indicated that Colombia was more open than suggested by the actual system of capital controls.

2.3 OVERVIEW

From the foregoing review of the literature on interest rate determination, we made several observations. First, the unifying theme in the construction of the variables has been the desire to focus explicitly on the role of price expectations. These inflationary expectations enter the model through the anticipated rate of inflation and through the anticipated price level;dominantly emerging from the public's behaviour.

Secondly we note that some of the models reviewed like Demery's (1978) assume free forces of demand and supply determining the equilibrium rate of interest. In as much as these models are important they fail to take into account the unique characteristics of developing countries. One such important feature is the exhibition of open and closed economy factors.

Lastly some of the models reviewed exhibit structural weaknesses due to the estimation techniques used. We need a model(s) that overcome these. It should too incorporate the importance of domestic and world monetary factors, which are not captured by Demery and Duck (1978).

Edwards and Khan's model is tailored to the generalized conditions of most LDCs. Though it has a fairly simple structure, it sufficiently incorporates the major determinants of interest; such as foreign interest rates, expectations in exchange rates changes and domestic monetary conditions. The model assumes the existence of a risk premium in the exchange rate. We prefer the model, because of its considerable potential to serve as a useful starting point for studying interest rates in Kenya. Conventional models of interest rate determination, like the Loanable funds model, the Wicksell model assume free forces of demand and supply determine the equilibrium rate of interest.

CHAPTER THREE

METHODOLOGY

In this chapter we present the study methodology. It is organized into three sections. In the first section we specify an econometric model, for interest rate determination in Kenya. In the second section we present the methodology for estimating the specified econometric model of interest rate determination. In the third section we describe type, sources and collection methodology of the data set required to estimate the specified econometric model.

3.1 ECONOMETRIC MODEL SPECIFICATION

As would already be clear, the econometric model of interest rate determination specified for Kenya was a modified version of the Edwards and Khan model (1985) reviewed above. Specifically, the model was expanded to endogenize exchange rate risk premium and incorporates the effects of government borrowing.

We modelled the exchange risk premium as a linear function of the relative supply of stocks of 'outside assets' and the relative wealth positions of the domestic economy vis a vis the rest of the word:

$$R_t = b_0 + b_1 OAKUK_t + b_2 WKUK_t + e_{1t} \qquad (3.1)$$

Where OAKUK is the ratio of existing stock of domestic currency denominated outside debts of the government to foreign currency denominated stock outside debts, WKUK is the ratio of domestic foreign net wealth. $b_1>0$ and $b_2<0$. e_t is a normally distributed random variable with zero mean and constant variance.

Unlike the Khan and Edwards model (1985), we modelled interest rate determination as partial adjustment to both international disparity and as a function of domestic monetary disequilibrium and government borrowing requirements:

$$\Delta r_t = \Theta [(r_t^f + \Delta S_t^e + R_t) - r_{t-1}] + K(\log M_t^d - \log M_{t-1}) + \phi PD_t + e_{2t} \quad (3.2)$$

Where M_t^d is the demand for real money balances at the end of period t, M_{t-1} is the outstanding stock of real money balances at the end of period t-1, K measures the magnitude of the interest rate adjustment in response to monetary stock disequilibrium, and PD_t represents the borrowing by the public sector from domestic resources in period t and e_{2t} is error term.

We adopted the following conventional demand for real balances expressed as a function of a scale variable and variables representing the opportunity costs of holding money completes the model:

$$\log M_t^d = c_0 + c_1 \log Y_t - c_2 \pi_t^e - c_3 r_t + e_{3t} \quad (3.3)$$

Where Y_t is the real income, π^e_t is the expected inflation from time t to t-1.

The above system of three equations of modified model of interest rate determination is simultaneous. The identification status of each equation of the model was determined using both the order and rank conditions. The order (necessary) condition for identification requires that: the total number of predetermined and endogenous variables excluded from an equation must at least equal the total number of predetermined variables; excluded in the model from an equation be at least equal to the number of endogenous variables included in it minus one. This can be stated algebraically as,

$(G - g_i) + (K - k_i) \geq G - 1$

or

$(K - k_i) \geq g - 1$

Where G is the number of all endogenous variables in the model, K is the number of predetermined variables in the model, g_i is the number of endogenous variables included in the i^{th} equation, k_i is the number of predetermined variables included in the i^{th} equation.

Applying the order condition to each of our three equations of the model we found the equations (3.1),(3.2) and (3.3) were over identified. The order condition is thus satisfied as shown in the table below.

Table 4: Summary of results of Order Condition of Identifiability

Equation	No. of Predetermined Variables excluded $(K-k_i)$	No.of Endogenous Variables included Less one.(g_i-1)	Identification Status of Equation
3.1	7	2	Over
3.2	5	2	Over
3.3	7	2	Over

3.2 ESTIMATION METHODOLOGY

From the above results of order condition of identification the simultaneous equation model specified above could be estimated using Indirect Least Squares (ILS) or Two Stage Least Squares

(TSLS) However, since R_t is unobservable, we estimated the following reduced form of the model derived by substituting equations (3.1) and (3.3) into (3.2) and rearranging:

$$r_t=\alpha_0+\alpha_1(r_t^f+S_t^e)+\alpha_2 OAKUK_t-\alpha_3 WKUK_t+\alpha_4 \log Y_t-\alpha_5\pi_t^e-\alpha_6 \log M_{t-1}+\alpha_7 PD_t+\alpha_8 r_{t-1}+e_{4t} \quad (3.4)$$

Where: $\alpha_0=\Theta b_0+Kc_0/1+Kc_3$ $\alpha_1=\Theta/1+Kc_3$ $\alpha_2=\Theta b_1/1+Kc_3$ $\alpha_3=\Theta b_3/1+Kc_3$

$\alpha_4=Kc_1/1+Kc_3$ $\alpha_5=Kc_2/1+Kc_3$ $\alpha_6=K/1+Kc_3$ $\alpha_7=\phi/1+Kc_3$ $\alpha_8=1-\Theta/1+Kc_3$

The reduced form model (3.4) will be estimated using either OLS or GLS. The co-efficient α_5 has a negative sign as opposed to the Fisher effect which predicts - positive relationship between inflationary expectation and nominal interest. The parameter α_5 represents this effect of inflationary expectation on interest rate through demand for money. The actual estimate and sign for the price expectation variable will depend on the relative strength of the Fisher effect and the demand for money effect.

3.3 DATA: TYPE, SOURCES AND COLLECTION METHODOLOGY

The domestic interest rate is represented by the annual Treasury bill bid rates. The Central Bank of Kenya, since 1969 invites tenders and sells the bills to the highest bidders. So that the treasury bill rate is one interest rate in Kenya which fluctuates relatively freely according to the money market conditions. This rate is therefore used as a representative rate of interest vis-a-vis other rates in the country. The foreign interest rate is taken to be the annual U.K Treasury Bill rate. The source of the Treasury Bills data is the IMF Financial International Statistics. The shilling - pound exchange rate is obtained from the Quarterly Economic Review of the Central Bank of Kenya. We take the actual exchange rate as the proxy for the expected exchange rate.

The net wealth of Kenya and the United Kingdom is calculated by accumulating budget deficits and the current account surplus to the bench mark estimates of wealth in the two countries as of December 1969. The wealth bench mark for Kenya is estimated following a procedure adopted by Frankel (1982b) by multiplying the ratio of GNP for Kenya in 1969 against estimated United Kingdom wealth. The estimated Kenyan wealth is then converted into shillings.

The annual current account for Kenya and the United Kingdom is calculated by subtracting from the current account of each year the trade balance so as to obtain the balance on services and transfers.

The stock of outside assets is calculated by taking the annual Government deficits to the stock of public debt as from 1969.

The real annual income variable is proxied by the index of industrial production. The indices are obtained from various issues of Central Bank of Kenya Quarterly Economic Review.

The money stock (M1) is at the end of the year and is deflated by the Consumer Price Index (CPI). The expected rate of inflation can be assumed to be generated by an adaptive expectations hypothesis of the form,

$$\pi_t^e = \pi_t^e - \pi_{t-1}^e = k(\pi_t - \pi_{t-1}^e) \qquad (3.5)$$

Where π_t is the actual rate of inflation in terms of the annual price level index, K is the adjustment co-efficient, $0<k<1$, that is the adjustment in the expectations of the current period is

Quarterly inflation data were derived from quarterly CPI data in Economic Surveys and Statistical Abstract.

CHAPTER: FOUR

ANALYSIS OF EMPIRICAL RESULTS

4.1 SUMMARY OF OLS RESULTS

In this Chapter we present and analyze the OLS and GLS estimation results of the reduced interest rate determination model specified in the previous chapter. A summary of the OLS results is presented in table 5 below:

Table 5: Summary of OLS estimation results

Independent	The dependent Variable is r_t Estimated	T=Statistic
c	52.287	4.050
$r^f_t+S^e_t$	-0.146	-1.517
$OAKUK_t$	0.051	0.372
$WKUK_t$	0.057	1.913
$LogY_t$	0.017	2.317
$LogM_{t-1}$	-14.179	-4.367
π^e_t	0.234	3.516
PD_t	0.001	2.648
r_{t-1}	0.229	1.304

R_2=0.96, adj.R^2=0.93, Dw=2.74, DF=13, $F_{(8,13)}$ =38.79,n=21,

$F_{0.05(8,13)}$=2.77, Loglikelihood=27.51, SEE=1.186, $t_{0.05}$=1.71

$t_{0.01}$=2.65

The Table above summarizes these regressions and contains the regression co-efficients for each variable along with its calculated t values, the adjusted value of the multiple co-efficient of

correlation (D.W) and the standard error of regressions, (SEE).

From the table we can make several observations. First the marginal effect of the expected exchange rate variable ($r^f_t+s^e_t$) has the expected (negative) sign, though it is not statistically significant from zero at both the 0.05 and 0.01 levels of significance. The result could be explained in terms of a unit increase in the expected exchange rate causes a 1.46 percentage change in the rate of interest. That implies that if capital can earn more (interest) abroad there no rationale for taking it where it earns less.

Second , the portfolio variables $OAKUK_t$ and $WKUK_t$ show mixed results. While the marginal effects of $OAKUK_t$ has the expected sign, that of the relative wealth variable ($WKUK_t$) has the wrong sign. However the marginal effects of $WKUK_t$ are statistically significant from zero at the 0.05 but not at the 0.01 levels of significance. The positive sign implies that a unit increase in outside assets would increase interest rates by 0.5 units. The negative sign for the relative wealth position ($WKUK_t$) means that if the foreigners with assets locally increased their wealth by a unit would lead to an increase of r_t by 0.05%. This result is strange and can be attributed to crude data and little variability in the data. This results are similar to the ones by Wee Beng (1987). Third, the marginal effect of economic activity variable (Y_t) on the interest rate (r_t) is statistically significant from zero at the usual 0.05 per cent level, but not at the 0.01 percent level, and has the expected sign. An increase in economic activity would lead to an increase in interest rates, due to the effect of increased incomes. Holding other variables constant economic activity would influence interest rates by 1.7%. The result is similar to the ones obtained by Duck and Demery (1978). Fourth the marginal effect of the lagged real money stock variable ($LogM_{t-1}$) on r_t has both

the expected sign and is statistically significant from zero at both the 0.05 and 0.01 levels of significance. The large co-efficient of the variable indicates that any excess real money balance will lower r_t. The result is similar to the ones obtained by Mundell (1963), Gramley and Chase (1966) and Eisner (1968). An increase in money stock would lead to a decrease in interest rates.

Fifth, the marginal effect of Government borrowing (PD_t) on r_t though small has both the expected (positive) sign and is statistically significant from zero at both 0.05 and 0.1 levels of significance. The result is similar to that of Patinkin (1965) implying that government borrowing that must be absorbed by the public would be expected to raise the interest rates.

Sixth the co-efficient attached to expected inflation indicates that unit increase in inflation leads to a 2.3% increase in interest rates. The marginal effect of π^e_t on r_t is statistically significant from zero at both 0.05 and 0.01 levels of significance. The result implies that inflationary expectations influence the determination of interest rates. The marginal effect of the lagged Treasury bill variable on r_t had both the expected (positive) sign but was not statistically significant from zero at both 0.05 and 0.01 levels of significance. The result implies that last year's Treasury bill rate has not statistically significant influence in the determination of interest rates, in the current year.

The variables included in the model jointly explain 96 percent of the variation in the interest rates. The explanation is statistically significant from zero at both the 0.05 and 0.01 levels of significance.

Finally, a Durbin-Watson test indicates the presence of serious auto-correlation problem invalidating the above statistical significance results.[1] This, in turn would imply incorrect policy implications. To overcome the problem we re-estimated the model using the GLS technique.

4.2 SUMMNARY OF GLS RESULTS

The GLS procedure used to correct the serial correlation was the Cochrane-Orcutt method. It involves a series of iterations, each of which produces a better estimate of serial correlation co-efficient Rho (P) then the previous one.

It utilizes the notion that Rho is a correlation co-efficient associated with errors of adjacent time periods. The procedure is based on the AR(l). This set values Rho in the interval (-l,l). Each value is used to compute the quasi-first differences and OLS is then applied to minimize Σe_t^2.

A summary of the GLS regression results for which convergence was achieved after 14 iterations is presented in table 6 below.

[1]The Durbin-Watson d statistic may not be used to detect serial correlation in an auto-regressive model,because the computed d value in such models generally tends towards two (2), which is the value of d expected in a truly random sequence. This applies only to large samples which is not the case in our study.(See Gujarati,Durbin.)

Table 6: Summary of GLS estimation results

Independent Variable	The Dependent Variable is r_t Estimated Co-efficient	T-Statistics
c	-20.059	-1.967
$r^f_t+S^e_t$	0.023	1.814
$OAKUK_t$	0.349	1.146
$WKUK_t$	-0.057	-2.672
$LogY_t$	0.282	1.244
$LogM_{t-1}$	-4.037	-2.922
π^e_t	0.055	0.453
PD_t	0.002	1.497
r_{t-1}	0.741	4.430

R^2=0.85,adjR^2=0.71,DW=2.01,D.F=13,F=5.83,$t_{0.05}$=1.71,$t_{0.01}$=2.65,

$F_{0.05}(8,13)$=2.77 loglikelihood=-41.87 SSR=2.57 n=21

There is a remarkable change in the results. Generally we note that compared with the OLS results, the above results indicate several differences. First, the results show a general reduction in both the marginal effects of the variables on r_t and t-statistics. Second the marginal effect of the exchange rate expectation is now statistically significant from zero only at the 0.05 level of significance, and has the expected (positive) sign. This implies that the expected exchange rate has a significant. Impact on interest rates. A similar result was obtained by KhateKhate D.R. (1980) pp. 208.

Thirdly the exchange rate risk premium variable and again register mixed results. The marginal effect of $OAKUK_t$ on r_t has the expected (positive) sign but is not statistically significant from zero at both 0.05 and 0.01 levels of significance. This has the meaning that variability in the deviation from the purchasing power purity relationship between Kenya and the United Kingdom

deviation from the purchasing power purity relationship between Kenya and the United Kingdom has no significance in determination of interest rates. On the other hand the marginal effect of $WKUK_t$, turns out as in the OLS results, but takes the expected sign (negative) and is statistically significant from zero at the 0.05 and 0.01 level of significance. This has the implication that a shift in the relative wealth position in favour of Kenya would lower the risk premium, consequently exerting a dampening effect on interest rates. An increase in the relative supply of domestic outside assets by raising the risk premium would increase the local interest rates by 3.4 percent. However this observation ought to be treated tentatively or cautiously given the crude nature in which we derive the portfolio variables.

Fourth, unlike the OLS results the marginal effect of the economic activity variable (Y_t) on r_t is not statistically significant from zero at both the 0.05 and 0.01 levels of significance. This implies that the level of economic activity has no statistically significant influence on interest rates. This result is strange, as from theory we expect that economic activity be negatively correlated with interest rates. This is a contrast to Demery's (1978) results from the U.K.

Fifth, the marginal effect of the lagged money stock is statistically significant from zero at both the 0.05 and 0.01 levels of significance; and has the expected (negative) sign. This again is consistent with the results in the literature (Mundell (1963), Eisner (1968). An increase in money stock would lead to a decrease in interest rates. This is in conformity with the empirical findings of Ackley (1961), Mundell (1963) and Fisher (1968) and Wee B. (1987).

Sixth, the marginal effect of the expected inflation has the expected positive sign, but is not statistically significant from zero at the 0.05 and 0.01 level of significance. The result is strange and differs from the results in similar studies [Demery and Duck (1978), Carr and Smith (1974)]. A plausible explanation can be advanced to rationalize this outcome. The standard error of the co-efficient is relatively large while the co-efficient is small.

Seventh, the marginal effect of the domestic government borrowing variable on r_t has the expected positive sign but is not statistically significant from zero at both 0.05 and 0.01 level of significance. This has the implication that government borrowing has no statistically significant impact on the determination of interest rates. This result does not conform with the literature. We could explain this rather strange outcome by posting that being small and statistically insignificant from zero is due to the standard error of the co-efficient being relatively large. We will hold our theoretical justification and empirical evidence of Demery (1978) and Duck (1978) and proceed to draw some policy conclusions.

The marginal effect of the lagged Treasury bill has the expected (positive)sign and is statistically significant from zero at the 0.05 and 0.01 significance levels. This implies the previous year's treasury bill rate has a statistically significant influence on the current years' rate. This contrasts the OLS results. From the estimated coefficient of the lagged dependent variable, we can calculate the value of which measures the speed at which the domestic interest rate would adjust to maintain the international parity relationship, it was 0.22. This implies approximately 22 percent of the interest rate differential is eliminated within a year.

Sixth, the marginal effect of the expected inflation has the expected positive sign, but is not statistically significant from zero at the 0.05 and 0.01 level of significance. The result is strange and differs from the results in similar studies [Demery and Duck (1978), Carr and Smith (1974)]. A plausible explanation can be advanced to rationalize this outcome. The standard error of the co-efficient is relatively large while the co-efficient is small.

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The marginal effect of the lagged Treasury bill has the expected (positive)sign and is statistically significant from zero at the 0.05 and 0.01 significance levels. This implies the previous year's treasury bill rate has a statistically significant influence on the current years' rate. This contrasts the OLS results. From the estimated coefficient of the lagged dependent variable, we can calculate the value of which measures the speed at which the domestic interest rate would adjust to maintain the international parity relationship, it was 0.22. This implies approximately 22 percent of the interest rate differential is eliminated within a year.

Finally the variables in the model jointly explain 85 percent of the variation in the interest rate. The explanation is statistically significant from zero at both the 0.05 and 0.01 levels of significance. The calculated F statistic is 5.83 which is greater than the F critical [$F_{0.05}$ (8,13)=2.77], hence there is variation between the variables and within the model.

We now discuss the results for each variable individually. The exchange rate expectation is now significant and positive. The GLS estimate indicates that the Sterling Pound denominated deposit Treasury bill rate adjusted for exchange rate expectation has a significant impact on the domestic Treasury bill rate. The exchange rate risk premium variables again register mixed results. The coefficient of $OAKUK_t$ has increased from 0.051 to 0.349, so has the t-statistic, but it is not significant. This has the meaning that variability in the deviation from the purchasing power parity relationship between Kenya and the United Kingdom has no significance in the determination of domestic Treasury bill rates. On the other hand the coefficient of $WKUK_t$ turns out same as before but takes the expected sign unlike in the OLS estimation. The t-statistic turns out to be highly significant too. This implies that a shift in the relative wealth position in favour of Kenya would lower the risk premium, consequently exerting a dampening effect on the domestic Treasury bill rate. An increase in the relative supply of domestic outside assets, by raising the risk premium would tend to increase the local Treasury bill rate by about 3.4 percent. However this observation ought to be treated tentatively or cautiously given the crude nature in which we derive the portfolio balance variables. The coefficient for real income Log Y_t drastically reduces and so does the t-statistic. Unlike in the OLS estimation results, the parameter is not statistically significant. This implies that the level of economic activity has no significant influence on the domestic

Treasury bill rate. A plausible explanation can be advanced to rationalize this outcome of the economic activity variable. This would account for the economic activity co-efficient being small and insignificant since the standard error of the co-efficient is relatively large. This result is rather strange, from theory we expect that economic activity be negatively correlated with interest rates. It contrasts Demery's (1978) for the U.K.

4.3 MODEL VALIDATION

We conducted an ex-post forecast to validate our model. In an ex-post forecast, the forecast period is such that observations on both endogenous variables and the exogenous explanatory variables are known with certainty.(Rubenfield and Pyndick pp 161). Thus we can use our ex-post forecasts to check against existing data and provide a means of evaluating the model. We check the validity of our model over 1985-89, a period of policy changes, relative to its past. This is the period when the government first allowed movement within the Treasury bonds towards market determined rates. Within this period also the government has taken steps towards gradual freeing of interest rates.

Using the TSP 4.1 computer programme, we generated a 16 period ex-post forecast (1969-84), with the following regression results.

Table 7: Ex-Post GLS Regression Results 1969-84

Independent Variable	Estimated Co-efficient	T-Statistics
c	47.779	2.264
$r^f_t+S^e_t$	-0.078	-0.542
$OAKUK_t$	-0.068	-0.497
$WKUK_t$	0.510	3.558
$LogY_t$	6.060	2.398
$LogM_{t-1}$	0.250	5.296
π^e_t	0.397	1.889
PD_t	-0.021	-2.611
r_{t-1}	-12.970	-2.430

R^2= 0.96 Adj. R^2=0.93 DW =2.50 D.F= 8 F=31.099

$F_{0.05}(8,16)$=3.44 loglikelihood=-27.66 SSE=1.24 n=16

There is a remarkable change in the results. The economic activity variable, expected inflation, the lagged Treasury bill rate, the real money stock and government borrowing variables are highly significant. Out of this set only the real money stock, and the lagged Treasury bill rate were significant in the GLS estimation. However, as the standard errors of regression are almost similar, 2.57 against 1.24, we argue that there is little surface evidence of predictive failure, despite the apparent difference in the sample results. The forecast results for r_t are as follows:

Table 8: Actual and Forecast values for r_t 1985-89

Period	1985	1986	1987	1988	1989
Actual	13.90	13.23	12.86	13.48	14.00
Forecast	14.64	13.99	16.39	17.24	19.21

The performance of the model is shown in the table above. As indicated, the forecast seems to approximate the observed pattern reasonably well. In most cases it successfully predicts the peaks and troughs, though it does not fit well for the 1988 and 1989 periods.

CHAPTER: FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

In this chapter we present a summary of key conclusions accruing from the above empirical findings and discuss their policy implications. We also outline limitations of the study and make suggestions for future research in the topic.

5.1 SUMMARY OF CONCLUSIONS

The current study confirms that the domestic interest rate responds to changes in foreign interest rate adjusted for exchange rate expectations . Hence some consideration has to be given to world interest rates and exchange rates in assessing domestic interest rates.

The attempt to model the exchange rate risk premium as a function of the deviation from the purchasing power parity was successful. However it fails as a function of relative supplies of outside assets.

Another key finding is that domestic money supply exerts considerable short-run influence on interest rates largely through the liquidity effect.

Surprisingly expected and government borrowing are significant, in the determination of interest rates.

5.2 IMPLICATIONS FOR FINANCIAL LIBERALIZATION POLICY

In this section we draw policy based on both individual and collective findings of the key variables.

The policy implications of this study, have previously been stated in technical and statistical terms. A general policy implication is that domestic interest rates in local currency must reflect not only the inflation differential(or the expected rate of depreciation of Kenya Shillings to the Sterling pound) but also the risk premium inherent in the discount registered in foreign markets. Interest rates that do not reflect this risk premium will not suffice to pull in capital from abroad nor prevent local capital from fleeing abroad if it finds an opportunity to do so. The cessation (or reversal) of capital inflow that is characteristic of the debt crisis could sharply reduce the supply of capital to kenya. The natural consequence of such a development must be a rise in (real) interest rates as compared to interest rates abroad. In a scenario of high inflation, real interest rates can become severely negative. To keep the real rate of interest positive, the problem of inflation itself has to be addressed to. Caution is necessary at this point, that indexation may not be a satisfactory solution but on the crucial aspect of ensuring high enough real interest rates it certainly provides a better answer than the policy of keeping nominal interest well below the rate of inflation.

We could further argue based on the statistical significance of our results that changes in the exchange rate and expectation on the change will have implications for the short-run conduct of interest rate policy in Kenya, through its influence on capital movements. Domestic equilibrium

would require that Kenya's interest rate be higher than that in the U.K, this can be achieved if the rate of inflation is lower in Kenya or if the rate of interest is higher. Further external equilibrium would demand that Kenya depreciate its exchange rate pari-passu with the difference between the domestic and foreign rates of inflation. Under these circumstances Kenya would stand to gain from a long-run inflow of capital to finance its long-run growth.

We need to qualify whether the domestic equilibrium is achieved by price stability or through high interest rates. When the domestic rate of inflation exceeds that of the U.K for example, we expect the domestic currency to depreciate in the long-run. The time lag of depreciation and of the expectation generated is expected to affect interest rates in the short-run. If a significant difference in inflation rates takes place for a long period without any exchange rate depreciation, the public could develop expectations of a considerable depreciation, so that the level of interest rates required for domestic equilibrium might be although high too low for equilibrium in the short-run. Long-run equilibrium would require that the domestic interest rate be higher than the foreign interest rate plus the expected rate of exchange rate depreciation of the domestic currency. Exchange rate policies that prevent exchange rate changes in the short-run make the effective difference between domestic and foreign deposit interest rates very large. This can cause large capital inflows. However, the response of capital movements is determined by expectations of the exchange rate which could considerably exceed the short-run exchange rate changes.

From the above we infer that in the first case there could be excessive short-term private capital inflows and in the second case excessive outflows. Exchange rate considerations should therefore

be given serious considerations as they easily influence domestic capital formation and efficiency of investment. As can be inferred from both cases above, the maturity structure of foreign borrowing could therefore be biased towards shorter maturities because of the greater uncertainty associated with the movement of the exchange rate.

As seen from the significance of the real money stock, the Central Bank as the manager of monetary policy should resort to use of indirect means of monetary control such as open market operations in influencing liquidity. This will be a better means of influencing policy on interest rates without directly regulating it.

The short-run implications of an increase in the interest rates for the liquidity of financial institutions' borrowers merits attention. A quick policy response would be the extension of the maturity of loans so as to cope with the problem. This adjustment of loan maturity has the limitation that it might shift the burden of short-run illiquidity to financial institutions. At risk here are the young financial institutions with a small capital base. In this case the Central Bank should lower the legal reserves for all the financial institutions proportionate with their capital base.

Though the estimate of public sector borrowing was not statistically significant from zero at five percent level, it is at the ten percent level. Further it has been argued and shown that it has crowded out private investment. With this view in mind we argue that the Government should aim at gradually limiting its borrowing in financial markets to the financing of projects with rates of return greater or equal to the social rate of return. In the meantime to enhance the financial market

development the borrowing should be reduced to a level that would permit it to borrow from financial markets in competition with the private sector. Moreover the Government should ensure that the projects financed by these resources have rates of return at least comparable to those obtained on projects in the private sector.

The public sector financing can be an impediment to interest rate liberalization and the economy as a whole. An increase in interest rates raises returns on private deposits and loans, but would also place upward pressure on the yield the Government has to pay on its securities. Thus that would also raise government debt service and the fiscal deficit. This would depress the economy further and defeat the need for liberalization in interest rates.

5.3 LIMITATIONS OF THE STUDY

This study uses nominal interest rates even when theoretical considerations indicate that the real rate is the relevant variable. Using the nominal rate instead of the real rate is equivalent to omitting a variable whose true regression co-efficient is equal in absolute value to the nominal rate but opposite in sign.

Another weakness of the study is the unreliability of data from the Statistical Abstracts and the Economic Survey. No two of these data publications give similar values for say GNP for the same year.

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