THE IMPLICATION OF LOW INFLATION RATE ON INTEREST RATE IN TANZANIA

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Abstract: Since the mid 1980s Tanżania has been party to the macroeconomic reforms which aim at addressing socio-economic problems which have faced the country for some decades now. The key measures, which have been undertaken include liberalizing the financial sector as well as the public sector. Among the macroeconomic achievements is the single digit inflation rate which has been achieved since mid 1990s and so far has been maintained.

The study is important and may have a notable value-added in the existing literature as it attempts to dwell on the implications of low inflation rate on interest rate in Tanzania basing on different maturities of monetary instruments and using an econometric approach. Many previous studies enquired on the link between interest rate and inflation. However, this study attempts to investigate how low inflation rate can affect treasury bills interest rate. The main findings indicate that Tanzania with a low and declining inflation rate, real interest rate becomes relatively high culminating into a disequilibrium in the savings-investment markets which largely underpins the excess liquidity stance in lending institutions. This implies that it is high time that competition was enhanced in financial markets .

Significantly, an attempt can be pursued to avert the disequilibrium if interest rates are made flexible as well as reducing the risk of doing business and in addition increasing the competition in the financial markets in the country. The paper is organized into six sectionss. Section one provides the introduction, followed by literature review in section two. Specification of the model used and regression are done in section three whereas analysis of the low bound comes in sectionr five. Finally, conclusion comes in section six.

INTRODUCTION

Tanzania's financial sector liberalization has been an integral part of the ongoing economic liberalization that started in the mid 1980s. However, the period that can be considered to have fully fledged financial reforms started in 1992, when the new Financial Act came into operation (Mduma, 1999). Since then, several interest rate policies have been put in place and consequently implemented so as to achieve market determined interest rates. Financial institutions have then become free to set their deposit and lending rates subject to the maximum lending rate of 31% set by the BoT, and the 12-month deposit rates being above the prevailing inflation rate. However, in July, 1993 the lending interest rate ceiling of 31% was abolished and in August 1994 the requirement that minimum rate on 12 month fixed deposits was abolished. Before, the rate had to be positive in real terms. Interest rates have thus been fully liberalized since 1994 and competition on the financial sector increased (BoT 1998).

With regard to key interest rates, in August 1993, the Bank of Tanzania (BOT) commenced Treasury bill (TBs) auctions, starting with 91-day treasury bills. Since then TBs act as a tool for financing short-term government spending. They have also been used as an instrument of liquidity management, and more importantly as the reference point for the determination of market based interest rates (Tuni 1997). For example, in January, 1994 the discount (bank) rate was increased from 27% to 50% and thereafter, the rate was to be adjusted bi-weekly, on the basis of marginal yields in the auction of the 91-days treasury bills.

Since the introduction of treasury bills auctions in 1993, the total volume of treasury

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bills subscribed, together with their respective yields fluctuated widely (Mduma 2001). Instability of treasury yields hindered their use as anchorage in the determination of interest rates in the financial markets during the period between 1993 and 1995 (BoT 1998). Now that Tanzania's macroeconomic situation has tended to stabilize, it is important to study the implications of low rates of inflation on interest rates.

Scope of the Study

As articulated earlier, financial liberalization is a long and dynamic process, having begun during the mid 1980s in Tanzania. The study focuses on the period between 1995 to 2001. The study period was chosen based on the fact that it was this period when financial market liberalization was completed culminating into a fully-fledged reformed financial sector.

The rest of this paper is organized as follows. Section two reviews the literature. The model used in the analysis is presented in section three. Sections four and five present the major findings of the study. Section six is the conclusion.

LITERATURE REVIEW

While literature on interest rate determination and the link between interest rates and the rate of inflation is abundant, those attempting to explain how low rates of inflation could affect the behavior of interest rates is limited (Saunders 2001).

Interest rates play important an role as analyzed by Karni (1972) in linking the monetary sector and the real sector of the economy. For example, the classical loanable fund model postulates that the rate of interest is determined by planned savings, which include financial savings, (Mduma, 1999) and planned investment. This is concomitant with the pre-Keynesian quantity of money theory, which asserts that changes in money supply (for e.g. due to tight monetary policy that Tanzania is currently pursuing) does not affect the rate of interest (Harris 1991).

In either case, the conclusions are based on partial equilibrium analyses, which ignore the interrelationship between other variables in the economy. It has been shown that due to the "Pigou Effect," change in the money supply and general price level could result to changes in rates of interest (Hariss 1991) indicating that real money balance also matters in the determination of interest rates (the liquidity preference theory). Thus, in a more general framework, changes in income or wealth, expected returns, risk, liquidity, and other variables influence interest rates .

However, for purposes of analyzing the short run dynamics of interest rates, the models describing the effects of (low) rates of inflation on interest rate are based on a framework developed by Fisher (1930). In this approach the behavior of nominal interest rate is linked to the behavior of real interest and the anticipated rate of change of price level.

THE MODEL

Consider a Tanzanian macroeconomic model with the following defined variables: Y = nominal income level; Π = profit in real terms; r = real rate of interest; i = nominal rate of interest; P= price level, M = nominal money supply, I = investment in nominal terms, S = savings in nominal terms, (t) = total wealth (real), m = M/P; and P^e = the expected rate of change in price level.

Assuming that saving in the economy is a function of total wealth including real money balance (Karni 1972) and that profit is a constant function of income we have the following macroeconomic model for which equation that characterize the real sector are:

$$Л = c.\ Y/P,\ 0 \leq c \leq 1 \quad (1)$$

$$\omega = m^s + Л \quad (2)$$

$$I = I(r), \ldots I^1(r) < 0 \quad (3)$$

$$S/P = s(y, r),\ s_r < 0 \quad (4)$$

Equation (1) reiterates our assumption that profit (and therefore labour income) in the economy is a constant fraction of the income. Equation (2) is simply a definition, showing that real wealth is the sum of real profit and real money balances. Equation (3) and (4) assume that real investment is declining function of real interest rate and real saving is increasing functions of real interest rate, respectively.

We also assume that the structure of the monetary sector of the Tanzania's economy is described by the standard LM equations as follows:

$$M = M(r, y) \quad (5)$$

$$M^s/P = M^d/P \quad (6)$$

$$i = r + P^e \quad (7)$$

In equilibrium, equation (5) and 6) will define the LM curve for this economy. Given the current policy intervention by the Central Bank of Tanzania, we assume that the authority exogenously determines money supply. Equation (7) is the usual Fisher Equation, which states that the nominal rate of inflation is a sum of the real rate of interest and the expected change in the general price level. Assuming further that in the very short run, production remains constant, equation (7) becomes the principle determinant of interest rates in the economy.

Although equation (7) may be considered as suitable for a closed economy, it may be extended to include characteristics of open economy like that of Tanzania. By noting that determinants of real rate of interest (r), include the liquidity conditions in the economy, we may express it as

$$r_t = \beta + \beta_1 EL_t \quad (8)$$

Where β = is the long run equilibrium real rate of interest and β_1 (< 0) is a parameter linking real interest rates with excess money supply (liquidity) in the economy (EL_t), which is partly influenced by the external sector. (Note that EL_t is determined by both foreign and domestic shocks, and therefore could partly be considered as risk premium). From the loanable fund theory of interest rate determination, the long run equilibrium real rate of interest (β) reflects the marginal productivity of capital (MPK), which tends to remain fairly stable in the short run (Saunders, 2001).

From equation (7), both real rate of interest and expected rate of inflation can be negative. However, nominal rate of interest is banded at (or close to zero) as long as there are currency and risk-free deposits available to hold as liquid assets (Black 1995).

Let i* = shadow nominal interest rate (which can be negative), fully reflecting underlying movement of expected rate of inflation and the observed nominal rate (which is bounded at or close to zero). Then the observed nominal interest rate could be expressed as follows:

$$i_t = \max(?t, i^*_t) \quad (9)$$

and it follows that,

$$i_t = \max(?t, r_t + P^e_t) \quad (10)$$

where $?t$ is the lower bound of nominal rate. Since real rate of interest is forced to be positive by the lower bound of the nominal rate, then the savings-investment market will be characterized by disequilibrium.

To establish lower bound, we postulate, when arranged in ascending order, the series of nominal interest rates will have the following curvature:

$$i = ? * \exp(\varphi * \chi) \quad (11)$$

Where, ? are constant (bother greater than zero), and χ is the rank of realized nominal interest rate. Invoking natural logarithm, the estimated equation is

$$\log_e i = \log_e ? + \varphi^*\chi + \varepsilon \ldots\ldots\ (12)$$

Where ε error term (assumed to be well behaved). The antilogarithm of the estimated ? will therefore constitute the lower bond of the nominal rate of interest.

Our analysis uses weekly and monthly data on Treasury Bill (TBs) Yields in Tanzania for the period between January 1995 and May 2001. Monthly data on inflation as well as series of 91 day, 182 day and 364 days TB yields were obtained from the Bank of Tanzania. The time series characteristics of data are explored using unit root tests. We then use Johansen Cointegration Technique to assess the relationship between TB yields and the rate of inflation in the Fisherman context. We first subdivided sample period into two sub-samples. The first period is January 1995 to June 1997, which was characterized by volatile TB yields, high rate of inflation and general macroeconomic instability (see Mduma 2001). The second period is from July 1997 to May 2001, the period that has witnessed relatively stable macroeconomic conditions, (e.g. lower rate of inflation). Later, we analyze the entire sample period.

FINDINGS

The unit root tests, using both Augmented Dickey Fuller ADF test and the Sagan Baghava Durbin Watson (SBDW) tests indicate that none of the series is stationary at levels . However the first difference of each series turned to stationary (Table 1).

Table 1 indicates that that the variables are integrated of order one (that is $y \sim I(0)$; where y could be inflation rates, 91 day TB yields, 182 day TB yields, and 364 day TB yields), using the ADF criteria. The number of lag structure used is five in the July 97 - May 2001 sample and the full sample. This lag structure was chosen on the basis of Akaike Information Criteria (IC). However, for a small sample, January 1995 to June 1997, the test used only three numbers of lags in the ADF. Again, this was selected on the basis of IC criterion.

Since all our variables of interest are integrated of order one, {i.e. I(1)}, the next step is to assess whether there is cointegration between interest rate (yields) and the expected rate of inflation (as implied by Fisher's Equation). This is because spurious and inconsistent regression problems are easily avoided when cointegration is applied.

The analysis done on the full sample revealed that all three kinds of TB yields are cointegrated with expected rate of inflation (this confirms the Fisher's Equation). All test statistics are significant at conventional levels. The results also show that the strength of the cointegration relationship increases with maturity (Table 2). This could be explained by the time available to correct for the deviations from the equilibrium (the long run cointegrating relationship).

The longer the maturity, the more time available for adjustment. It can also be explained by the risk averse behavior of investors who tend to avoid the costs of mistakes in committing resources to relatively long period. It can therefore be deduced that the investors who decide to invest in relatively long maturity security are more concerned with the movement in the rate of inflation. Moreover it shows that the risk component of real rate interest rates also tend to become relatively stable as the planning horizon increases.

Table 3 presents the long-run cointegrating vectors associated with each row of cointegration statistics in Table 2. In each vector, normalization is on the interest rate yields.It reveals that the component real rate of interest in the nominal rate increases with maturity. This is true loanable fund theory that the underlying marginal

Table 1: *Unit Root Test*

	Jan 95 - June 97		July 97 - May 2001		Full Sample	
	ADF	SB	ADF	SB	ADF	SB
91 day TB						
• Level	-0.762	0.0549	-1.843	0.251	-2.356	0.0593
• Difference	-2.38*	0.975	-3.836**	-2.128*	4.639**	1.487
182 day TB						
• Level	-1.191	0.0802	-1.531	0.247	-2.004	0.0671
• Difference	-3.927**	1.905	-3.976**	1.654	-5.145**	1.475
364 day TB						
• Level	-0985	0.594	-0.7556	0.1596	-2.495	1.182
• Difference	-3.122*	0.7364	-3.81**	1.403	-4.706**	0.9911
Inflation						
• Level	-2.212	1.794	2.112	1.094	-2.259	1.182
• Difference	-4.293**	2.776*	-6.436**	2.98*	-7.942**	2.713*

Table 2: *Test Statistics for Cointegration Between Inflation Rates and TB Yields*

	Trace Statistics	Eigen Statistics
91 day TB	19.26*	23.13*
182 day TB	35.85**	40.13**
364 day TB	37.07**	40.41**

Table 3: *Cointegrating Vector Between the Expected rate of Inflation and TB yields*

	Constant (the real rate of interest)	Expected rate of inflation
91 day TB	7.04	0.21
182 day TB	7.44	0.14
364 day TB	8.52	0.25

Table 4: *Cointegration Results for July 97 - May 2001 Series*

	Coefficient's		Statistics	
	Constant (real rate of interest)	Expected rate of Inflation	Trace	Eigen
91 day TB	-12.92	3.051	19.88**	21.26*
182 day TB	-9.904	2.795	20.23**	22.02*
364 day TB	-5.24	2.392	21.55**	23.62*

Table 5: *Estimated Lower Bound of TB Yields in Tanzania*

	Lower Limit 95%	Expected (Actual parameter) value	Upper Limit 95%
91 day TB	3.86	4.02	4.19
182 day TB	4.40	4.59	4.78
364 day TB	5.74	5.99	6.25

productivity of investment and risk premium increase with maturity. The results show that by increasing maturity from three months to six months the risk premium increases by about 1.4%. The increase is relatively high (Saunders 2001), probably reflecting low predictability of investment in Tanzania. Unexpectedly however, there is no significant risk between six-month and one-year maturity.

The coefficients in the third column show that changes in expected rate of inflation impact relatively heavily on the lower maturity . The impact on the 182-day TBs and 364-day TBs increases with maturity.

For the sub sample, January 1995 to June 1997, there seemed to have no clear pattern of associating between the expected rate of inflation and the TB yields. The results show that there was no cointegrating vector between 364-day TB yields and the expected rate of inflation in this period. However there was weak cointegration relationships between the expected rate of inflation on one had and 91 day and 182 day TB yields. Moreover, this relationship was not robust to change in the lag structure. For the sub sample, July 1997 to May 2001, there was some cointegration relationship between TB yields and expected rate of inflation (Table 4).

When compared to first sub-sample, Table 4 shows that after a rapid reduction in the rate of inflation (thus, expected rate of inflation), equilibrium real rate of interest is faced to be negative (called shadow real rate, see Saunders 2201). The results show also that with relatively stable macroeconomic conditions, the yields closely follow the expectation of the rate of inflation.

Although our analysis shows that the shadow real rate of interest is forced to be negative by fall in expected rate of inflation, the nominal rate of interest has never been negative. This is because they are bounded at (or close to) zero. The next section analyses the low bond of interest rates in Tanzania.

THE ANALYSIS OF THE LOW BOUND

The graphs presented in the Annex indicate that when arranged in the order of magnitudes, the three series of TB yields follow some cubic or exponential function. However for simplicity, we have worked with exponential functions. The results of analysis of lower bound of TB yields in Tanzania are presented in Table 5 and show that all the interest rates in Tanzania are bounded below at relatively high rates when compared to other countries (Saunders, 2000). Our simulation results show that the lower bound for the 91-day TB yields is slightly above 3.75% per annum (at 95% confidence interval). Indicatively, this implies that given the obtaining (macro)economic conditions, the chance that three-month interest rates are below 3.86% per annum is five out of a hundred.

Such a high rate of lower bound of interest rate in the economy has serious implication on the risk-taking behavior of economic agents in the financial markets. With falling of expected rate of inflation (under the current tight monetary policy in Tanzania), real rate of interest is forced to remain relatively high causing disequilibrium in the savings-investment markets. This finding could explain why many financial (lending) institutions in Tanzania are characterized by excess liquidity (Mduma1999). Another implication of this finding is that high (forced) real rate of interest not only disequilibrate the Savings-investment markets but also the composition of investment in the country. Since the dominant part of the real rate of interest reflects the risk premium, projects most sensitive to the "real" component of return are most likely to be affected (Back 1995). On average the relative risk of project selected in the economy increases. In turn, this phenomenon causes lending institution to charge high lending rates (anticipating that the projects presented for financing are risky). This explains party why there is wide interest rate spread in Tanzania financial markets.

CONCLUSION

The motive behind low rate of inflation in Tanzania is always good , but has thrown other key markets into disequilibrium. However, the complained excess liquidity in Tanzania banks is an indication that much is needed to restore equilibrium, and develop an enabling environment for monetary policy to work. This can be achieved if interest rate are made flexible (both downward and upward) as well as reducing risk of doing business etc. This will partly require increased competitions in the financial markets so to avoid problems caused by few players in the Tanzanian financial markets.

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END NOTES

1 The Financial Institutions and Banking Act 1991 has since then remained the basis of the existing legal and regulatory framework in the financial sector in Tanzania.

2 For instance, BoT's responsibility of setting interest rates was lifted on July 1,1992 except only for the maximum lending rate

3 The introduction of Treasury bill auctions was a major step towards the development of market based interest rate in addition to the promotion of competitive financial system in general. The aim was to assign interest rates more roles in determining the prices and the allocation of resources and in the conduct of indirect monetary control (Mduma 1999).

4 For example, Table 2.2 shows that treasury bill rates decreased from 15.5% per annum in 1991 to 13.5% per annum in 1992 before it increased to 75.5% per annum in 1993. However, it has declined to 15% per annum in 1997. Due to its link with Treasury bill yields, discount rate also increased from 22% per annum in 1991 to an alarming rate of 67.5% in 1994. Similarly, like Treasury bill rates it has declined to 15% in 1997 (Mduma 1999).

5 Pigou's effect or real balance effect is a mechanism by which an increase in real money supply resulting from a fall in the price level can influence aggregate demand through increasing autonomous expenditure, all else being equal. The Pigou's effect is a counter argument to the Keynesian observation that if autonomous planned spending was very unresponsiveness to changes in interest rate, monetary impotence resulted.

6 A more general approach to the effects of inflation rates on interest rate (which this paper adopt) was presented by Karni (1972)

7 Equation (15 follows from the following derivation, $1 + i = (1 + r)(1+P^{e}) = 1+e+P^{e}r+P^{e}$. Assuming r and P^{e} are small, then $P^{e}*r \longrightarrow 0$ so that, $i=r+p^{e}$.

8 Note also that ADF test has not always being consistent with the SBDW test, expected in the case of the rate of inflation. Another exception occurs also in the base of June 1997 to May 2001 sub sample where the stationary of the first deference in confirmed by both the ADF and the SW tests.

9 Further analysis revealed that they are all random walk with drafts.

10 It was established that there were no significant loss of information of the number was restricted five-lag structure.

11 Cointegration analysis was also based on the three kinds of samples.

12 Although, as we saw earlier, this relationship is relatively weak compared to two other set of series.

13 This could be attributable to high volatility of TB yield in this period, and the general macroeconomic instability that characterized this era.

14 These graphs show the best-fit cubic functions. R is also reported.

15 However, the behavior of the financial markets during the transitional period calls for additional measures so as to yield optional results.