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**WELFARE EFFECT OF PRICE TARGETING ON FIXED INCOME
EARNERS (A FRAMEWOK FOR ANALYSIS)**

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ABSTRACT

The paper examines the welfare implications of price targeting from the perspective of when central bank has credibility of persistently achieving the target rates and when people have lost confidence on such credibility. In the former, it was observed that the principle of Pareto optimality holds while there will be welfare loss and social bliss denied in case of the later. The paper thus recommends a cautious monetary policy from the monetary targetters that will not affect the goal of ensuring maximum welfare and social justice in the society.

1. **INTRODUCTION**

Over the years, the management of the Central Bank of Nigeria (CBN) has developed a view of how the Nigerian economy works, as well as processes that help in using this view effectively in the conduct of monetary policy. This policy objective is couched in terms of maintaining price stability and promoting non-inflationary growth which could boil down into promotion and ensuring citizens' welfare. The primary means adopted to achieve this objective is to set aggregate money supply targets and to rely on the open market operations (OMO) and other policy instruments to achieve the targets.

Monetary policy in Nigeria has relied more on indirect transmission mechanisms. Overtime, the practice is to target the monetary base (Nnanna, 2001). However, the practice of targeting base money is based on the assumption that there is stable money demand function in the economy. The reliance on indirect transmission processes anchored on instruments which exact impact are not known makes monetary policy making in Nigeria a very challenging responsibility. A resultant of this has been large observed discrepancies between policy targets and outcomes overtime (as shown in table 1)

**MOVEMENTS IN DOMESTIC PRICES AND MONEY SUPPLY (M₂) IN
NIGERIA(2003-2013)**

Year	Inflation rate		Money	Supply (M₂)
	Actual (%)	Target (%)	Actual (%)	Target (%)
2003	72.8	9.0	19.4	10.1
2004	29.3	9.0	16.8	16.8
2005	8.5	9.0	16.9	15.0
2006	10.0	9.0	29.3	15.8
2007	8.6	9.0	31.0	10.0
2008	6.9	9.0	48.10	14.6
2009	18.9	7.0		12.2
2010	12.2	9.3	27.03	12.2
2011	23.8	9.0	21.6	15.2
2012	10.0	10.0	14.0	15.0
2013	11.6	10.0	16.03	15.0

Source: Central Bank Statistical bulletin (Various issues).

Sometimes, it is difficult to relate targets to outcomes in much meaningful ways, especially how these discrepancies affect welfare and marginal utility of income of consumers. Though, the Central Bank usually blames this deficiency on fiscal dominance. This paper intends to investigate the resulting effect of forward price targets error of monetary authority on the social welfare of people, especially the fixed income earners. These categories of people were chosen because they were considered as the largest consumer of domestic product in the country.

So far, the studies on Nigeria, inflation have been able to tell us that expectation in the price level have been tested under adaptive expectation where as the assumptions for rational expectation of prices are considered to be too strong for prices (see Terlumun, 2006). Thus, it is imperative to examine the ability of monetary policy at reducing forward-looking expectations to tolerable levels that are consistent with desired level of prices. Also, looking at the situation, where public confidence on the monetary targetters is guaranteed, such that, their current and plan consumption are based on the previous level of targeted price (which may be accurate or not accurate).

In order to contribute to this subject matter, this paper tries to incorporate the distortions in the price level occasioned by uncertainty and forward price prediction error by the monetary authority on the welfare of

country's citizen, especially the fixed income earners. In order to obtain a unique solution we adopt the Bergson-samuelson welfare functions. This is used for its ability in determining consumers consumption efficiency level (Pareto optimality) and the social justice (social bliss) level.

Apart from this introductory section, the rest of the paper is organized as follows; section 2 deals with welfare function of reasonable price targets. In section 3 we look at the welfare function with relatively large error of prediction. Section 4 reviews the policy implications of the welfare functions while in section 5 we conclude.

2. **WELFARE FUNCTION**

The determination of socially optimal allocations of resources requires explicit comparisons of the utility levels of the various members of society. It is necessary to know whether a change from which some individuals gain and some lose is desirable. A common procedure is to express social welfare as a function of the utility levels of all members.

We assume that there exists a social welfare function of the general form; $W = w (U_A, U_B, \dots, U_Z)$ -----2 1

Where U_A is the level of the utility index of the individual A, U_B for B etc. but, for our purpose, let assume two individuals (A and B) whose utility functions are

$$U_A = U_A (X_1, X_2, \dots, X_n) \dots\dots\dots 2.2$$

$$U_B = U_B (X_1, X_2, \dots, X_n) \dots\dots\dots 2.3$$

Where X_i is the amount of commodity consume by individual (A and B).

To be specific, assume that the social welfare function is;

$$W = w (U_A, U_B) \dots\dots\dots 2.4$$

The goal of society is to maximize 2.4 subject to the following constraints

TASTES OF INDIVIDUALS

$$U_A = U_A (X_A, Y_A) \dots\dots\dots 2.5$$

$$U_B = U_B (X_B, Y_B) \dots\dots\dots 2.6$$

EXPENDITURES

$$X = P_x X_A + P_x X_B = X (M_A^X, M_B^X) \dots\dots\dots 2.7$$

$$Y = P_y Y_A + P_y Y_B = Y (M_A^Y, M_B^Y) \dots\dots\dots 2.8$$

RESOURCES/INCOME

$$M_A = M_A^X + M_A^Y \dots\dots\dots 2.9$$

$$M_B = M_B^X + M_B^Y \dots\dots\dots 2.10$$

Where X = consumer good

Y = producer good

X_n, Y_A are commodities X and Y consumes by A

X_B, Y_B are commodities X and Y consumes by B

P_x, P_y are price of commodity X and Y respectively.

M_A^X, M_A^Y are income of individual A spent on commodity X and Y respectively.

M_A, M_B denotes fixed status of income of individual A and B.

If individuals have confidence on the prediction of monetary targetters due to their previous experience, then, current consumption will depend on the anticipated level of price (given that the previous prediction was reasonable).

Setting Lagrangian multiplier to our equations 2.1 to 2.10

$$L = W \left[U_A(X_A, Y_A), U_B(Y_B, Y_B) \right] - \lambda_1 [X(M_A^X, M_B^X) - (P_X X_A + P_X X_B)] - \lambda_2 [Y(M_A^Y, M_B^Y) - (P_Y Y_A + P_Y Y_B)] - \lambda_3 [M_A^X + M_A^Y - M_A] - \lambda_4 [M_B^X + M_B^Y - M_B] \quad \text{---2.11}$$

Take the partial derivatives with respect to all endogenous variables

$$L_{X_A} = W_{U^A} U_{X^A} + \lambda_1 P_X = 0 \quad \text{---2.12}$$

$$L_{X_B} = W_{U^B} U_{X^B} + \lambda_1 = 0 \quad \text{---2.13}$$

$$L_{Y_A} = W_{U^A} U_{Y^A} + \lambda_2 P_Y = 0 \quad \text{---2.14}$$

$$L_{Y_B} = W_{U^B} U_{Y^B} + \lambda_2 P_Y = 0 \quad \text{---2.15}$$

To obtain efficient consumption, that is, the Pareto optimally condition from 2.12 and 2.14.

$$W_{U^A} U_{X^A} = \lambda_1 / \lambda_2 (P_X / P_Y)$$

$$W_{U^A} U_{Y^A}$$

For a constant and persistent prediction of p_x and p_y , the ratio $P_x/P_y = 1$. Thus, $MRS_{X^A, Y} = \lambda_1/\lambda_2$.

$MRS_{X^A, Y} = MRS_{X^B, Y}$ (Pareto efficiency) see Fig 1 for the edgeworth box that shows the contract curve.

To obtain other mix efficiency

$$LMA^X = -\lambda_1 X_{MA} - \tau_3 = 0 \quad \text{----- 2.16}$$

$$LM^YA = -\lambda_2 Y_{MA} - \tau_3 = 0 \quad \text{-----2.17}$$

$$LMB^X = -\lambda_1 X_{MB} - \tau_4 = 0 \quad \text{----- 2.18}$$

$$LMBY = -\lambda_2 Y_{MB} - \tau_4 = 0 \quad \text{----- 2.19}$$

From 2.16 and 2.17

$$\tau_1/\lambda_2 = Y_{MA}/X_{MA}$$

From 2.18 and 2.19

$$\lambda_1/\lambda_2 = Y_{MB}/X_{MB}$$

$Y_{MA}/X_{MA} = Y_{MB}/X_{MB}$ rearrange

$$X_{MB}/X_{MA} = Y_{MB}/Y_{MA} \quad \text{----- 2.20}$$

The implication of 2.20 is that, under the condition of reasonable price target we assume for monetary targetters, the marginal rate of spending on the two commodities by the two individuals are equal, tantamount to efficient product mix.

As well, from equations 2.12 and 2.14 with assumption of $P_x/P_y = 1$

$$\lambda_1/\lambda_2 = U_X^A/U_Y^A$$

From 2.16 and 2.17

$$\lambda_1/\lambda_2 = Y_{MA}/X_{MA}$$

Therefore,

$$U_X^A/U_Y^A = Y_{MA}/X_{MA} \text{ ----- 2.21}$$

Under this condition, (2.21) the ratio of marginal utility equals the ratio of marginal spending of individual A. The same is applicable to individual B.

From equations 2.12 and 2.13 with equations 2.14 and 2.15, the objective of social justice is achieved. that is,

$$W_U^A U_X^A = W_U^B U_X^B \text{ and}$$

$$W_U^A U_Y^A = W_U^B U_Y^B$$

The resultant effect of unreasonable predictions by the monetary targetters on the welfare of citizens is examined in the next section using the same approach.

Fig 2.1 Optimum consumptions of Individuals

In the figure above, we show the points of optimum consumptions of individuals that maximize their welfare. Any point in the consumption surface circumscribed within the box diagram and not lying along OAOB general contract curve is not point of Pareto optimality. Thus L and T are not optimum welfare points. A movement from these points toward point H or I on the locus of the contract curve is clearly desirable because while one group of individual (A or B) is made better off, nothing adverse happens to the other and consequently the total welfare increased.

3. EFFECTS OF UNCERTAINTY (FORWARD PRICE TARGET ERROR) ON WELFARE

Though, the traditional theory of consumer behaviour does not include an analysis of uncertain situation. However, von neumaun and morgestern have shown that under some circumstances, it is possible to construct a set of numbers for a particular consumer that can be used to predict her choices in uncertain situation.

In this section, we examine a situation where price targets of monetary authority fail frequently as we observed in table 1. Such that consumption of individuals is based on the target price plus the error (such as $P_x + e$). To obtain a unique result, we assume for our purpose price of another good (say y) to remain constant (i.e equal to the target) and the two goods independent of one another

Like we have in section 2, the welfare function of the two individuals shall be; $\text{Max } W = W (U^A, U^B)$ ----- 3.1

The goal of this welfare maximization shall be subject to the following constraints.

TASTES

$$U_A = U_A (X_A, Y_A) \text{ ----- } 3.2$$

$$U_B = U_B (X_B, Y_B) \text{ ----- } 3.3$$

And

EXPENDITURES

$$X = (P_x + e) X_A + (P_x + e) X_B = x (M_A^X, M_B^X) \text{ ----- } 3.4$$

$$Y = P_Y Y_A + P_Y Y_B = y (M_A^Y, M_B^Y) \text{ ----- } 3.5$$

With,

RESOURCES

$$M_A = M_A^X + M_A^Y \text{ ----- } 3.6$$

$$M_B = M_B^X + M_B^Y \text{ ----- } 3.7$$

Setting a multiplier function

$$\begin{aligned} L = & W [U_A (X_A, Y_A), U_B (X_B, Y_B)] - \lambda_1 [X (M_A^X, M_B^X) - [(P_x+e) X_A + \\ & (P_x + e) X_B] - \lambda_2 [Y (M_A^Y, M_B^Y) - (P_Y Y_A + P_Y Y_B)] - \lambda_3 \\ & (M_A^X + M_A^Y - M_A) - \lambda_4 (M_B^X + M_B^Y - M_B) \text{ ----- } 3.8 \end{aligned}$$

The definitions of variables are as defined in section 2, except $P_x + e$ which is the target price of good x plus the error accruing from

monetary authority mis-specification (we assume here for our case $1 < e \leq \infty$).

Now taking partial derivatives and set them equal zero.

$$LX_A = W_U^A U_X^A + \lambda_1 (P_x + e) = 0 \text{ ----- 3.9}$$

$$LX_B = W_U^B U_X^B + \lambda_1 (P_x + e) = 0 \text{ ----- 3.10}$$

$$LY_A = W_U^A U_Y^A + \lambda_2 P_y = 0 \text{ ----- 3.11}$$

$$LY_B = W_U^B U_Y^B + \lambda_2 P_y = 0 \text{ ----- 3.12}$$

Optimal consumption

From 3.9 and 3.11

$$W_U^A U_X^A / W_U^A U_Y^A = \tau_1 / \tau_2 (P_x + e / p_y)$$

From 3.10 and 3.12

$$W_U^B U_X^B / W_U^B U_Y^B = \lambda_1 / \lambda_2 (P_x + e / p_y)$$

The ratio e/p_y prevent the marginal rate of substitution (x,y) for the two individual not to be equal, thus inefficient consumptions due to prediction error. The problem is aggravated especially when the error (e) is large.

As well;

$$LM_A^X = -\lambda_1 (X_{MA} + e) - \lambda_3 = 0 \text{ ----- 3.13}$$

$$LM_A^X = -\lambda_2 Y_{MA} - \lambda_3 = 0 \text{ ----- 3.14}$$

$$LM_B^X = -\lambda_1 (X_{MB} + e) - \lambda_4 = 0 \text{ ----- 3.15}$$

$$LM_B^Y = -\lambda_2 Y_{MB} - \lambda_4 = 0 \text{ ----- 3.16}$$

From 13 and 14

$$\lambda_1/\lambda_2 = Y_{MA}/(X_{MA} + e) \text{ and from 3.15 and 3.16}$$

$$\lambda_1/\lambda_2 = Y_{MA}/X_{MB} + e$$

$$Y_{MA}/X_{m+e} = Y_{MB}/X_{MB} + e$$

$$\therefore X_{MB} + e/X_{MA+e} = Y_{MB}/Y_{MA} \text{ ----- 3.17}$$

The implication of 3.17 above is that the ratios of marginal spending on the two commodities are not equal and thus not efficient because of the forecast error.

In terms of ratio of marginal utility for individual A;

$$U_X^A/U_Y^A \{P_Y/P_{X+e}\} = Y_{MA}/X_{MA+e} \text{ (from 3.13 and 3.14)}$$

Thus for the error (e) the ratio of marginal utility of consumption is not equal to marginal utility of income (Y_{MA}/X_{MA}). The same holds for individual B. now depend on whether $U_X^B/U_Y^B > Y_{MB}/X_{MB+e}$. (Welfare gain) otherwise there will be welfare loss.

As a result of the error in prediction the goal of social justice may not be achieved because this condition requires;

$$WUA UAX = W_U^B U_X^B \text{ and}$$

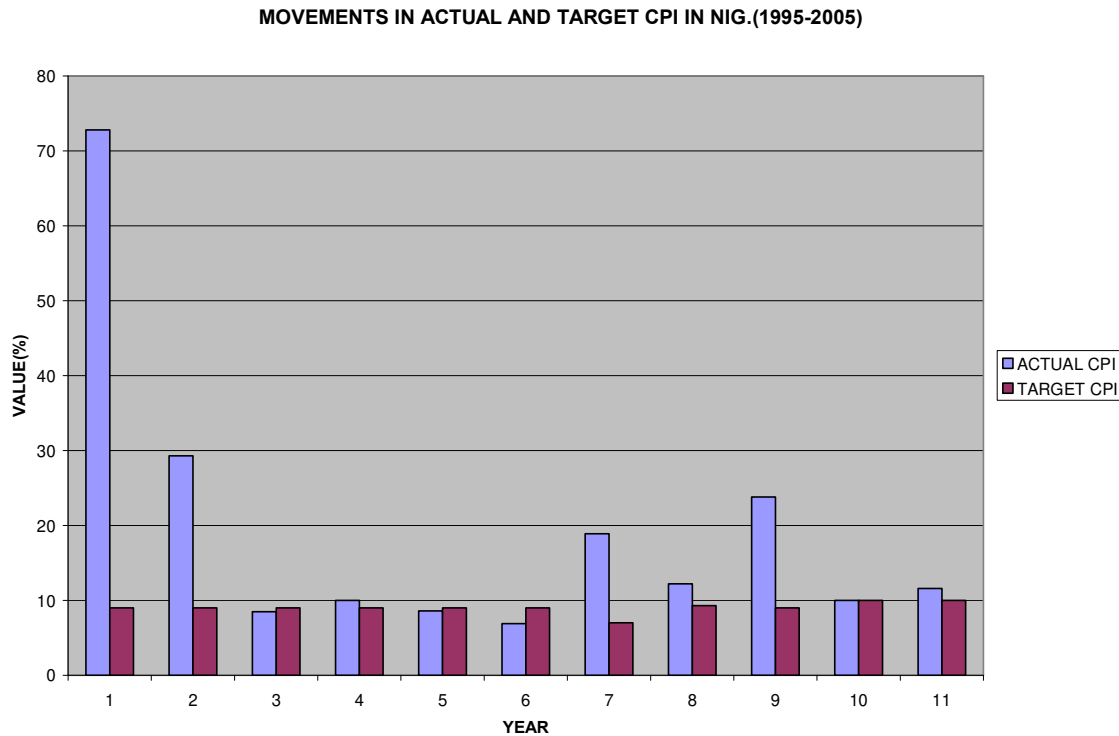
$WUA UAY = W_U^B U_Y^B$. The condition which may suffer with frequent prediction error by the monetary authority.

In the next section, we shall write explicitly on the policy implications of all the mathematical expressions of both section 2 and 3.

4. POLICY IMPLICATIONS

Price stability in Nigeria refers to the achievement of a single-digit inflation rate on an annual basis. Indeed, this objective has not been achieved to a sustained basis. For instance, as shown in the figure below (Fig 4.1), the target of single digit were achieved in only three (3) times (2005, 2007 and 2008), while the rest of the years under the period of analysis experienced two (2) digits. In most cases, there have been discrepancies between the target rates and the actual rates, the highest discrepancy was experienced in 2003 (72.8; actual and 9.0; target) and the lowest in the year 2006 with just one percent deviation above the

targetlevel.



Going by the policy framework established earlier (the effect of consistent prediction error of target price on the welfare of individual in the society, especially the fixed income earners), we want to establish that Central Bank can face different types of uncertainty that may affect monetary policy decisions, such as; uncertainty about current and future data, the most appropriate model and preferences etc but instead of formulating a monetary target that will be characterized with errors, leading to the populace losing confidence on the monetary authority, because their welfare is indirectly affected, Brainard (1967) has explored how a monetary authority should respond to uncertainty showing that, if

uncertainty is additive, a monetary authority with a quadratic objective function should display certainty equivalence. A more cautious policy is regarded optimal. However, when probability distributions over possible events are unknown, the author advocated that robust control methods lead policymakers to minimize the loss that arises. The signal extraction problem that accompanies imperfect knowledge of key input or target variables causes both Central Bank and private sector to learn gradually about the realization of shocks. This form of bounded rationality provides a plausible framework for modeling the behaviour of Central Bank and private agents. However when private sector expectations are determined by adaptive behaviour, like the one assumed in our welfare functions, optimal monetary policy response more persistently to cost-push shocks. The higher the private sector's initially perceived inflation persistence, the stronger and more persistent is the optimal policy responses (See Gaspar, Smets and Vestin, 2006).

To cap it all, the interaction between private sector uncertainty about the Central Bank's inflation target level (that is the Central Bank's lack of credibility) and the Central Bank's uncertainty regarding the private sector's uncertainty about the inflation target can have serious implications for monetary policy, leading to policy errors and raising inflation

persistence, thus welfare loss on the citizens (see also, Aoki and Kimura, 2005).

5. **CONCLUSION**

The paper has examined welfare implications of inflation targeting from two perspective; one, the implication on welfare when the Central Bank has credibility of persistently achieving the target rate; two, when the monetary authority has loose individual confidence of setting what is considered a reasonable targets. In the former situation, using a welfare function that controls for individual tastes; expenditure and resources income. It was derived that efficient consumption level and social justice are still maintained while in later condition (Central Bank lacking confidence) pareto optimality failed to ensued, the ratio of marginal utility of consumption not equal to the ratio of marginal spending (welfare loss) and there is no social bliss. The implication of which means that, monetary targetters should be cautions in all its policy as not to tamper with the goal of ensuring maximum welfare for the citizens in the society.

REFERENCES

- Aoki, K. and T. Kimura (2005), "Learning about belief about inflation target and stabilization policy: London School of Economics.
- Brainard W. (1967). "Uncertainty and the effectiveness of policy". American Economic Review 57 (2) 411-25.
- Gasper, V.F. Smets and D. Vestin (2006) "Adaptive Learning, Persistence and optimal monetary policy", Working paper 644. Frankfurt: European Central Bank.
- Mishkin F.S and K.S. Hebbel (2006), "Monetary Policy Under inflation targeting: An introduction" Working papers NO 396 Central Bank of Chile.
- Von Neumann J and O Morgenstern (1947) "Theory of Games and Economic Behaviours (2nd Ed. Princeton N.J. Princeton University Press In Henderson J.M and R.E. *** and (2006) "Microeconomic theory- Mathematical approach (3rd ed pg. 56).
- Taiwo I.O. (2003) "Welfarism" A lecture note on advanced microeconomic analysis for Msc Student at Department of Economic University of Ilorin.
- Nnanna J. (2001). "Monetary Policy Framework in Africa. The Nigerian Experience" Working Paper, Central Bank of Nigeria

Terlumun A.E. (2006) "Price Volatility, Expectations and Monetary Policy in Nigeria" Working Paper, Central Bank of Nigeria, C22, C32, D84, E31, E40, E5, E60.

Henderson J.M. and R.E. Quandt (1980) Microeconomic theory. A mathematical approach. Third edition. International Student Edition Tata McGraw Hill Pub. 15 Ltd.

Varian H. (1972) Microeconomic Analysis 3rd Edition, W. Norton and company. New York. London.

