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Non-traded Sector Inflation and Growth Potential: A Threshold Inflation Theory

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Abstract

A structural theory of inflation and growth potential is developed based on a two-sector model of the economy, the traded goods sector and the non-traded. Since the traded goods sector is directly exposed to international competition unlike the non-traded, the latter is more prone to inflation. As the non-traded products have inelastic demand, their consumption propensity rises with the sector's price level with the consequence that consumption propensity for traded products falls with inflation. As derived from the model, the threshold inflation rate is the upper bound for non-negative impact of non-traded goods sector on the growth of the traded goods sector, indicating the inflation tolerance level of the traded-goods sector of the economy. The model shows that the threshold inflation varies with the level of output, consumption propensity, investment expenditure ratio, and inflation rate in the non-traded sector. A ***growth potential indicator*** based on the inflation threshold rate is constructed for predicting an economy's growth potential or prospects.

As applied to Nigeria, the model confirms the expected negative impact of non-traded sector inflation rate on the output of traded goods. The empirical result shows wide yearly variation in the threshold inflation rates; but generally a 1% inflation rate above the threshold causes 0.32% fall in the output of the traded-sector and 0.27% fall in GDP.

Keywords: inflation rate, macroeconomic model, economic growth, development policy

JEL: C02, C13, C32, E31, 011.

1. Introduction

The relationship between inflation and economic growth has engaged the attention of many economists in recent times from the theoretical, empirical, and policy angles. The Phillips curve probably was the first empirical study of the relationship, though indirectly (Philips, 1958). The Phillips curve through a lengthy period of empirical study of the UK economy established a negative relationship between inflation rate and unemployment, implying that inflation rate is correlated positively with growing employment and hence with output expansion. Phillips' position has however been extensively challenged as not valid in the long run. The new classical version (Lucas, 1976; Friedman, 1977; and Phelps 1977, 1994) of the Phillips curve states that inflation rate is constant in the long run, and hence is independent of long run (potential) output and natural rate of unemployment, or non-accelerating inflation rate of unemployment (NAIRU) comprising only of frictional and structural unemployment; and that any negative relationship observed between inflation rate and unemployment is valid in the short run only.

In some new Keynesian dynamic stochastic general equilibrium models, inflation rate (and hence the general price level) has positive relationship with aggregate demand, thus upholding Philips curve, as in the model of Blanchard and Gali (2007). This position is actually consistent with neo-Keynesian macroeconomic theory of income determination in the short run (Lipsey and Ragan, 2001: 559-564).

Neo-classical theory, however, puts forward a contrary view, employing the same macroeconomic framework, but differing in assumptions about the adjustment process. During recession, it is the SRAS curve that shifts downwards to push intersection with AD curve towards the potential output, without any need for expansionary fiscal policy to shift AD curve upward. The neo-classical position may not be valid where expansionary fiscal policy is usually resorted to due to prolonged recession.

Recent empirical studies have however been throwing clearer light on the relationship between inflation and growth, indicating that we cannot conclude that the relationship is positive or negative monotonically in the short

or long run. The studies generally seem to conclude that inflation rate beyond a certain threshold has a negative relationship with economic growth in the long run. The earliest of such studies are probably those of Kormendi and Meguire (1985). Thereafter, extensive econometric studies on the relationship between inflation and economic growth were carried out by several authors in a pooled regression covering well over 100 countries for three or more decades, all coming to similar conclusion about the negative relationship between rapid inflation and economic growth. Ghosh and Phillips (1998) analysed 3,603 annual observations covering 145 countries for the period 1960 to 1996, and came to the conclusion that inflation rate around 2-3% has positive relationship, while inflation rates above that threshold has negative convex relationship with economic growth, even when the time series and cross section dimensions of the data are separated. Khan and Senhadji (2001) analysing data for 140 countries brought in the inflation "threshold" effects, which vary for industrial countries and less-developed countries. Beyond the threshold level, inflation rate bears very significant negative relationship with economic growth. For industrial countries, the threshold is 1% to 3% while it is 11% to 12% for less-developed countries. Dewan and Hussein (2001) analysing 41 middle-income countries also confirmed the negative relationship between inflation and economic growth in the short and long-run. Other notable empirical studies confirming the negative relationship between inflation and economic growth are Fischer (1993), De Gregorio (1993), Barro (1996) and Sarel (1996).

Most recently, Banerji (2005) has generally observed the phenomenon of high inflation rate with high unemployment or stagflation; while the study of Arato (2008) though confirming the significant negative relationship for high inflation rates, could not be definite about the low inflation rate, stating that "marginal growth effect is weakly negative or even positive at low inflation rates and convex at high inflation rates".

However the study of Brazil's data for 1980-98 by Faria and Carneiro (2001) concluded that the relationship between inflation and economic growth was negative only in the short run. This may not be disputed as Gokal and Hanif (2004) on the extensive literature reviews and econometric study of the Fiji data concluded that the result of the study for a country "obviously depends on the nature and structure of the economy, and will thus vary from country to country."

One is thus persuaded to believe that the relationship between inflation and growth will be negative after a certain inflation rate threshold, owing to some structural factors. This study intends to contribute not only to the on-going debate on the relationship between inflation and growth, it will also attempt to identify some structural factors of causality in the relationship between inflation and growth, especially as most studies have been looking into the nature and extent of correlation rather than causality. We also hope to show in line with the observations of Gokal and Hanif (2004) that the relationship between inflation and growth in respect of the inflation rate threshold depends on the nature and structure of the particular economy.

Towards these objectives, the economy is divided into two major aggregate sectors that are perhaps more functionally distinct that any other dichotomy. The division is in respect of the non-traded products sector and that of the traded. Tinbergen (1965, 1966) has referred to this dichotomy as the 'national' and 'international' sectors. The distinction is critical because demand and supply characteristics and price determinations differ considerably, and these may have substantial implications for the prospects of the economy depending on the market structure of the non-traded (or national) sector. For the traded products (or international) sector, there is substantial exposure to external competition such that the qualities and prices of tradable domestic products are subject to global checks. Consequently domestic production of such traded products must remain competitive globally to be sustainable. That implies that prices in the traded products economy must remain stable while maintaining global standards of quality. Failure to achieve this means non-sustainability of domestic production and continual decline of the traded products economy. Contrasted with this, the non-traded products economy is not facing global competition because its products cannot be imported and must be produced locally. Depending on the degree of market imperfection, price determination in the non-traded products economy may experience inflation rate much in excess of the traded products. But inflation in the non-traded sector, through certain mechanisms, is expected to have significant negative impacts on the traded-products sector and long-term prospects of the whole economy. Apart from global competition being a source of major distinction between the traded and non-traded sectors of the economy, elasticities of demand is another major source of distinction between the traded and non-traded products sectors. The non-traded products sector generates largely essential goods and services for which demand is relatively price and income inelastic, such as housing, local transportation, education, health care, electricity, water supply, waste disposal, and security of life and property. By contrast, the traded-goods sector produces largely industrial goods for which price and income elasticities of demand are absolutely and relatively elastic.

The effect of rising general price levels on aggregate demand will thus be more negative on demand for traded products than for non-traded products, thus altering the sectoral shares of gross national product and

consumption propensities in favour of non-traded products. But this is not favourable to the whole economy since the traded products sector has the greater potential of contributing more to national economic growth in view of its price and income elastic demands and access to vast global markets.

This study first establishes the macroeconomic framework and transmission mechanisms through which inflation in the non-traded sector of the economy affects the traded sector and long-term prospects of the economy. As a formal extension, a theory is developed setting forth a relationship between inflation rate and growth potential. Thereafter an empirical application to the Nigerian economy is carried out to investigate the postulated theories and their policy implications that may be applicable especially for less developed countries. In this respect, section two develops a simple two-sector macroeconomic model for the derivation of the relationship between inflation in the non-traded products sector and growth potential of the economy, which is also formalized into a theory. Section three is an empirical application to Nigeria while section four constitutes the summary and policy conclusion.

2. Theoretical Framework and Model

We recognize two sectors, namely sector 'N' denoting non-traded products, and sector 'T' for traded products. Real output (or income) of the non-traded and traded sectors are denoted by lower-case letters as y_N and y_T respectively, while the nominal output counterparts are denoted by capital letters Y_N and Y_T. The links between the real and nominal incomes are the indexes of general price levels P, P_N, and P_T respectively for total national income, income in the non-traded products sector, and income in the traded products sector.

The basic assumption about production function or aggregate supply is that output in the non-traded products sector follows a trend growth rate determined by exogenous technical progress and population growth in accordance with neo-classical growth model.[1] On the other hand, output in the traded products sector is determined by effective demand for traded products subject to output capacity constraint, which is determined by capital stock, in accordance with neo-Keynesian growth model.[2]

With respect to aggregate household demand, the basic assumption is that demand for non-traded goods and services, largely essential goods and services, is relatively price and income inelastic compared with the demand for traded products. The implication of this is that consumption propensity for non-traded products will rise with the general price level, resulting in a fall in the residual consumption propensity for traded products or savings propensity, given the budget constraints. What will offset this tendency is when per capita income growth rate exceeds inflation rate in the non-traded sector. Another way to look at consumption propensity for non-traded and essential goods and services is that the consumer will defend the aspiration levels of priority needs (such as food and shelter) so that even if price rises, the consumer will have to spend more to ensure that minimum requirements of his basic needs are fulfilled. Indeed the consumer may spend increasing amount of his income until the minimum amounts of such priority needs are met, thus encroaching on the demand for goods of lower priority. Teekens (1984) has presented an analytical model to explore such behaviour.[3]

2.1 A Two-sector Model of Inflation and Growth Potential

With the preliminaries given above, the two-sector model of inflation and growth potential is proposed as follows:

Aggregate Outputs:

Non-traded sector output:

$$y_{N,t} = (1+g_N)y_{N,t-1} \tag{1}$$

Traded output capacity constraint:

$$y_{T,t} \leq (1/u_{t-1})(1-\delta_T)y_{T,t-1} + (1/\sigma_T)\Delta i_{T,t-1} \tag{2}$$

Total output:

$$y_t = y_{N,t} + y_{T,t} \tag{3}$$

where y_t, $y_{N,t}$ and $y_{F,t}$ respectively denote real national income, real outputs for non-traded sector N and traded sector T, for period t; g_N is trend growth rate in the non-traded sector; 'u_{t-1}' the capacity utilization rate in the previous year, δ_T is impact of depreciation on output, 'i' is real investment in the traded products sector and 'σ_T' the investment ratio of income.

Aggregate Demand Constraints

Non-traded sector:

$$P_{N,t}y_{N,t} = c_{N,t}Y_t + I_N \tag{4}$$

Traded Sector:

$$P_{T,t}y_{T,t} = (1 - c_{N,t} - s)Y_t + P_{T,t}i_{f,t} + X_t - M_t \quad (5)$$

Where nominal (total) national income

$Y_t = Y_N + Y_T$ is given as:

$$Y_t = P_{N,t}y_{N,t} + P_{T,t}y_{T,t} \quad (6)$$

And I_N is given as:

$$I_N = \sigma_{N,t}P_{N,t}y_{N,t} \quad (7)$$

$P_{N,t}$ and $P_{T,t}$ are current price indices for non-traded (N) and traded (T) sectors respectively, Y_t is national income (GDP) at current prices, X_t is exports of goods and services at current prices (by the traded-goods sector only) and M_t is imports at current prices; $\boldsymbol{c}_{N,t}$ is national propensity to consume non-traded goods and services, $\sigma_{N,t}$ is investment ratio of income in non-traded products sector, and $\boldsymbol{s}$ is national savings propensity. It may be noted that equation (4) is derived from the equilibrium condition relating aggregate supply to aggregate demand as applicable to the two sectors. That is:

$$Y_N = C_N + I_N \text{ , where } C_N = c_{N,t}Y_t \text{ , and } \quad I_N = \sigma_{N,t}P_{N,t}y_{N,t} \qquad Y_T = C_T + I_T;$$

Considering our theoretical analysis of consumer behaviour, national propensity to consume non-traded goods and services c_N is given by:

$$c_{N,t} = (c_{N,t-1})(P_{N,t}/P_{N,t-1}), \quad (8)$$

This means that consumer demand for essential non-traded goods and services must not diminish in real terms and so has to be indexed by cost of living. When prices are constant, that is $P_{N,t} = P_{N,t-1}$, the propensity remains a constant parameter, otherwise not.

Furthermore, we make an additional assumption that gross investment ratio in the non-traded sector $\sigma_{N,t}$ is exogenous, considering the substantial government involvement and the necessity to maintain the infrastructures and improve upon them in the face of growing population and industrial activities.

2.2 Domestic Inflation and Growth Potential

Based on the model developed in subsection 2.1, this subsection derives the relationship between 'domestic' inflation and growth potential of the economy. The non-traded or 'national' sector exhibits relatively more price inelastic demand than the 'international sector'. By domestic inflation, we are referring to inflation originating from the non-traded products or 'national' sector and inflationary consequences of unstable exchange rates reflecting the depreciating domestic currency or excess foreign exchange demand. The prices of traded products is influenced by international competition and tend therefore to be more stable or less inflationary than the prices of non-traded products; any inflation observed in the traded products will be due to domestic currency depreciation and the corresponding decline in the exchange rate. And such devaluation is a consequence directly or indirectly of inflation in the non-traded goods and services, spilling over to external imbalance.

The relationship between non-traded sector inflation and growth potential can be established by obtaining the derivatives of the traded sector output y_T with respect to the price level P_N and output y_N of the non-traded sector, in order to determine the impact of non-traded sector on the traded sector and the whole economy. In order to obtain the appropriate expression of $y_{T,t}$ in terms of $P_{N,t}$ and $y_{N,y}$, we only require equations (4), (6), (7) and (8). First substitute equations (6) and (7) into (4) to derive the expression:

$$P_{N,t}y_{N,t} = c_{N,t}(P_{N,t}y_{N,t} + P_{T,t}y_{T,t}) + \sigma_{N,t}P_{N,t}y_{N,t}$$
$$= c_{N,t}P_{N,t}y_{N,t} + c_{N,t}P_{T,t}y_{T,t} + \sigma_{N,t}P_{N,t}y_{N,t}$$

Dividing through by $c_{N,t}$ and making $P_{T,t}y_{T,t}$ the subject of the expression, we have:

$$P_{T,t}y_{T,t} = P_{N,t}(1 - \sigma_{N,t})y_{N,t}/c_{N,t} - P_{N,t}y_{N,t}$$

Substituting equation (8) finally into the equation above, we have

$$P_{T,t}y_{T,t} = P_{N,t-1}(1 - \sigma_{N,t})y_{N,t} / c_{N,t-1} - P_{N,t}y_{N,t}$$

so that $y_{T,t}$ is given by:

$$y_{T,t} = P_{N,t-1}(1 - \sigma_{N,t})y_{N,t}/P_T c_{N,t-1} - P_{N,t}y_{N,t}/P_{T,t} \quad (9)$$

Taking partial derivatives of equation (9) we have:

$$\partial y_{T,t}/\partial P_{N,t} = -y_{N,t}/P_{T,t} < 0 \quad (10)$$

$$\partial y_{T,t}/\partial y_{N,t} = [P_{N,t-1}(1 - \sigma_{N,t})/c_{N,t-1} - P_{N,t}]/P_{T,t} \quad (11)$$

The first derivative (10) is definitely negative. This implies that inflation rate in the non-traded goods sector has negative impact on the traded-goods sector, other things being equal, so that the more rapid the inflation rate is in the non-traded sector, the more will growth of output be hampered in the traded-goods sector. The second derivative ($\partial y_{T,t}/\partial y_{N,t}$) is the more significant one, and can be positive or negative. It will tend to be positive, and hence favourable to growth prospects in the traded-goods sector, if current inflation rate, as reflected by $P_{N,t}/P_{N,t-1}$, is relatively low (but negative if current inflation rate is relatively high), given the values of the parameters $\sigma_{N,t}$ and $c_{N,t-1}$. That is, expansion in the non-traded sector will have positive impact on the traded-sector if $\partial y_{T,t}/\partial y_{N,t}$ is positive, requiring that:

$$P_{N,t}/P_{N,t-1} < (1 - \sigma_{N,t})/c_{N,t-1} \quad (12)$$

For a more formal analysis of the condition for positive impact of non-traded sector on growth potential, we note that the left side of inequality (12) will tend to be smaller and favourable to growth, the less rapid the inflation rate is, while the right side will tend to be bigger and favourable to growth, the smaller the consumption propensity for non-traded goods is. From this, we can articulate the condition for the existence of growth potential and construct an indicator to measure the growth potential of the economy, as a guide to policy. Subtracting 1.0 from both sides of inequality (12), we obtain below expression (13) indicating the upper bound for tolerable inflation rate in the non-traded goods sector:

$$G_P < (1 - \sigma_N)/c_{N,t-1} - 1.0 \quad (13)$$

where G_P ($=P_{N,t}/P_{N,t-1} - 1$) is non-traded sector inflation rate and σ_N is investment ratio of income in the non-traded goods sector. Beyond such an upper bound, inflation in the non-traded sector will have a negative impact on the growth of output in the traded-goods sector. This relation puts an upper bound on non-traded sector inflation rate, G_P, in terms of investment ratio of income in the non-traded sector and consumption propensity for non-traded goods. If the inflation rate exceeds this upper bound, then the international sector of the economy will cease to grow, and non-traded sector inflation will exert negative impact on the external sector. The condition (13) appears then to determine the ***threshold*** for non-traded sector inflation rate, above which the inflation rate exerts negative impact on growth. So the Threshold Inflation Rate (*TRI*) is given by

$$TIR = 1 - \sigma_{N,t})/c_{N,t-1} - 1.0 \quad (14)$$

Thus, when actual inflation rate G_P is less than the threshold inflation rate, *TRI*, the traded-goods sector has good prospects to grow; but if actual inflation rate G_P exceeds *TRI*, the economy has a tendency to stagnate or contract.

3. Empirical Application to Nigeria

For empirical application of the growth potential condition, we require some parameters or data that are not directly available. The parameters are:

(i) Investment ratio σ_N of output in the non-traded products sector;

(ii) Previous-year national consumption propensity $c_{N,t-1}$ for non-traded products; and

(iii) Inflation rate ($P_{N,t}/P_{N,t-1} - 1$) in the non-traded products sector.

So we have to devise some ways of estimating those parameters or generating the required data.

In respect of the dichotomy between non-traded and traded products sectors, we follow with minor modification the Central Bank of Nigeria national accounts five-sector classification of:

(i) Agriculture;

(ii) Industry (Crude Petroleum, Natural Gas, Mining and Manufacturing);

(iii) Building & Construction;

(iv) Wholesale and Retail Trade; and

(v) Services (including utilities – electricity, gas and water)

The last three sectors constitute predominantly the non-traded products sectors. Although agricultural sector is generally considered a traded-commodity sector, the sector is predominantly non-traded in Nigeria. This is because the largely subsistent peasant agriculture account for about 95% of the sector's output (CBN, 2000:31), while exports (traded part) has always been below 2% of the sector's output. Therefore we shall consider the sector to be 98% non-traded, producing predominantly non-tradable local food crops and livestock. In particular the value of exports was below 1.7% in 1997 and below 1.5% in 2004. Yet, the largest export components, namely, cotton, cocoa bean, and rubber, which are not food staples account for more than 80% of total agricultural export

earnings. In recent years, the sector's share of crops production has stabilized around 83% while the sector's combined shares of forestry and fishing has always been below 7%. But 99.4% of the crops production is locally consumed while 99.9% of the forestry and fishing is locally consumed. The sector's share of livestock, 100% of which is locally consumed, is 10%. In other words, the three basic non-traded-goods sectors (i.e. building & construction, internal trade, and services) in addition to the 98% agricultural sector constitute the ***non-traded products sectors*** (***Y_N***), which are largely essential goods and services.

Data used are largely time series figures for GDP and general price levels, broken in this manner into non-traded and traded components. Other series required are national investment expenditure, broken into non-traded and traded components, where the non-traded components (I_N) consist of investment in building and construction, land development, and costs of installation. The time series data are tabulated in Appendix I.

Time series data for non-traded investment expenditure $I_{N,t}$ are not directly available because total investment expenditure does not distinguish between the traded and non-traded. So we have obtained $I_{N,t}$ by subtracting imported capital goods from total investment expenditure, on the assumption that non-traded capital goods are largely imported so that the rest of investment expenditure consists of non-traded investment expenditure.

On the other hand, the (national) propensity to consume non-traded goods $c_{N,t}$ is obtained by taking the sum of private and public consumption expenditure (C_G+C_P) subtracting the value of imported consumer goods (M_C) and consumer manufactured (traded) goods (C_{manuf}), before dividing it by gross national product (at market prices). Manufactured consumer goods, C_{manuf}, is equal to the output (value-added) of manufactured goods (Q_{manuf}) less exports (X_{manuf}) of manufactured goods and less manufactured capital goods (I_{nmanuf}). That is:

$$c_{N,t} = [C_G + C_P - M_C - (Q_{MANUF} - X_{MANUF} - I_{MANUF})]/GDP \quad (15)$$

For the purpose of breaking down the general price level P_t into the non-traded sector price level $P_{N,t}$ and the traded sector price level $P_{T,t}$, the base year selected is 1990. That is:

$P_{1990} = 1.0$, $P_{N,1990} = 1.0$, and $P_{F,1990} = 1.0$ respectively.

In order to estimate the sectoral price levels, we need to adopt weights for the sectors. Denoting the weights for the traded products and the non-traded products respectively as w_T and w_N, the general price level or price deflator P is related to the sectoral price levels by the formula:

$$P_t = w_{T,t} P_{T,t} + w_{N,t} P_{N.t} . \quad (16)$$

Furthermore, we assume that the price level for traded products is determined by the exchange rate ($e_{xr,t}$) of Naira to US Dollar, in the sense that traded product prices remain stable on account of international competition, and any inflation observed in their prices are due to the depreciation of domestic currency.

Therefore, $P_{T,t}$ is given as

$$P_{T,t} = 100(e_{xr,t}/e_{xr,0}); \text{ where } P_{T,0} = 100(e_{xr,0}/e_{xr,0}) = 100$$

for base year price level. Thus, given the values of P_t , $P_{T,t}$, $w_{T,t}$, and $w_{N,t}$ derivable from national accounts statistics, $P_{N,t}$ can be estimated using equation (16) as follows:

$$P_{N,t} = (P_t - w_{T,t} P_{T.t})/w_{N,t} . \quad (16b)$$

The basic data as well as the derived variables and parameters for the calculation of the threshold inflation rate (*TIR*) are given in Appendix I.

We recall that the threshold inflation rate (*TIR*) G_P defines the inflation rate upper limit for the growth of an economy. That is, the economy is incapable of growth if inflation rate exceeds the limit. The farther G_P is from the upper limit, the greater is the growth potential. In other words, the growth potential condition defines the threshold beyond which inflation rate exerts negative influence on growth. As derived in expression (13), the tolerable level of non-traded sector inflation rate $G_{P(N)}$ has its upper limit given as:

$$G_P < (1 - \sigma_N)/c_{N,t-1} - 1.0$$

where G_P is inflation rate in the non-traded sector (i.e. $P_{N,t}/P_{N,t-1} - 1$), σ_N is investment ratio of income in the non-traded goods sector while c_N is the non-traded consumption propensity of national income. The c*ondition* puts an upper bound on inflation rate G_P in terms of investment ratio σ_N of income in the non-traded goods sector and consumption propensity c_N for non-traded goods and services (largely essential needs). If the inflation rate exceeds this upper bound, then the international sector of the economy will cease to grow, and inflation will exert negative impact on the external sector. The expression (13) determines the threshold inflation rate, above which the inflation rate in the non-traded sector will exert negative impact on growth of the traded-sector output for the type of economy modeled.

Computed values of the non-traded sector and traded-sector inflation rates as well as threshold inflation rates (*TIR*) with respect to non-traded and the traded for the period 1982 to 2009 are contained in Table 1. Also contained in the table are the corresponding growth rates of GDP and manufacturing sector output based on US$ valuation of the current outputs. The use of deflated national income accounts is considered not quite reliable on account of deliberate or non-deliberate errors in the estimation of inflation rates on which the GDP deflators are based.

In accordance with our theory, inflation rate in the non-traded sector is expected to have negative impact on the output of the traded sector. Secondly, inflation rates above the theoretical threshold inflation, referred to as "threshold inflation rate gaps", are expected to have negative impacts on growth rates of the manufacturing sector in particular and GDP as a whole. Growth rate is based on the equivalent U.S. Dollar value of domestic output at current prices considered a more reliable estimate of real output.

Demonstration regression analyses were carried out with the Nigerian data to explore the relationships between the dependent variables of growth rates of GDP and manufacturing sector output and the threshold inflation rate gaps as explanatory variables. We have calculated two threshold inflation rate gaps (columns 7 and 8 of Table 1), one referring to inflation rate in the non-traded sector and the other referring to inflation rate in the traded-sector.

The results are presented in the Tables 2(a) to (e). The threshold inflation rate gap [*TIRG(N)]* with respect to the non-traded sector exerts a negative but non-significant influence on the growth rates of GDP and manufacturing sector. However, the threshold inflation rate gap [TIRG(T)] with respect to the traded-sector exerts negative and significant impacts on the growth rates of GDP and manufacturing sector. A 1% increase in traded-sector inflation rate beyond the inflation rate threshold causes 0.32% fall in the output of the traded sector or 0.27% fall in GDP.

Table 1. Growth Rates and Threshold Inflation Rates for Nigeria 1982-2009

(1) YEAR	(2) Growth Rate % of GDP at current US$	(3) Growth Rate % of Manuf. Sector Output at current US$	(4) Threshold Inflation Rate %	(5) Inflation Rate % (Non-traded Sector)	(6) Inflation Rate % (Traded Sector)	(7) Threshold Inflation Rate Gap Non-traded Sector (col. 5 – col. 4)	(8) Threshold Inflation Rate Gap Traded Sector (col. 6 – col. 4)
1982	-6.59	-2.64	1.98	3.89	10.31	1.91	8.33
1983	0.58	2.05	12.50	12.13	7.61	-0.38	-4.90
1984	6.28	-17.21	19.25	5.56	5.63	-13.69	-13.61
1985	-2.53	13.39	13.35	6.38	16.85	-6.96	3.51
1986	-54.96	-54.61	11.00	-11.64	126.07	-22.64	115.07
1987	-23.47	-43.02	9.59	44.88	98.85	35.29	89.25
1988	17.07	30.65	22.11	27.59	12.91	5.48	-9.20
1989	-4.33	-30.50	12.27	39.20	62.93	26.93	50.66
1990	13.49	8.38	41.11	-35.90	8.74	-77.01	-32.37
1991	-5.37	6.79	45.96	99.31	23.29	53.35	-22.67
1992	-2.25	-20.08	59.86	53.90	74.56	1.20	14.71
1993	0.72	13.26	35.60	13.74	27.47	-21.86	-8.13
1994	32.58	62.55	19.25	33.76	-0.75	14.50	-20.00
1995	-41.97	-54.78	18.34	44.24	270.20	25.90	251.86
1996	39.41	25.86	20.02	75.03	0.28	55.01	-19.73
1997	3.17	7.91	12.34	0.16	0.49	-12.18	-11.85
1998	-5.83	-4.34	13.48	-13.62	2.64	-27.10	-10.84
1999	7.03	-3.18	-2.95	19.15	10.18	22.10	13.14
2000	31.42	1.98	18.27	66.75	9.16	48.48	-9.11
2001	-6.94	6.91	63.40	-14.43	10.81	-77.82	-52.58
2002	29.42	5.25	18.14	3.30	13.03	-14.84	-5.11
2003	15.65	14.45	16.25	22.29	6.16	6.04	-10.09
2004	36.15	22.93	14.10	14.76	-1.24	0.66	-15.35
2005	29.43	19.75	22.89	30.91	-1.34	8.02	-24.23
2006	29.70	18.05	27.74	25.96	-1.78	-1.78	-29.51
2007	13.39	10.93	35.46	4.85	-1.87	-30.61	-37.33
2008	24.56	19.06	11.22	15.97	-5.58	4.75	-16.80
2009	-18.71	-16.39	23.87	-16.50	25.13	-40.37	1.26

Source: Computed by the author from basic data contained in Appendix 1.

Table 2 (a). GDP Growth (GGDP) and Threshold Inflation Rate Gap [TIRG]

Dependent Variable: GGDP				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.467673	3.181380	2.347306	0.0268
TIRG	-0.267491	0.054054	-4.948615	0.0000
R-squared	0.485034	Mean dependent var		5.610714
Adjusted R-squared	0.465228	S.D. dependent var		22.85956
Durbin-Watson stat	1.704536	Prob(F-statistic)		0.000038

Source: Regression analysis carried out by the author based on data in Appendix 1.

Table 2 (b). Growth of Manufacturing Sector (GMAN) and Threshold Inflation Rate Gap (TIRG)

Dependent Variable: GMAN				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.810525	3.260359	1.168744	0.2531
TIRG	-0.325624	0.055396	-5.878154	0.0000
R-squared	0.570622	Mean dependent var		1.550000
Adjusted R-squared	0.554107	S.D. dependent var		25.65588
Durbin-Watson stat	1.616984	Prob(F-statistic)		0.000003

Source: Regression analysis carried out by the author based on data in Appendix 1.

Table 2 (c). GDP Growth Rate (GGDP) and Growth Potential Indicator (GPI) Regression Equation

Dependent Variable: GGDP				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.145125	3.131552	1.004334	0.3245
GPI	0.620330	0.120257	5.158384	0.0000
R-squared	0.505787	Mean dependent var		5.610714
Adjusted R-squared	0.486779	S.D. dependent var		22.85956
Durbin-Watson stat	2.369864	Prob(F-statistic)		0.000022

Source: Regression analysis carried out by the author based on data in Appendix 1.

Table 2 (d). Growth of Manufacturing Sector (GMAN) and Growth Potential Indicator (GPI)

Dependent Variable: GMAN				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.530733	3.053767	-0.501261	0.6204
GPI	0.775097	0.117270	6.609533	0.0000
R-squared	0.626897	Mean dependent var		1.550000
Adjusted R-squared	0.612547	S.D. dependent var		25.65588
Durbin-Watson stat	2.103608	Prob(F-statistic)		0.000001

Source: Regression analysis carried out by the author based on data in Appendix 1.

Table 2 (e). Growth of Manufacturing Sector (GMAN) and Non-Traded Sector Inflation Rate (INFR)

Dependent Variable: GMAN				
Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.41525	3.628433	3.146055	0.0041
INFR	-0.340710	0.057524	-5.922957	0.0000
R-squared	0.574339	Mean dependent var		1.550000
Adjusted R-squared	0.557967	S.D. dependent var		25.65588
Durbin-Watson stat	1.447317	Prob(F-statistic)		0.000003

Source: Regression analysis carried out by the author based on data in Appendix 1.

4. Summary and Policy Implication

4.1 Summary

The paper develops a theory of structural and threshold inflation and the impacts on growth prospects, based on two-sector division of the economy, one sector producing internationally traded goods and services, the other producing the non-traded. In principle, the traded goods sector (also referred to as the international sector) is directly exposed to international competition in its price formation while the non-traded sector is not. Thus inflation in respect of traded goods is checked by competitive imports subject to exchange rate movements while inflation in the non-traded sector is subject to domestic forces of demand and supply for non-traded goods and services. In addition, price and income elasticities of demand vary significantly between demand for the traded and the non-traded products. For the non-traded products, a lot of which are essential needs, demand tend to be much more inelastic, such that the aggregate consumption propensity for non-traded goods and services varies with price level. The consequence of this is for the aggregate consumption propensity for traded products to fall or for aggregate savings propensity to fall. Whatever the case, inflation rate in the non-traded products sector will tend to result in a depression. Output growth in the non-traded sector is assumed to follow neo-classical growth behaviour determined by population growth and exogenous technical progress, while output in the traded products sector is assumed to follow neo-Keynesian growth model governed by residual demand for traded and less essential goods and slack production capacity constraints.

A brief and highly simplified macroeconomic model is then built to reflect these basic principles and draw the implications of endogenous price determination on the prospects of the manufacturing sector that produces most of the traded goods.

The implications of the model are:

(i) That inflation in the non-traded products sector exerts negative impact on the output of the traded products.

(ii) That output in the non-traded products sector may have positive or negative impact on the traded products, depending on the consumption propensity for non-traded products and the ratio of investment expenditure to output in the non-traded products sector, both of which are subject to the price levels in the non-traded products sector. The condition for the positive impact defines the threshold inflation rate; in other words, the threshold inflation is the line separating the positive from negative impact.

From the implications described above, we construct a ***growth potential indicator*** for the purpose of measuring or predicting the growth prospects of the traded goods sector and guiding development policy. When the indicator is positive the prospects are good, otherwise not; and the larger the indicator the greater are the growth prospects not only for the traded-goods sector but also for the whole economy, since the traded goods sector has the greatest potential for contributing to economic development on account of its access to vast world market.

In the application of the model to Nigeria during the period 1981-2009, a 1% inflation rate above the threshold causes 0.32% fall in the output of the traded-sector and 0.27% fall in GDP.

4.2 Policy Implication

In order to promote the growth prospects of the traded-sector and the whole economy, as well as check inflation, it is necessary to adopt development and welfare policies that will lower the proportion of expenditure of the non-traded goods in total income. Such policies will include lowering the prices of food, rent, transportation, and other essential consumer goods, requiring the promotion of efficient production systems in agriculture, housing, transportation, energy, educational and health care services. This will free more income for patronizing the traded-goods sectors. In order to promote the competitiveness of domestic traded-goods industries, investment in

efficient infrastructural development to favour the nation's potential areas of comparative advantages and competitiveness in trade has to be vigorously promoted. Vibrant domestic markets for such competitive products will spur the rapid growth and enhance the competitiveness of the traded-goods sector. Rising corporate and personal income taxes due to more rapid industrial growth may be channeled to financing the prescribed infrastructure and social development. Initial budget deficits for these purposes may not be avoidable but the authorities have to be skilful in safeguarding price stability. There will also be need to check cost push inflation in the economy occasioned by arbitrary increases in factor incomes as a result of imperfections in product and factor markets.

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Notes

Note 1. Adopting the Solow (1957) neo-classical growth model, the growth of output *Y* is given by

$$g(Y) = \alpha g(K) + \beta g(L) + v$$

where *g(K)* is growth of capital stock, *g(L)* is growth of labour (or population), α is output elasticity of capital stock, β is output elasticity of labour and *v* is total productivity growth (exogenous technical progress). With the assumption that $\alpha + \beta = 1$ (linearly homogeneous production function), and change in capital stock is financed out of national income mplying that *g(K)= g(Y)* in the long run, the growth of output *g(Y)* is reduced to:

$g(Y) = n + v/(1-\alpha)$, where *g(L) = n*, the population growth rate.

Note 2. In accordance with Kaldor and Mirrless (1962) technical progress function, productivity growth is a function of growth in investment per operative, such that productivity increases at decreasing rate until it reaches the optimal level **γ** at which the productivity growth rate equals the growth rate of investment per operative. That is:

$$dy/y = f(di/i),\ f(0) > 0,\ f' > 0,\ f'' > 0, \tag{17}$$

At equilibrium the growth of productivity equals the growth of investment per operative. That is:

$$dy/y = di/i = \gamma.$$

With modification from per capita unit to total income and total investment, and employing discrete format, we can render the expression as:

$$\Delta Y/Y = \Delta I/I \quad or \quad \Delta Y = (Y/I)\Delta I \tag{18}$$

Since investment ratio of income $\mathbf{I/Y = \sigma_f}$, the reciprocal $\mathbf{Y/I = 1/\sigma_f}$. So the second part of equation (18) can be rewritten as

$$\Delta Y = (1/\sigma_f)\Delta I \tag{19}$$

But ΔY is the planned increase in capacity output, that is, $\Delta Y = Y_t - Y^*_{t-1}$, where Y^*_{t-1} is capacity output for the previous year given by $Y^*_{t-1} = (1/\mathbf{u_{t-1}})Y_{t-1}$ where Y_{t-1} is actual output and $\mathbf{u_{t-1}}$ is corresponding capacity utilization rate.

Appendix I. Basic Times Series Data and Derivatives for Nigeria

YEAR	Y: GDP current Prices (Nb)	P: GDP Deflator [P(1990) = 100]	I: Total Investment Expenditure (Nb)	Non-traded Investment (Nb): I(N) = I - I(M)	Cp: Private Consumption Expenditure	Cg: Government Consumption Expenditure	Y(F): Traded Sector Output (Nb)	Non-traded Sector Output: Y(N) = Y-Y(F)
1981	47.62	37.57	18.22	11.84	28.57	7.58	15.80	31.82
1982	49.07	40.94	17.15	11.14	30.41	8.41	14.42	34.64
1983	53.11	47.77	13.34	8.67	35.22	8.89	13.60	39.51
1984	59.62	51.16	9.15	5.95	42.86	8.46	14.47	45.15
1985	67.91	53.19	8.80	5.72	49.30	9.36	18.23	49.68
1986	69.15	52.22	11.35	7.38	51.54	9.42	16.39	52.75
1987	105.22	75.44	15.23	9.23	75.98	8.06	34.48	70.75
1988	139.09	95.60	17.56	10.36	106.68	11.31	41.20	97.88
1989	216.80	129.54	26.83	16.73	126.19	12.44	89.60	127.20
1990	267.55	100.00	40.12	26.12	177.23	13.98	115.59	151.96
1991	312.14	166.04	45.19	5.69	206.81	15.90	136.63	175.51
1992	532.61	259.52	70.81	-12.09	373.53	33.12	274.76	257.86
1993	683.87	318.12	96.92	11.92	502.78	46.80	282.31	401.56
1994	899.86	405.44	105.58	65.68	610.34	169.67	283.56	616.30
1995	1,933.21	824.44	141.92	57.62	1,387.45	242.74	873.88	1,059.33
1996	2,702.72	1,098.07	204.05	72.15	2,124.27	280.38	1,293.23	1,409.49
1997	2,801.97	1,108.76	242.90	85.40	2,091.07	377.78	1,215.91	1,586.06
1998	2,708.43	1,026.97	242.26	103.46	2,371.33	393.55	882.03	1,826.40
1999	3,194.01	1,190.31	231.66	118.16	2,454.79	231.29	1,179.55	2,014.46
2000	4,582.13	1,628.20	331.06	132.26	2,478.78	393.55	2,359.31	2,222.81
2001	4,725.09	1,596.91	372.14	94.64	3,687.66	403.10	1,874.08	2,851.00
2002	6,912.38	1,725.54	499.68	110.58	5,540.19	478.29	2,042.72	4,869.66
2003	8,487.03	2,002.73	865.88	134.78	7,044.54	450.49	3,037.71	5,449.33
2004	11,411.07	2,162.91	863.07	191.17	8,111.13	785.82	4,610.08	6,800.98
2005	14,572.24	2,593.25	1,204.80	648.10	10,099.42	1,003.10	6,094.89	8,477.35
2006	18,564.59	3,115.80	1,546.53	660.83	11,834.58	1,283.40	7,488.74	11,075.85
2007	20,657.32	3,256.96	1,915.35	932.22	16,135.89	1,642.03	8,085.38	12,571.94
2008	24,296.33	3,614.44	2,030.51	988.39	17,166.51	1,400.20	9,719.51	14,576.82
2009	24,712.67	3,446.92	2,442.70	1,338.18	17,930.85	1,434.78	7,972.49	16,740.18

Appendix I (Contd.)

YEAR	Exr: Naira/US$ Exchange Rate	I(M): Capital Goods Imports Nb.	Traded Sector Output Deflator	Non-traded Sector Output Deflator	Non-traded investment ratio: σ(n)=I(N)/Y(N)	$Y: GDP current Prices (US$b)	C(T): Manufactured Consumer Goods (Nb)	C(N) = Cp+Cg - C(T): Non-traded Consumption Expenditure	C(N)/Y: Non-traded sector Consumption Propensity	Manufacturing Sector Output (US$b)
1981	0.61	6.38	7.6	52.46	0.37	78.0	4.48	31.67	0.67	7.70
1982	0.67	6.00	8.4	54.50	0.32	72.92	4.77	34.05	0.69	7.50
1983	0.72	4.67	9.0	61.11	0.22	73.34	5.44	38.67	0.73	7.65
1984	0.76	3.20	9.5	64.51	0.13	77.95	4.77	46.55	0.78	6.34
1985	0.89	3.08	11.1	68.62	0.12	75.98	6.04	52.62	0.77	7.19
1986	2.02	3.97	25.1	60.64	0.14	34.22	6.10	54.86	0.79	3.26
1987	4.02	6.00	50.0	87.85	0.13	26.19	7.00	77.05	0.73	1.86
1988	4.54	7.20	56.4	112.09	0.11	30.66	10.39	107.60	0.77	2.43
1989	7.39	10.10	91.9	156.03	0.13	29.33	11.40	127.23	0.59	1.69
1990	8.04	14.00	100.0	100.02	0.17	33.29	13.85	177.36	0.66	1.83
1991	9.91	39.50	123.3	199.35	0.03	31.50	18.30	204.42	0.65	1.95
1992	17.30	70.81	215.2	306.79	0.00	30.79	25.52	381.12	0.72	1.56
1993	22.05	85.00	274.3	348.95	0.03	31.01	37.22	512.35	0.75	1.77
1994	21.89	39.90	272.2	466.74	0.11	41.12	60.99	719.02	0.80	2.87
1995	81.02	84.30	1,007.7	673.22	0.05	23.86	101.85	1,528.33	0.79	1.30
1996	81.25	131.90	1,010.6	1,178.32	0.05	33.26	128.39	2,276.27	0.84	1.64
1997	81.65	157.50	1,015.5	1,180.22	0.05	34.32	139.58	2,329.27	0.83	1.76
1998	83.81	138.80	1,042.4	1,019.53	0.06	32.32	137.76	2,627.12	0.97	1.69
1999	92.34	113.50	1,148.5	1,214.77	0.06	34.59	146.23	2,539.86	0.80	1.63
2000	100.80	198.80	1,253.8	2,025.64	0.06	45.46	161.09	2,711.23	0.59	1.67
2001	111.70	277.50	1,389.3	1,733.37	0.03	42.30	182.05	3,908.71	0.83	1.78
2002	126.26	389.10	1,570.4	1,790.63	0.02	54.75	219.47	5,799.01	0.84	1.88
2003	134.04	731.10	1,667.1	2,189.81	0.02	63.32	266.14	7,228.90	0.85	2.15
2004	132.37	671.90	1,646.4	2,513.03	0.03	86.21	321.38	8,575.56	0.75	2.64
2005	130.60	556.70	1,624.4	3,289.81	0.08	111.58	375.17	10,727.36	0.74	3.16
2006	128.28	885.70	1,595.5	4,143.71	0.06	144.72	429.27	12,688.71	0.68	3.73
2007	125.88	983.13	1,565.7	4,344.67	0.07	164.10	464.61	17,313.31	0.84	4.14
2008	118.86	1,042.12	1,478.4	5,038.72	0.07	204.41	520.83	18,045.88	0.74	4.93
2009	148.73	1,104.52	1,849.9	4,207.50	0.08	166.16	539.10	18,826.54	0.76	4.12

Source: CBN Statistical Bulletin and Annual Reports and Statement of Accounts for basic data; the last eight columns were derived by the author.