THE MACROECONOMIC EFFECTS OF HIGHER OIL PRICES IMP WORKING PAPER WP/01/14

BY

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A Review of Iyabode Masha*

The objective of the article was to use the IMF's multi-country model, MULTIMOD, to analyze the macroeconomic effects of oil prices shocks, with particular focus on the implications to economic activity and inflation in the industrial countries. The authors believed that the MULTIMOD simulations could shed more light on the basic issues that have dominated empirical enquiry on oil price increases, as well as provide some perspectives on the key channels of transmission and the implications for monetary policy. This review examines the main issues discussed in the paper.

Oil Price Behaviour: The analysis started off with a review of the oil price behaviour since the 1950's. It was observed that since the sharp decline in oil prices in the mid-1980s, oil prices have fluctuated around a fairly stable mean, with most standard deviations from the average price being short-lived. In addition, the last round of oil price increases, spanning 1999-2000 was found to be comparable to the oil price rise of the late 1970s. Finally it was argued that there has not been anything systematic about oil price behaviour, therefore the historical movement holds no information about future oil prices, severity of price movements or likely duration in future. However, the paper noted that no matter the behaviour, significant macroeconomic effects usually accompany rising oil prices.

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The Transmission or Oil Price Shocks:

In the analysis of the transmission of oil price shocks, the paper noted the following five main channels:

- The increase in international oil sale revenue accruing to oil exporting countries results in a transfer of income from oil importing to oil exporting countries. The fall in global (aggregate) demand in oil importing countries is usually more than the rise in demand in oil exporting countries. This key assumption here is that the propensity to spend in oil exporting countries is smaller than in oil importing countries.
- The increase in production costs, whereby the cost of inputs to production increases, which reduces the amount of non-oil output that could be produced profitably.
- The cost-push effect that results when workers and producers resist the decline in their real wages, thereby putting pressure on unit labor costs and prices of finished goods and services.
- The impact of the higher prices on headline price indexes and potential for pass through to core inflation, which could induce central banks to tighten monetary policy.
- Finally, erosion of monetary policy credibility that occurs when the nexus between policy reactions and objectives / outcomes are inconsistent.

The MULTIMOD Analysis of Oil Price Shock:

In the discussion that followed, a MULTIMOD estimation was undertaken. MULTIMOD is a multi-regional econometric model developed by the IMF staff for the primary purpose of analyzing alternative scenarios for the World Economic Outlook (WEO). Two important assumptions that characterize the demand and supply side In the MULTIMOD analysis are

very critical to the analysis of the oil price shocks. For the demand side, a major assumption is that oil price shock hinges heavily on the nature of the wage/price behaviour and the monetary policy reaction function. It was assumed that countries' monetary policy reaction function is an inflation forecast-based rule (IFB) which presupposes that "monetary authorities set the short-term interest rate at a level that depends on the deviation of their forecast of inflation from some target inflation rate" and on the magnitude of the output gap.

On the supply side, MULTIMOD assumes that production technology uses capital and labour inputs only with no consideration for primary and intermediate inputs, and firms choose the profit maximizing level for the capital stock based on production technology, input costs and output prices.

The estimation of the effects of oil price transmission focused on those equations in the MULTIMOD that play key roles in transmitting the effects of oil price increases into the inflation process. The characterization of the inflation is based on a reduced fom Phillips curve, and distinguished between core and headline inflation. Core inflation, the measure on which most monetary policy decisions are based is defined as the rate of change of the GDP deflator (excluding oil), while CPI inflation is inflation conventionally defined. MULTIMOD's wage/price structure, which was estimated for the industrial countries namely the US, the UK, Japan, Canada, Euro Area and other Industrial Countries, consisted of three equations for CPI inflation, Core inflation and inflationary expectations.[1]

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1 The three equations are:

$$\pi_t^{CPI} = \delta_1 \pi_t^M + \delta_2 \pi_t^e + \delta_3 \pi_t^{POIL} + [1-\delta_1-\delta_2-\delta_3]\pi_{t-1}^{CPI} \quad (1)$$

$$\pi_t^C = \psi \pi_{t+1}^e + [1-\psi]\pi_{t-1}^e + \gamma[(u_t^*-u_t)/(u_t-\phi_t)] + \alpha\gamma[\pi_{t-1}^{CPI}{}_2 - \pi_{t-1}^C] \quad (2)$$

$$\pi_{t+1}^e = \Omega[\lambda\pi_{t-1}^{CPI} + (1-\lambda)\pi_{t-1}^e] - [1-\Omega][\lambda\pi_{t-1}^{CPI} + (1-\lambda)\pi_{t-1}^e] \quad (3)$$

where:

π_t^{CPI} is CPI inflation, π^M is the rate of inflation of the domestic currency price of manufactured imports, π_t^{POIL} is the rate of inflation of domestic currency price of oil, π^C is core inflation and π_t^e is a measure of expected inflation. In addition, u^* is the non-accelerating -inflation rate of unemployment (the NAIRU); u is the unemployment rate, ϕ is the minimum absolute lower bound for the unemployment rate; and δ_1 δ_2 δ_3 ψ λ γ α Ω are parameters.

The parameter estimates show interesting results on the effect of oil prices on different industrial countries, (See Table). The direct effect of the rate of inflation of domestic-currency price of manufactured imports is lowest in Japan and Canada, and highest in the Euro Area. Pass through to core inflation was high in all the countries, with parameter estimates ranging from .73 for Japan to .41 for Other Industrial countries. Direct increase in the domestic currency price of crude oil, is highest in the US and Euro Area (.31 and .33 respectively and lowest in Japan and the UK. The rate of inflation of the domestic currency price of manufactured imports was highest in the UK and the Euro areas. In a simulation of a 50 percent increase in oil prices, it was discovered that the effect on CPI inflation in the US and Euro Areas would be a 1.3 percentage rise, .6 in both Japan and the UK, and .8 in Canada and other industrial countries. The parameters of the core inflation equation were less skewed. The effect of inflationary expectations in the countries all deviated slightly from the mean of .54.

Table: Parameter Estimates of MULTIMOD Base-Case

	$10\delta_3$	δ_2	δ_1	ψ	α	Ω	λ
Average	.22	.58	.08	.54	.26	.57	.48
United States	.31	.58	.08	.51	.35	.53	.48
Euro Area	.33	.44	.12	.51	.12	.58	.60
Japan	.14	.73	.06	.59	.09	.60	.31
United Kingdom	.15	.69	.11	.58	.42	.60	.34
Canada	.20	.61	.06	.51	.16	.50	.41
Other Industrial Countries	.18	.41	.08	.55	.42	.60	.74

The study also considered the effect of oil prices on both CPI and core inflation in a dynamic framework, through the two channels represented by the parameters λ (the expectations channel) and α (the degree of real wage catch up channel). It was shown that though oil price movements have important effects on core inflation in all the countries, the effects were particularly strong in the US and the Euro Areas.

Simulations:

The simulation exercise centered on five different scenarios. One is the response of GDP and inflation to oil price shocks in the economies. The other is the response to transitory and more permanent shocks under alternative assumptions about the wage setting pattern. In another scenario, it was considered how asymmetric responses from micro agents to changes in their real wages might explain some of the observed relationship between oil prices and macroeconomic activity. Fourthly there is a simulation on the effect of delaying monetary policy responses, and finally the policy implications of uncertainties.

The findings of the simulation were closely related to the relative differences in the parameter values for the countries. The initial finding was that in general, inflation subsides more gradually with permanent shocks than under persistent shocks. Secondly the effect of real GDP and inflation is small in Japan, and larger in the US. In assessing the strength of the pass through effect, the study found that when the shock is temporary, the responses of output and inflation under the two different wage / price structures are similar, though the result could be markedly different for countries with large estimated real wage catch up effects.

Furthermore, the simulation result showed that the degree to which output and inflation respond asymmetrically to output shocks varies, depending on the strength of the real wage catch up effect. In general it

was found that negative oil-price shocks create downward pressures on core inflation through the expectations channel, which allows monetary policy to ease.

In cases where the monetary policy reactions of the authorities to the change in oil price is delayed, especially in the context of the IFB rule of the model and interest rate is held unchanged for 12 to 18 months, the results are mixed. Japan reported little or no effect on economic activity. Other countries report expansionary effect on aggregate demand and GDP in the short run, but sharper interest rate responses by the third year, and subsequently contractionary effect on GDP. In another longer term scenario (10 years), the effect was a cumulative loss on output of the order of .3 percent of GDP in UK, though much less in others, and cumulative price level change effect of .3 to .5 percent.

Appraisal of the study:

The application of MULTIMOD to the study of the effect of oil shocks on selected industrial countries sheds more light on the macroeconomic effect of higher oil prices and represents an advance over earlier studies. The system of equations estimated distinguishes between core and headline inflation, and is particularly useful from the point of monetary policy.

However, the assumption that oil price increases are not predictable is open to debate. A cursory look at the high oil price episodes of the past fifty years shows that they usually revolve around conflicts in the Middle East, which affect major suppliers, such as the Arab-Israeli War of the 1970's, the Iran-Iraq War of the 1980's and the Persian Gulf War of the late 1980's to early 1990. Though the last round of increase 1999-2000 did not follow the same antecedent, it did occur at a time of unusually high growth and expansion in global economy. Therefore these and similar

occurrences can serve as warning bells for oil price increase.

Secondly, the focus of the study is on industrial countries with varying extent of dependence on oil imports, which affects the prices, they face and controlling for this fact may have shed further light on the issues. For example, UK is largely oil producing, though domestic oil prices may or may not be misaligned from international ones.

Though the study is not about developing economies, the findings have serious implications that are applicable to all economies. One of these is with respect to the adverse effect of delayed monetary policy reaction when exogenous shocks arise. The simulation results show that countries that delayed monetary policy responses ended up with adverse result for output and core inflation. Monetary policy should therefore be proactive if it is to curtail the adverse effect of terms of trade shocks, and other developments within the macro economy.

Secondly, the wage setting policy operating in an economy has important implications for the extent to which changes in prices affecting headline inflation are transmitted to core inflation. Wage catch up clauses or the agitation for increase in wages, as is the case in Nigeria need to be aligned to the achievement of price stability and output growth objectives.