

NIGERIA'S MACROECONOMIC CRISIS EXPLAINED

Channing Arndt, Chuku Chuku, Adedeji Adeniran, Morakinyo Adetutu, Victor Ajayi, George Mavrotas and Chukwuka Onyekwena*

Abstract

Nigeria confronts a prolonged period of adjustment. For more than a generation, the oil sector generated large volumes of foreign exchange. However, with the recent bust in global oil prices and the resumed restiveness in the oil rich Niger-Delta region since 2014, Nigeria was thrust into macroeconomic crisis. Nearly four years on, we argue that policymakers effectively responded to the dual shocks mainly through import compression. However, the scope for continued import compression is now distinctly limited. For Nigeria to grow and prosper, the long-discussed diversification of the export base must occur via rapid expansion of non-oil exports.

* Arndt: International Food Policy Research Institute, Washington (email: C.Arndt@cgiar.org); Chuku: Department of Economics, The University of Uyo, Uyo, Nigeria (email: chukuchuku@uniuyo.edu.ng); Adeniran: Center for the Study of Economies of Africa, Nigeira (email: aadedeji@cseaafrica.org); Adetutu: Department of Economics, Nottingham Trent University, UK (email: morakinyo.adetutu@ntu.ac.uk); Ajayi: Judge Business School, University of Cambridge (email: va301@cam.ac.uk), Mavrotas: International Food Policy Research Institute, Nigeria (email: G.Mavrotas@cgiar.org); Onyekwena: Center for the Study of Economies of Africa, Nigeria (email: conyekwena@cseaafrica.org)

Introduction

We find that Nigerian macroeconomic policymakers have performed reasonably well through the crisis. The economy has suffered, since late 2014, a large and persistent terms of trade shock, in the form of dramatically lower oil prices, combined with an uprising in violence in oil-producing regions that resulted in reduced oil production, further compressing export revenue. In this situation, success is partly measured by what did not happen: GDP did not collapse and inflation has not spiralled out of control. In terms of what has happened, a reasonable external balance has been reestablished, notably through strong compression of import volumes.

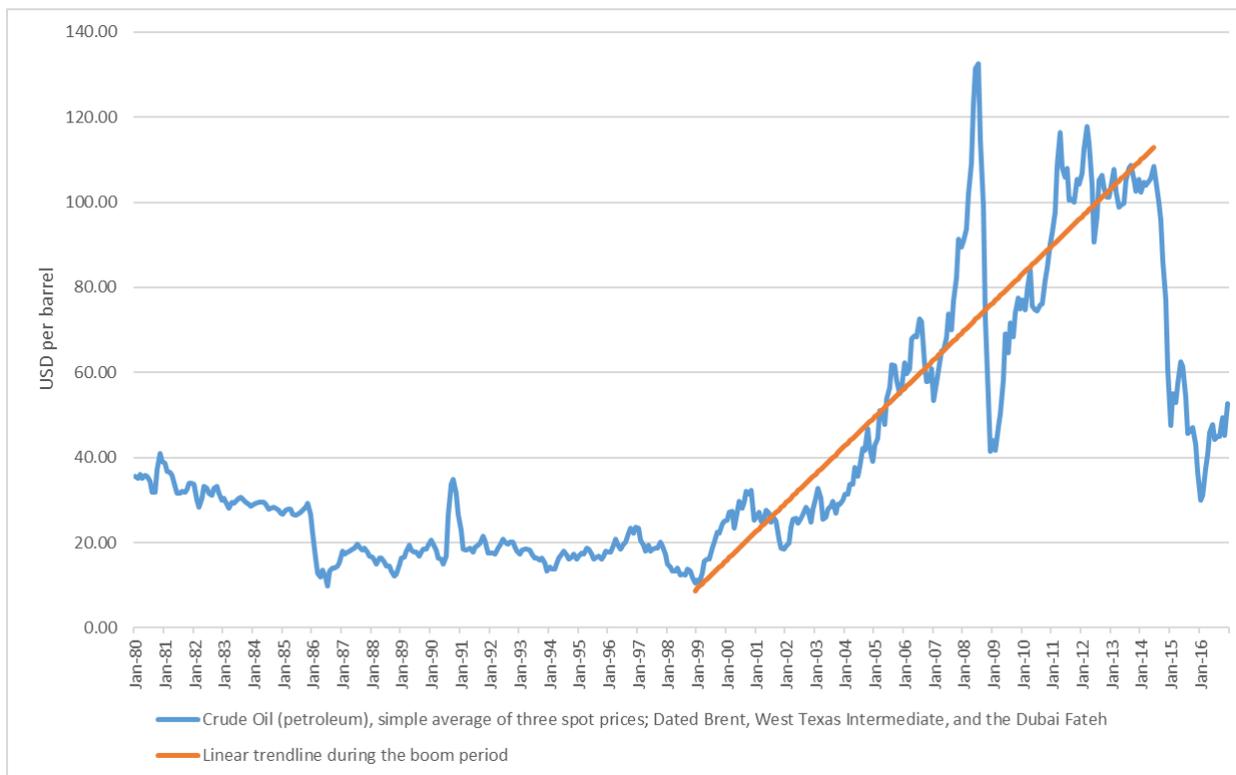
Macroeconomic policymakers are, unfortunately, far from being out of the woods though oil price rises in the first half of 2018 have provided some breathing space. The import compression noted above began from a relatively low level of imports as a share of GDP, leaving, at this point, relatively little space to compress imports further. Perforce, the imported capital goods and intermediates that will be critical to a sustained growth process must be paid for through increased exports. Accordingly, Nigerian businesses, whose secret to success for more than a generation has been a focus on products sheltered from global competition, must learn to compete globally. This will be difficult, and it will take time. Nevertheless, barring a major oil price or production resurgence, it is the only route to a sustained and rapid economic growth and development process.

This note seeks to illuminate the roots and features of the macroeconomic crisis. It then considers fundamental policy orientations looking forward. We use simple approaches to boil down to the main driving forces. Specifically, we employ descriptive analysis, two equations, and one parsimonious economic model presented in one graph (with four quadrants). A shock to this model is then presented graphically and run empirically using Nigerian data.

The Roots of the Crisis

The overwhelming dependence of the Nigerian economy on oil exports has been a focus of discussion for decades. From 1998 to 2014, an oil price boom unfolded that saw Nigeria's dominant export increase in dollar terms by a factor of ten, from about \$10 per barrel to more than \$100. Figure 1 shows nominal oil prices from 1980 to early 2018 using data from the International Monetary Fund. A Linear trend highlights the boom period. While the boom period was characterized by some volatility, most notably in 2008, on average the oil price rose continuously for more than 15 years. This price boom permitted Nigeria to purchase more imports for the same volume of exports. This is known as terms of trade gain.

Figure 1: Crude oil nominal world prices.



Source: IMF commodity price data accessed on 1 February 2018.

The benefits to Nigeria of this trend in world oil markets can be illustrated in two equations. The first, equation (1), illustrates the essentials of the balance of payments:

$$B + P_E E - P_M M = \Delta R \quad (1)$$

Where:

B = Net financial flows such as loans taken or repaid and net direct and portfolio investment

P = World prices

E = Exports

M = Imports

ΔR = Change in foreign currency reserves of the central bank.

In equation (1), net financial flows, B, plus export revenues, $P_E E$, determine the availability of foreign currency. The third term on the left-hand side is the value of imports. If foreign currency available exceeds the value of imports, then foreign currency reserves of the central bank increase. If B and ΔR are relatively stable, a constantly increasing price of exports, relative to the price of imports, allows for a constant increase in the quantity of imports for the same volume of exports.

In short, for about 15 years, Nigeria could purchase rapidly increasing volumes of imports for the same export volume.

The second equation is the familiar gross domestic product (GDP) identity, presented in two ways:

$$\text{GDP} = C + I + G + (E - M) \quad (2a)$$

$$\text{GDP} + (M - E) = C + I + G \quad (2b)$$

where C is household consumption, I is investment, G is government, and M and E are imports and exports as before. Equation (2b) takes the GDP identity and moves M and E to the left-hand side. For simplicity, analysts normally suppress the price indices (shown explicitly in Equation (1)). Both formulations of Equation (2) can be conceived of in either value or volume terms.

Let us consider Equation (2b) in volume terms. GDP is volume of goods and services produced in the economy and M is the volume of imports. The sum of GDP and M is the total quantity of “stuff” (total supply) in the economy. Some of this supply, exports, is sent away for foreigners to use. The resulting value on the left-hand side is defined as absorption ($A = \text{GDP} + M - E$). Absorption, A, corresponds to the economy’s total use of goods and services (“stuff”) and is the broadest available measure of economic welfare. The right-hand side of equation (2b) illustrates how this total volume of goods and services is distributed between consumption (C), investment (I), and government (G), which are also called the components of absorption ($A = C + I + G$). A terms of trade gain allows for increases in C, I, and/or G for the same volume of exports and the same volume of production or GDP.

The Macroeconomic Crisis

The Shock

Unfortunately, the process also works in reverse. As shown in Figure 1, oil prices fell precipitously towards the end of 2014. Prices have since then remained relatively low. Oil prices have recently rallied from their lows but remain well below the levels observed in May 2014, especially in real terms.

The shock from the price collapse manifests itself through the balance of payments. From equation (1), we can see the menu of options available to Nigerian macroeconomic policymakers in response to the drop in P_E observed in late 2014. They can:

- Use changes in currency reserves, ΔR
- Increase financial flows, B, by, for example, borrowing from abroad,
- Decrease imports, M, and/or
- Increase exports, E.

These options are listed in rough chronological order of deployment. The first two are short-term options. They may be all that is required for sufficiently temporary changes in prices such as the massive oil price collapse in the second half of 2008 and rebound in 2009. For more persistent shocks, policymakers in developing countries typically apply all four options using reserves and borrowing to soften the initial impact of the shock. However, because borrowing capacity and reserves are finite, there is a need, normally within a matter of months, to move beyond purely

short-term financial measures. The next move is usually to compress imports, which can typically be accomplished more readily than expanding exports.

All of these policy options are welfare decreasing in terms of absorption. The first two options shift costs to later in time. The second two options operate through equation (2b). A reduction in imports and/or an increase in exports reduces the volume of goods and services available in the economy even if GDP remains constant.¹ This contraction in absorption must be distributed across the components of absorption: C, I, and G.

While a terms of trade gain generates welfare increases for doing nothing, there is, correspondingly, nothing policymakers can do (or at least nothing that they should not have been doing anyway) to offset the welfare declines from terms of trade losses. With substantial terms of trade loss, such as the one experienced by Nigeria beginning in the second half of 2014, there are substantially fewer goods and services available ($A = GDP + M - E$ is smaller).

Policies such as changes in taxes, subsidies, or government expenditures can influence the distribution of welfare losses across the components of absorption. Should households consume less? Should investment be cut? Should government services be curtailed? Some combination of reductions across the components is required for aggregate demand for goods and services to confront the reality of a more restricted aggregate supply. Policy also has a role for allocations within each component of absorption. Should poor households receive temporary support? If so, how? Which investment projects should be prioritized and which ones should be shelved? Which government programs are to be scaled down and by how much for each one? None of these are easy choices.

The Adjustment Mechanism

Returning to the trade balance equation (1), policymakers can directly affect financial flows (B) by, for example, taking loans in foreign currency; and they can decide to use reserves (ΔR). In the context of a market economy in a developing country and persistent terms of trade decline, they need a mechanism for exercising their remaining two options: compressing imports and increasing exports. The principle macroeconomic mechanism is the exchange rate.

In Nigeria, consideration of the exchange rate is complicated by a multiple rate structure that confers favourable rates to preferred actors. There is, nevertheless, a reasonably well-known market rate between the Naira and major currencies. This rate has moved dramatically from about 180 Naira per USD in 2014 to about 400 Naira per USD at the end of 2016. This has been reeled back to about 360 Naira per USD as of January 2018.

The intent and effect of these moves in the spot market price of a unit of foreign currency in Naira (the nominal exchange rate) is to alter the relative price of traded to non-traded goods. Traded goods are those where a reasonable share of demand or supply are imported or exported. An example of a traded good is rice. A non-traded good is one that is neither imported nor exported at all or is imported or exported in small volumes such that the world price for this good has

¹ Typically, GDP effects magnify the terms of trade effect in the short run. The real income/wealth increase driven by a terms of trade gain can pull idle resources into production while the real income/wealth decline resulting from a terms of trade loss can generate unemployment and idle factories and other capital.

relatively little impact on the price of similar goods in the domestic market. An example of a non-traded good is a hair salon service.

The effect of the nominal depreciation is to drive up the price of tradeables such as rice. To import one USD worth of rice cost 180 Naira in 2014 (at the market exchange rate) and about 400 Naira at the end of 2016. This price increase enters the domestic market and encourages consumers to search for domestic substitutes for rice, such as cassava, whose price is less closely tied to global markets and hence to exchange rates. On the production side, the higher market price encourages production of domestic rice, further facilitating the compression of imports.

For hair salons, there is no direct tethering of the price of their service to a world market price. Hence, the price of hair salon services has no strong tendency to rise. Meanwhile, the price of imported intermediates used at the hair salon, such as scissors or hair dryers, rise in line with the exchange rate. With similar forces operating throughout the economy, the overall effect is to increase the price of traded goods relative to non-traded goods throughout the economy with the effect of discouraging imports and encouraging the production of import substitutes and exports.

A Simple Model

We are now ready to condense the elements discussed so far into a parsimonious and elegant macroeconomic model of the real economy. Before proceeding, it is important to highlight that, while the model is elegant, the real-world process being described is not. For instance, for poor consumers who depend on rice consumption for a large share of their calorie requirement, compression of rice consumption via substantial price increases can be permanently damaging or even fatal, especially for children. As emphasized above, policymakers cannot completely eliminate the economic pain associated with sharp terms of trade declines; but they can influence the distribution of the burden. There is a real logic to shielding vulnerable households from pronounced impacts.

The model is the one country, two sectors, and three commodities model, called the 1-2-3 model, of Devarajan, Lewis, and Robinson (1993).

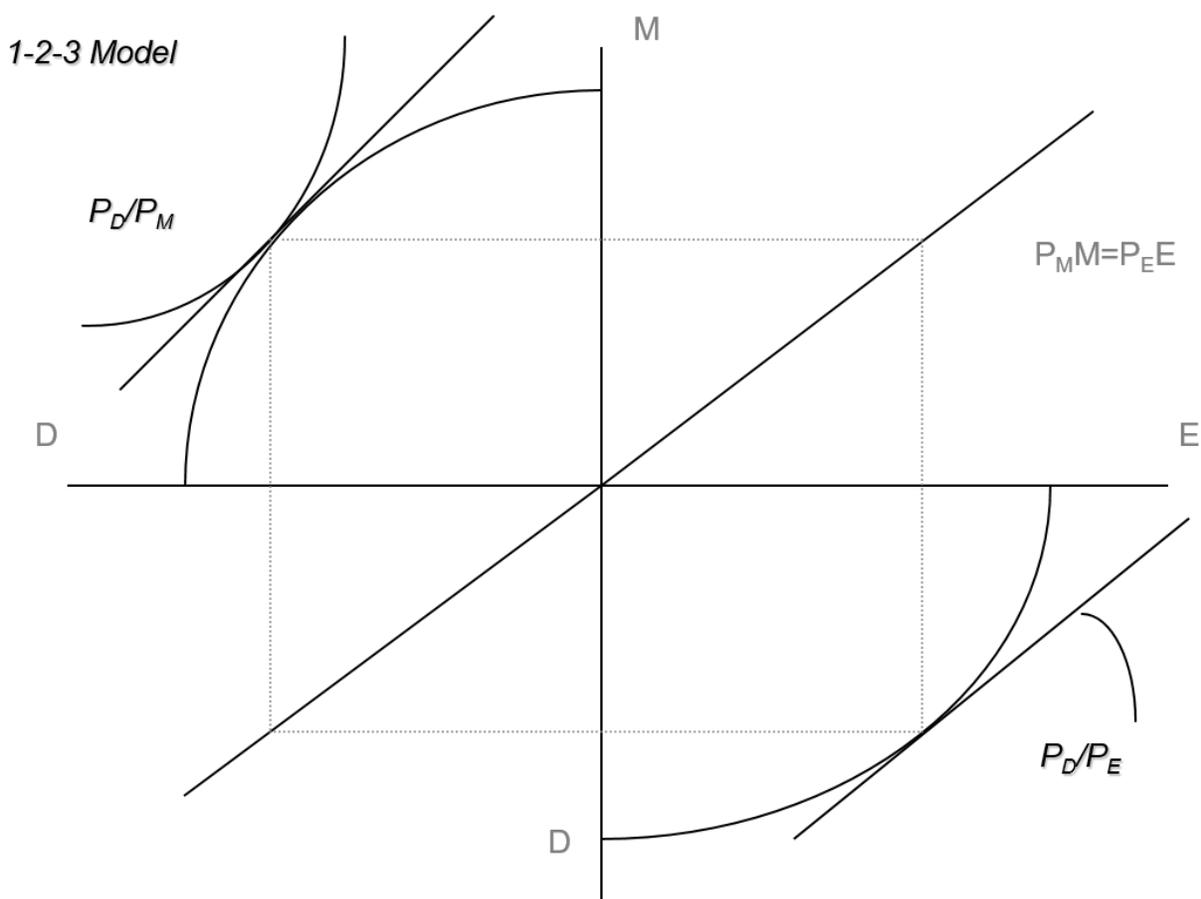
Graphical Exposition

The fundamentals of this model are illustrated in the four-quadrant diagram shown in Figure 2, which features a representative developing country (we will customize to Nigeria later). The model has two sectors that produce two commodities:

- D, domestic goods, and
- E, exports.

The third commodity, M, is imported (and not produced domestically).

Figure 2: A graphical representation of the 1-2-3 model.



Source: Devarajan, Lewis, and Robinson (1993).

Let us start in the lower right-hand quadrant of Figure 2, which has E on the horizontal axis and D on the vertical axis. This is a standard production possibilities frontier (PPF). The economy could specialize in E, at the point where the PPF intersects the horizontal axis; or it could specialize in D, at the point where the PPF intersects the vertical axis. The curved shaped of the PPF is in accordance with the law of diminishing marginal product. So, if one moves from full specialization in E to some production of D, the cost in terms of foregone production of E is relatively small because one would allocate the resources relatively best suited to the production of D. As one increases production of D, one is obliged to employ resources that are relatively less well suited to the production of D and relatively better suited to the production of E. Accordingly, as one approaches full specialization in D, the cost of additional production of D in terms of foregone production of E becomes very high.

The upper right quadrant illustrates the trade balance. The horizontal axis necessarily remains E, but the vertical axis represents M. Because E and M are aggregates (total exports and total imports), there is no natural choice of units, such as tons or litres. We can thus implicitly define units by arbitrarily setting the world price of a unit of imports and a unit of exports at one. Hence, one unit of imports buys one unit of exports. This price ratio (1/1) defines the slope of the 45-degree line in the upper-right-hand quadrant. We can also note that, when $E=0$ (full specialization in D), then

$M=0$. This implies that financial flows, B in equation (1), are equal to zero. If incoming financial flows were positive, M would be positive even if E were zero.

The upper left quadrant represents the demand side. The vertical axis (necessarily) represents M . The horizontal axis is D . The curve that looks like a production possibilities frontier is, in fact, a consumption possibilities frontier. Note that if the economy is fully specialized in E and prices of imports and exports are one, then the economy can purchase the quantity of M shown at the point where the consumption possibilities frontier (CPF) crosses the vertical axis. If the economy is fully specialized in D , then it can consume at the point where the CPF crosses the horizontal axis. In between these extremes, the CPF traces the possible combinations of D and M given the PPF and world prices.

The upper left quadrant also contains utility level curves reflecting the degree of substitutability between D and M within the macro economy. The final quadrant, lower left, simply assures demand and supply balance for D . Equilibrium is achieved where utility is maximized (highest possible utility level curve) given world prices (P_E and P_M), financial flows (B), the shape of the PPF (which defines a constant level of real GDP), market equilibrium for the supply and demand for foreign currency (the trade balance) and supply/demand balance for D .

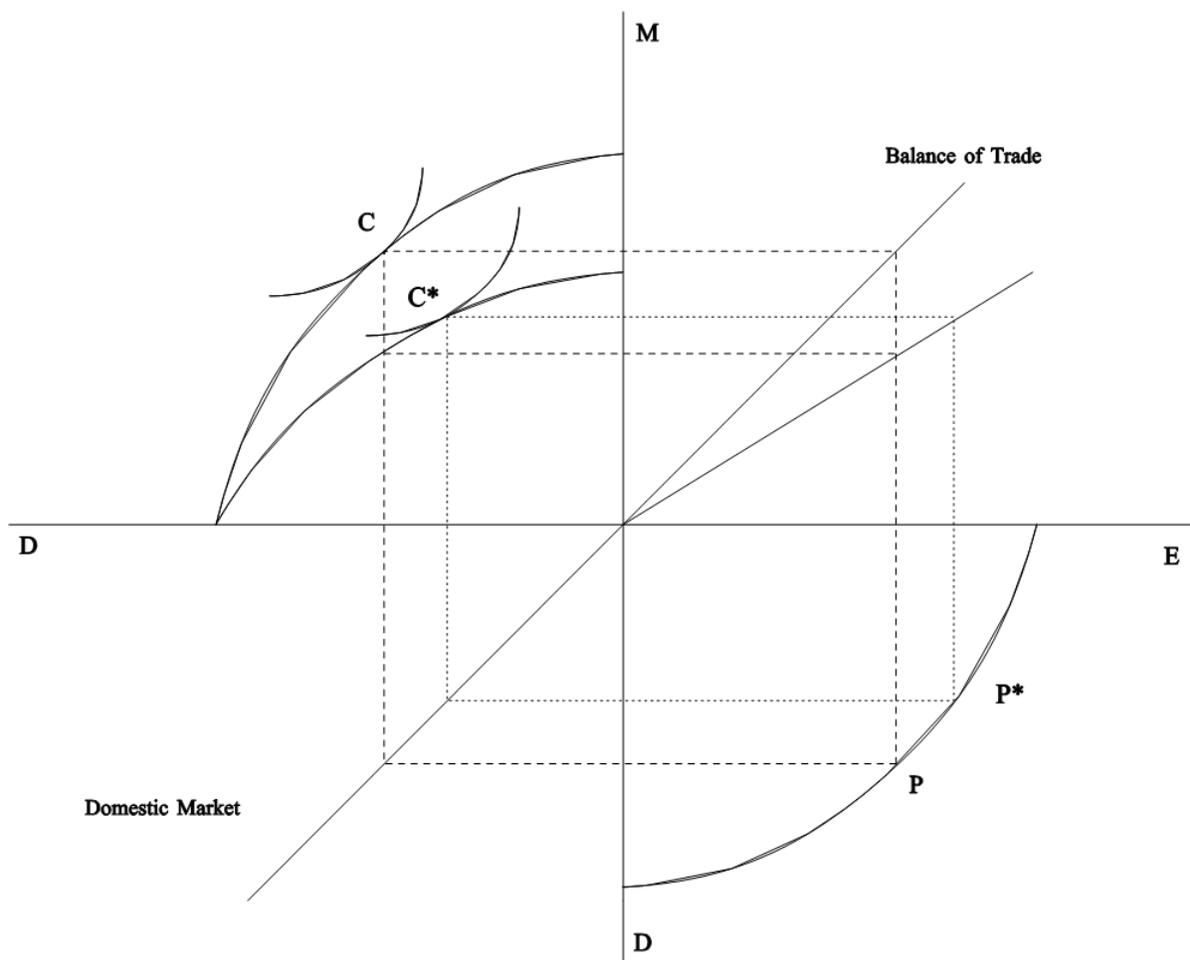
The equilibrating price variable is P_D . With P_M and P_E determined in world markets using the small country assumption, P_D determines the ratios P_D/P_M and P_D/P_E . Alternately put, P_D determines the relative price of tradeables to non-tradeables, which is the real exchange rate.

We can now shock the model. Suppose, the world price of exports declines and no additional finance for imports (financial flows or changes in reserves) are forthcoming as in Figure 3. The shift in terms of trade reduces the slope of the 45-degree line in the upper right quadrant. This new, less steep, trade balance line indicates that any level of exports buys fewer units of imports. The unambiguous negative welfare effect of the terms of trade loss is represented by the inward shift of the consumption possibilities frontier.

There are three economic adjustments of note. First, on the production side, a real depreciation, meaning a rise in the ratio of P_E/P_D , encourages a move along the PPF towards the production of more E at the expense of less D . Note that the real depreciation must offset the decline in the world price of the export good, P_E . Hence, the nominal exchange rate depreciation and/or actual decline in P_D (if there is a fixed exchange rate as was the case for Greece in the post-financial crisis period then the only mechanism for achieving a real depreciation is an actual decline in the price of non-tradeables) must be considerable in order to provide incentives that encourage production of E at the expense of D despite the decline in the world price of E .

Second, there is an income or impoverishment effect that is represented by the inward shift of the CPF. This effect reduces consumption of both D and M . Finally, there is the price effect related to the P_M/P_D ratio, which rises to encourage consumption of D at the expense of M .

Figure 3: The response to a terms of trade loss in a developing economy: 1-2-3 model.



Source: Devarajan, Lewis, and Robinson (1993).

Figure 3 is a reasonable stylized representation of the basic macroeconomic adjustment mechanisms that have occurred in Nigeria to re-establish external balance following a large world oil price decline. It is important to highlight that these mechanisms are driven by Nigeria's need for imports (formally, the curvature of the indifference curves in the upper left quadrant). If imports were not critically important to the functioning of the economy, external balance in response to a world export price fall could be achieved by reducing the quantity of exports and the quantity of imports by even more (because each export buys fewer imports). This is very sensible on the production side—the world price of the export good falls and the exporter responds by producing less of it. But, it is only possible if the implications on the import side-- far fewer imports-- are acceptable.

Like nearly all developing economies, Nigeria's economy depends critically upon imports to underpin economic activity today and to generate growth for tomorrow. Large and critical import items include fuel, food, intermediate goods, transport equipment and other capital goods. Without fuel imports, for example, the whole economy would grind to a halt in short order. If imports are critical, the macroeconomic system must work to push down imports, despite their criticality, and seeks to soften this decline in imports via a rise in the quantity exported, despite the

decline in world price. This calls for a real exchange rate depreciation, which is what happened in Nigeria from 2014 to 2016—the most recent full year for which we have reasonably complete data.

Empirical Implementation

It is relatively straightforward to implement the 1-2-3 model empirically. Table 1 illustrates the assumptions driving the model and empirical results for two simulations seeking to simulate the situation in 2016 compared to 2014, which is the model's base year. The version of the model labelled Alpha=1 is almost exactly an empirical implementation of the graphical model shown in Figures 2 and 3 (technical notes are provided in Appendix A).

Table 1: Empirical implementation of the 1-2-3 model.

	Actual			2016 Simulated			
	2014	2016	% Change	Alpha=1	% Error	Alpha=1.25	% Error
Imports	85,748	48,028	-44.0%	55,316	15.2%	48,253	0.5%
Exports	85,523	72,392	-15.4%	84,624	16.9%	72,030	-0.5%
D	477,834	496,558	3.9%	484,326	-2.5%	496,920	0.1%
GDP	563,356	568,950	1.0%	568,950	0.0%	568,950	0.0%
B (in nominal USD)	226	7,277	3126.4%	7,277	0.0%	7,277	0.0%
PWE	100	52.1	-47.9%	52.1	0.0%	52.1	0.0%
PWM	100	92.9	-7.1%	92.9	0.0%	92.9	0.0%
EXR	100	241.5	141.5%	183.0	-24.2%	212.0	-12.2%

Sources: International Monetary Fund, World Economic Outlook Database, October 2017; World Development Indicators downloaded in January 2018; Economic Report of the President (2012) for US GDP deflators; and author's calculations.

The left-hand panel of Table 1 shows actual data. Imports, exports, domestic demand (D), and GDP are reported in millions of real 2014 USD. Financial flows (B) are reported in nominal USD (millions). Indices of real import and export prices, as well as the exchange rate index (EXR), are set arbitrarily to 100. In 2014, valued in USD, trade is essentially in balance, implying that B is small relative to trade and GDP. By 2016, real export prices (principally oil prices) are estimated to have fallen by nearly 50%. Imports prices also decline relative to 2014, due principally to cheaper fuel prices.

The major effect of the terms of trade shock is a drastic reduction in import volumes. Export volumes also declined, exacerbating the shortage of foreign exchange. This was partially offset, in 2016, by a rise in net financial inflows to about 7.3 billion USD. Real GDP grew by about one percent over the two-year period, implying a decline in GDP per capita. The import compression was brought about by a large exchange rate depreciation. The observable Naira to USD exchange rate, deflated by the GDP deflator of both countries, depreciated by more than 140%. As noted in section 1, preferred actors gained access to foreign exchange at a less depreciated rate, implying a somewhat less dramatic depreciation on average.

The year 2016 is simulated by applying the 2016 world prices, GDP, and net financial flows (B) to the 2014 base and running the model to regain equilibrium (as in Figure 3). Two runs of the model

are applied. In the first (Alpha=1), the model, essentially exactly as developed in Figure 2, is shocked. This model produces results that are qualitatively not too far from the results observed.

The notable exception is in export volumes. In reality, Nigeria experienced difficulties in maintaining oil export volumes despite strong incentives to export in order to gain foreign exchange. The US Energy Information Agency, among others, pointed to disruptions as a consequence of a surge in militant attacks in the Niger Delta in 2016 (US Energy Information Agency 2016).

The simple model (where Alpha=1) is not capable of tracking this export volume decline, which is essentially due to a concurrent negative productivity shock to the export sector and an associated decline in the ratio E/D produced for given prices. To capture this, a distortion factor (Alpha) is added to the model that allows for a lower ratio of E/D. This distortion factor is set at 1.25.² With this adjustment, results are strikingly close to what is observed. The exchange rate depreciation required to achieve the outcome is approximately 112%. This is a first cut estimate of the exchange rate depreciation that would have been required had a unitary exchange rate policy, as opposed to the multi-tiered exchange rate structure actually in effect, been pursued.

The real exchange rate, the price of tradeables relative to the price of non-tradeables, is also influenced by the value of world prices, which are lower for both imports and exports. The price of the domestic good, P_D , is fixed at one. The weighted average increase in the domestically observed price (world price times the exchange rate) of P_E and P_M (relative to P_D) is about 57% in the Alpha=1.25 scenario where the weights are the shares of imports and exports in total trade in 2016. This is an estimate of the (substantial) real exchange rate depreciation, change in the price of tradeables relative to nontradeables, that was required to achieve the situation observed in 2016.

The model also provides insight on the implications for real economic welfare. The model calculates a real absorption hit of not quite nine percent (or more than 12% in per capita terms when population growth is factored in) as a result of the combined terms of trade loss and production losses due to militant attacks in the Niger delta. This is large. By way of comparison, per capita real absorption in the United States fell by approximately eight percent between 2007 and 2009 due to the global financial crisis. This was the biggest economic shock suffered by the United States since the Great Depression.

Discussion

Nigeria confronts a prolonged period of adjustment. For more than a generation, the oil sector generated large volumes of foreign exchange. Fundamental economic incentives, mainly the real exchange rate, channelled Nigerian firms into the production of non-tradeable goods (or of traded goods behind the shelter of high tariff barriers). In the absence of a long-term rebound in oil production and/or world oil prices, foreign exchange earnings from the sale of oil can be expected to remain relatively constant (with the potential for declines in world prices if rapid electrification of transport materializes on a global basis).

² The distortion factor does not map one to one to a productivity decline and should not be interpreted as a 25% decline in real oil sector productivity.

As shown in Table 1, Nigeria has already undergone massive compression of import volumes beginning from a level of only about 15% of GDP in 2014, or about half the world average share of imports in GDP of not quite 30% (World Bank 2018). Hence, the scope for import substitution was already limited in 2014 and has been compressed very significantly since then. No country in the world produces all of its own intermediate goods, transport equipment, and other capital goods. This is so because no country is best at everything. If foreign currency earnings from oil are likely to remain essentially stagnant, then additional imports must be financed through additional exports. For domestic producers to obtain progressively more of the most efficient intermediate inputs and capital goods as part of an ongoing growth process, there must be growth in exports to finance these imports.

In other words, the long-running discussion of diversification of Nigeria's export base has transformed into a growth imperative. Without rapid and sustained growth in non-oil exports and exporting sectors, it is difficult to envision a sustained and rapid growth process taking hold (barring another oil price boom). Nigerian producers, habituated to hiding from international competition via the production of non-traded goods (or hiding behind high tariff barriers as in poultry) are now faced with the task of successfully competing in global export markets.

This will be difficult. And, it will take time. Nigerian producers need to develop products of export quality at competitive prices as well as the international linkages required to market those products abroad. Outside of oil, Nigerian experience in this domain is extremely thin. Diverse agricultural products are potentially a part of the solution, especially in the relatively near term as global agricultural markets are relatively easy to enter if quality and cost are competitive. Regional service provision, such as Lagos as an airline hub and shipping center, are reasonably obvious options worthy of careful consideration. These options have the added advantage of facilitating the transport of Nigerian goods to regional and overseas destinations. Over time, Nigeria, with its large domestic market and large labor force, may have the potential to attract foreign direct investment in manufactures with potential to learn to compete on global markets.

Overall, macroeconomic policymakers in Nigeria have performed reasonably well. GDP and basic monetary control have been maintained. The economy has withstood a very large combined shock to oil prices and to oil production. The challenge, from this point forward, is to guide the transformation process. This requires exchange rate levels that provide sufficiently strong incentives to Nigerian firms to produce tradeable goods, especially exports, but not so strong that an excessive number of firms are tipped into bankruptcy (though an absence of bankruptcies is a sure indicator of inadequate transformation pressure).

Looking forward, a review of the border and other policy measures that influence trade is merited. This review should seek to inculcate the outward-looking perspective that is required for growth in the current environment and for the foreseeable future. It should focus industrial policy on sectors with real potential and consider means to limit the implicit tax on exporting that is inherent in excessive import protection.

References

Devarajan, Shantayanan, Jeffrey D. Lewis, and Sherman Robinson. "External shocks, purchasing power parity, and the equilibrium real exchange rate." *The World Bank Economic Review* 7.1 (1993): 45-63.

International Monetary Fund. Electronic data. Accessed January 2018.

United States Council of Economic Advisors. *Economic Report of the President*. (2012). Washington DC.

United States Energy Information Agency. "Crude oil disruptions in Nigeria increase as a result of militant attacks." <https://www.eia.gov/todayinenergy/detail.php?id=27572> (August 2016).

World Bank. Electronic data. Accessed February 2018.

Appendix A – Technical Notes

For the production possibilities frontier, the empirical implementation assumes a constant elasticity of transformation (CET) equation with a transformation elasticity value of 0.5. The CET non-linearly disaggregates GDP into exports E and domestic products D. Composite consumption is obtained using a constant elasticity of substitution function with a substitution elasticity value of 0.85. Composite consumption is interpreted as real absorption. It is a non-linear aggregate of imports M and domestic demand D.

In the CET function and its first order condition, E is multiplied by the distortion factor, alpha. When alpha is equal to one, the distortion factor has no influence. Values greater than one correspond to a reduction in the ratio of E produced relative to D for a given set of prices.

Acknowledgements: Financial support from the United States Agency for International Development (USAID). The views expressed are those of the authors who are solely responsible for the content.