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The Challenge of Job Creation in Nigeria

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Abstract

In this paper attempt is made to show the structural nature of jobless growth in Nigeria. This is done from the perspective of, firstly, structural transformation and its effect on the resultant sectoral composition; secondly, from labor market dynamics; and thirdly, from production organization of sectors that are driving GDP growth. We found that the rate of unemployment rose by 1.1% a year between 2000 and 2010. This is caused, on the supply side, by a 2.5% annual increase in the number of new entrants into the labor market; and on the demand side, by sectors' inability to create sufficient number of jobs. Job creation increased only by 1.4% a year. We attributed this to capital intensive growth as seven of the nine broad sectors studied are capital intensive and together they accounted for 61% to 74% of the GDP growth. In addition, the structural nature of jobless growth is evident on country's employment intensity of growth. We found that, under business as usual scenario, the country need to grow by double digit to create 1.8 million jobs annually, equivalent to those that newly enter the labor force every year. The paper makes the following policy recommendations: in the short term, more jobs can be created by targeting support in sectors with proven high employment absorption capacity, demonstrated by their high employment multiplier; in the medium term, by promoting Domestic Value Chain Development/value addition guided by existing backward linkages and forward linkages; and in the longer term through a concerted effort that channels support to weakly integrated but deserving sectors to ensure their integration with other sectors of the domestic economy. This will ensure that growth is broad based as it makes sectoral growth contribute to overall growth over and above direct contribution to total GDP growth.

1 | Introduction

Nigeria is one of the fastest growing economies in Africa, with average GDP growth rate of between 5% and 6% between 2000 and 2011. This growth has happened together with structural transformation; however, it has not translated into a reduction in rate of unemployment; ironically unemployment

surged from about 11% in 2000 to over 23% in 2011.

The government of Nigeria, has put in place various policy measures to reverse this. It introduced policies to reform the restrictive investment climate that dominated the period between 1962 to

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the return to democracy in 1999 which ushered private sector led growth strategy. Recent policy measures that supported this included the National Economic Empowerment Development Strategy (NEEDS) adopted in 2003. NEEDS gave way to Vision 20:2020 of 2009 which inspired successive National Development Plans and the Transformation Agenda of 2011-2015. The latter, among others, made economic development and inclusive growth its overarching development agenda which made job creation an integral part of sector level reforms. In addition, programs managed by the Federal Government level, aimed at supporting job creation were introduced. This included, inter alia, the Subsidy Re-investment and Empowerment Program (SURE-P), which comprised Community Service Scheme and Graduate Internship Scheme; and the Youth Enterprise with Innovation in Nigeria (YouWiN!) program, which comprised the Conditional Cash Transfer (CCT), vocational Training, Public Works and Science and Technology. Many of the above policy initiatives are new thus it is too early to assess their overall employment impact. However, we believe that jobless growth in Nigeria is structural in nature, thus a broader framework that takes cognizance of this is required to reverse the situation.

The remaining part of this paper is organized into three sections. Section two looks into the role of sectoral composition, during structural transformation, on employment creation. This is done by reviewing the experiences of successful comparator countries with a view to drawing useful lessons. This is followed by section three where the structural nature of jobless growth is explored from the perspectives of labor market conditions and sector level production organization. Further it gives policy options to reverse the jobless growth situation. Finally, section four gives summary and conclusions.

2 | Structural Transformation versus Employment Creation

Both theoretical and empirical literature establish that structural transformation could be both the cause and effect of economic growth (Timmer, 2012). It is the outcome of a rise in capital accumulation in growing sectors which eventually result in productivity differentials across sectors and become a cause for flow of labor and resources out of the primary to the secondary and tertiary sectors. These coupled with changes in demand patterns (the workings of the Engle law) would result in a reduction in the share of agriculture in total GDP. The effect of this on employment would come from

a rise in demand for labor in the growing sectors. This would alter existing distribution of employment in favor of growing sectors and ultimately result in a rise in total employment. In this section, common definition of structural transformation is adopted to ascertain, the presence or lack thereof of structural change in Nigeria. This is then followed by comparison of Nigeria's experience with comparator countries in terms of the nature and pattern of structural transformation.

A country is said to have undergone structural transformation when the following four conditions are met: (1) declining share of primary sector in both GDP and employment; (2) rapid urbanization as people migrate from rural to urban areas; (3) emergence of modern secondary and tertiary sectors; (4) demographic transition from high to low rates of births and deaths takes place. However, when this happens, agriculture's value added should increase in absolute terms. This entails a rise in agriculture's productivity; at a rate lower than that in the growing sectors (industry and service) to allow flow of labor from agriculture to high productivity sectors.

In Nigeria, many of the conditions for structural transformation are met, though mildly. Table 1 shows that the share of the primary sector in GDP and employment fell from 46% in 2000 to 30.6% in 2010 (condition 1); the country has seen significant increase in rate of urbanization, it rose from 16% in 1970 to 40% in 2010 (condition 2); the service sector is increasing in importance in GDP and employment, its share rose significantly from 29% and 42% in 2000 to 52% and 56% respectively in 2000 and 2010 (condition 3); and the country has undergone little demographic transition, birth and death rates per 1000 population have fallen, but not significantly so, from 46 & 20 in 1990 to 39.9 and 14.3 in 2012 (Trading Economics, 2014).

In addition, change in labor productivity, defined as the ratio of sectoral output to input, driver of inter-sectoral flow of resources and labor, and thus supposedly a root cause for sectoral variations in GDP and employment shares has occurred in anticipated direction. Table 1 shows that labor productivity rose across sectors between 2000 and 2010; but growth was relatively rapid in the service sector compared with other sectors. It rose fifteen fold in services, much higher than the seven fold increases in agriculture and industry. Therefore, it can be argued based on the above data that structural transformation is taking place and it is service-led.

Available literature does not dispute the link between structural transformation and growth. The literature further

Table 1 Indicators of Structural Transformation in Nigeria

	2000			2010		
	GDP %	Employment %	Productivity	GDP %	Employment %	Productivity
Agriculture	34	46.1	0.07	24	30.6	0.88
Industry	37	12.2	0.29	24	13.6	2.1
Services	29	41.7	0.07	52	55.8	1.03

Source: Own Computations Based on Data from various sources.

underscores that the effect of structural transformation on the resultant sectoral composition matters on whether growth is employment creating or not. Sectoral composition that favors labor-intensive growth would affect employment positively than would be the case otherwise. The paragraphs that follow compare growth experiences of emerging/fast growing resource based Asian economies - Indonesia and Malaysia - with Nigeria to check if any discernible difference emerges from their experiences in structural transformation.

In Malaysia and Indonesia, like in Nigeria, structural transformation resulted in larger service sectors (Figure 1). The share of the service sector rose from 45% to 58% in Malaysia; 31% to 38% in Indonesia; and 32% to 51% in Nigeria. However, growth was significantly higher and faster in Nigeria, compared with comparator countries. Is the fast service sector growth in Nigeria justified by country's level of economic development? Badiane (2012) argues to the contrary; he found that in Western and Central African Countries, service sector growth is faster than is normal under successful transformation.

As is expected in any structural transformation process, the share of agriculture in GDP fell by more than three-fold from 25% to 7% in Malaysia; more than three-fold from 57% to 15% in Indonesia; and by about two-fold from 55% to 24% in Nigeria. However, industry's performance over the period was mixed. It showed a distinctly upward trend in Malaysia and Indonesia, but it fluctuated within a lower band in Nigeria (Figure 1). It is also interesting to note that the share of manufacturing, a sub-sector within the industry sector, rose in Indonesia and Malaysia whilst it more or less stagnated in Nigeria (Figure 1). This has to do, among others, to favorable manufacturing policies followed by Malaysia and Indonesia.

In addition, it is apparent from Figure 1 that the contribution of manufacturing to GDP over the period studied was the lowest in Nigeria. It ranged from 2% to 9% in Nigeria against 10% to 28% in Malaysia; and 8% to 25% in Indonesia. From

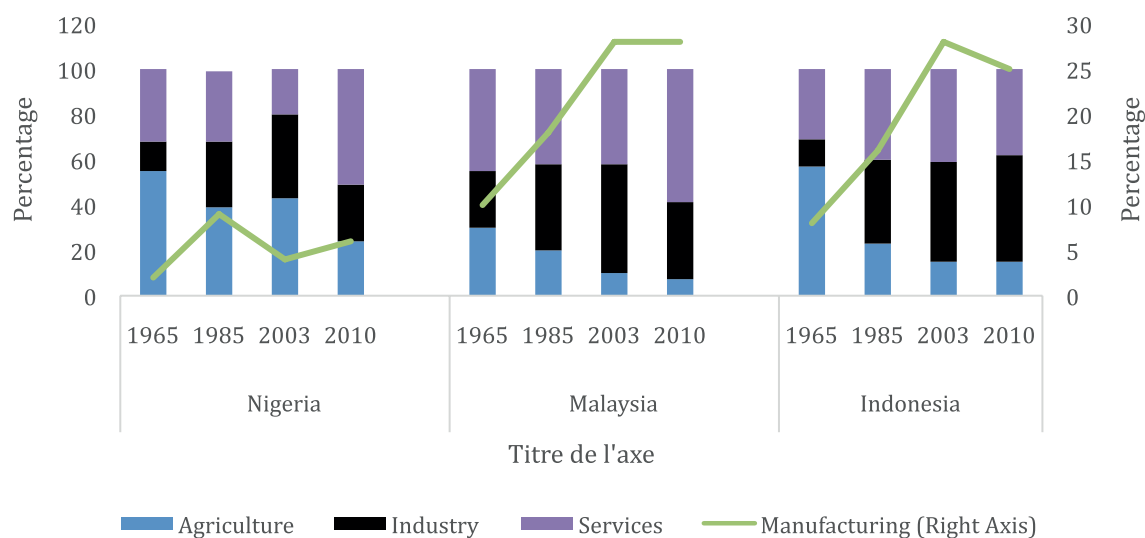
the aforementioned, it can thus be argued that this positive correlation between structural change and the resultant sectoral composition that favors industry and manufacturing is apparent in comparator countries but was lacking in Nigeria.

The effect of this divergent sectoral compositions is evident on employment. Comparator countries were able to contain rate of unemployment at lower ranges; but this was not so in Nigeria where it jumped from 13% in 2000 to 23% in 2011. This surge occurred during its period of service sector-led growth.

Why is growth in Nigeria service sector-led? Why is it that industry had limited role to play in the structural transformation process? A number of factors could be mentioned in this regard. The unfavorable policy environment for industrialization could be one. The successive development strategies that spanned the period from 1962 to 1999 were not supportive of industrialization. For example, the First National Development Plan (NDP) from 1962-1968; Second NDP, 1970-1974; Third NDP, 1975-1980 all had, as their overarching development strategy, industrialization through import substitution, in line with the development paradigm of the time. However, they were implemented in an environment that restricted foreign ownership in a wide range of economic activities including basic manufactures. The restriction was made tighter with the introduction of indigenization decrees in 1972 and 1977, under the Nigerian Enterprise Promotion Decree (NEPD) which reserved some business activities exclusively to Nigerians.

Since the mid-1990s, the development strategies have somehow taken lesson from past policies and experiences. This was reflected in successive government policies and programs - the National Economic Empowerment Development Strategy (NEEDS) of 2003; Vision 20:2020, a long term plan introduced with the objective of making Nigeria one of the 20 largest economies in the world by 2020; various

Figure 1 Economic Structure in Nigeria and Selected Comparator Countries



Source: Own Computation Based on WDI Data.

Annual Development Plans; the Transformation Agenda (2011-2015) and other federal and state managed job creation initiatives.

In addition to policy constraints, the role of structural impediments in the outcome of structural transformation cannot be underestimated. In view of this, the government is busy preparing a 30-year National Integrated Infrastructure Master Plan (NIIMP). In addition, on the policy front, reforms are underway in the power, transport, water and sanitation, etc.

Be that as it may, one could argue the structural nature of unemployment situation in Nigeria. Thus, policy support that target changing the current employment-GDP growth nexus or technically the employment intensity of growth is necessary. This can be achieved by promoting either labor-intensive growth or making growth broad based through Domestic Value Chain (DVC) development. This will ensure that the growing sectors induce growth in other sectors and contribute to broader economic growth over and above their direct contribution to total output.

Domestic Value Chain Development entails improving Hirschman-type production linkages of backward linkages

and forward linkages. Backward linkages occur when sectors are vertically integrated with upstream sectors. It leads to an increase in the demand for the output of upstream sectors. The additional demand created in upstream sectors could in turn result in increased capacity utilization, investment or upstream technical upgrade. The effect of backward linkages on the economy and employment becomes larger the smaller the proportion of sector's value added to its output compared with intermediate inputs; the higher the proportion of intermediate inputs that is domestically sourced relative to imported; and on the nature of the sectors with which it is backward linked and their own backward linkages.

Forward linkages on the other hand occur through sectors' impact on downstream sectors by lowering the cost of their outputs which are used as intermediate inputs by downstream sectors. This could cause increase in productivity, investment and capacity utilization in downstream sectors. The economy wide effect of forward linkages depends on the proportion of final output in total output and on the nature of the sectors with which it is forward linked and their own forward linkages.

3 | Structural Factors Constraining Employment Creation in Nigeria

In this section, the conceptual template introduced towards the last part of the previous section is used to examine causes of jobless growth in Nigeria. This will be done in two ways. Firstly by examining the situation from the perspective of labor market dynamics – broad analysis of demand for and supply of labor. Secondly, by treating the structure of the Nigerian economy as possible cause for the poor GDP growth and employment mix.

The situation in the labor market will be examined using employment data obtained from various sources – National Bureau of statistics (NBS), World Development Indicators (WDI) and other sources. On the other hand, the structure of the Nigerian economy and its effect on employment will be examined using a Social Accounting Matrix (SAM) to calculate multipliers, among others, output, demand, GDP, employment, backward and forward linkage indices, etc. Here the 46 sectors are grouped into nine broad sectors: agriculture (4); manufacturing (13); Oil & Gas (1); Mining (3); Construction (1); Utility (2), constituting electricity and water supply; transport (10); trade (2) constituting, trade and accommodation and food services; and 'other services' (10). In addition, we calculate the coefficient for employment intensity of growth for Nigeria which will be used to run scenarios to have a glimpse of the difficulty of creating the

required number of jobs every year under business as usual assumption.

The working age population, between 15 to 64, rose yearly on average by 1.7 million (2.8% average increase) between 2000 and 2010. On average, 1.5 million of them entered the labor market for the first time (2.5% average increase). Conversely, the economy could create only 0.66 million new jobs a year (a 1.4% yearly average increase). This demand and supply imbalance in the labor market contributed to average rise in the number of unemployed by about 0.8 million a year (i.e. equivalent to a 1.1% rise in rate of unemployment per year) [See Figure 2]. According to recent estimates by NBS, the average number of new entrants into the labor force is currently estimated at 1.8 million a year against 1.1 million new jobs created, adding about 0.7 million people to the rank of unemployed a year.

The majority of the unemployed, according to the 2010 NBS's national manpower Stock and Employment Survey, are the youth, falling within the 15-24 age cohort; they are female; they reside in rural areas; they have some form of education; and they come from relatively poor states. The rate of unemployment was more than national average in 2010 in 21 of the 36 states. Many of these states come from under developed North East and Southern parts of the country. Overall, unemployment has worsened in almost all states in 2010 compared with 1999 (Figures 3a and 3b).

Figure 2 New Entrants to Labor Force versus New Jobs Created, %

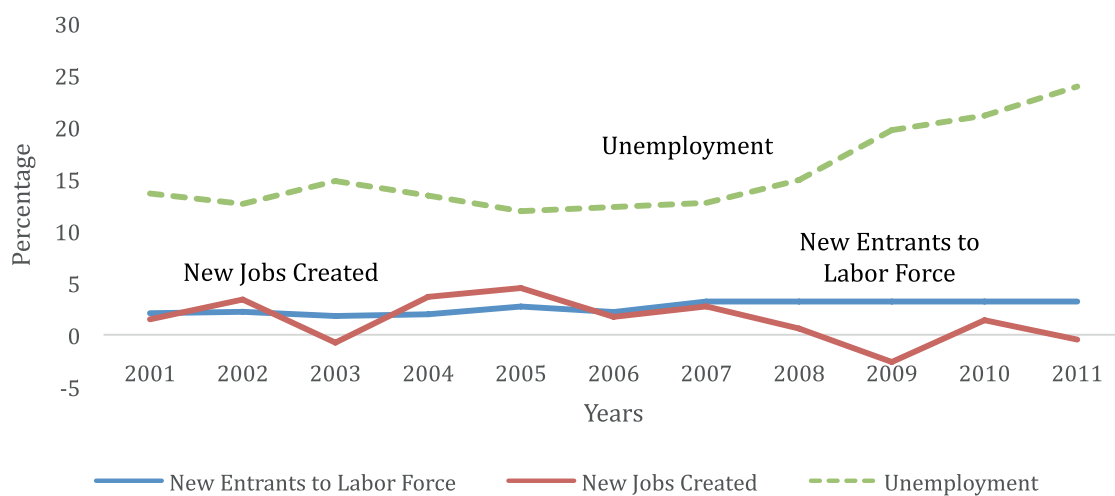
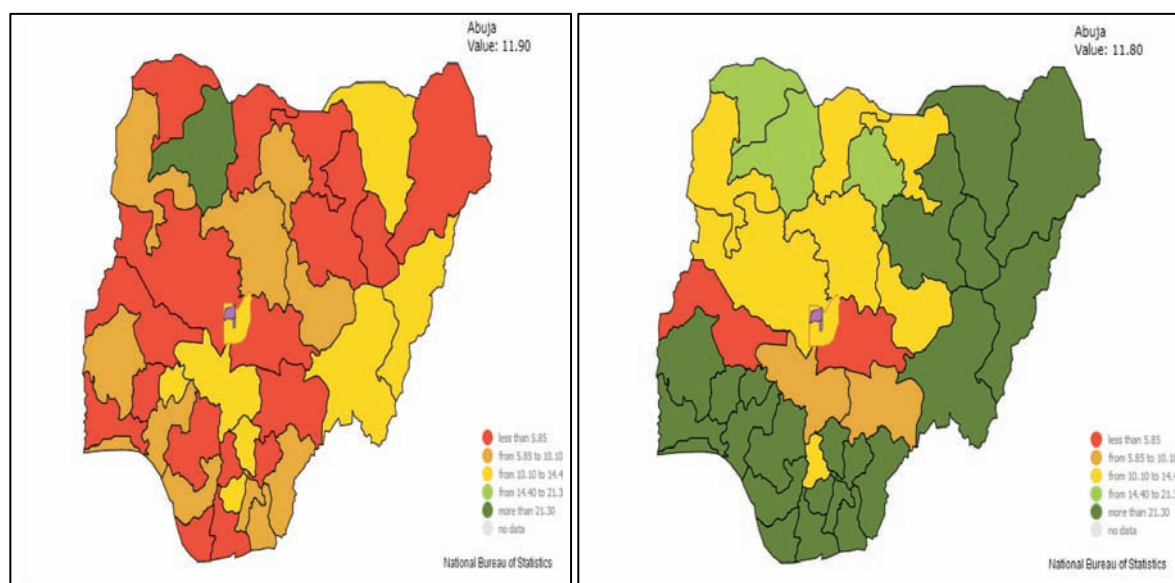


Figure 3 Change in the Rate of Unemployment between 1999 and 2010



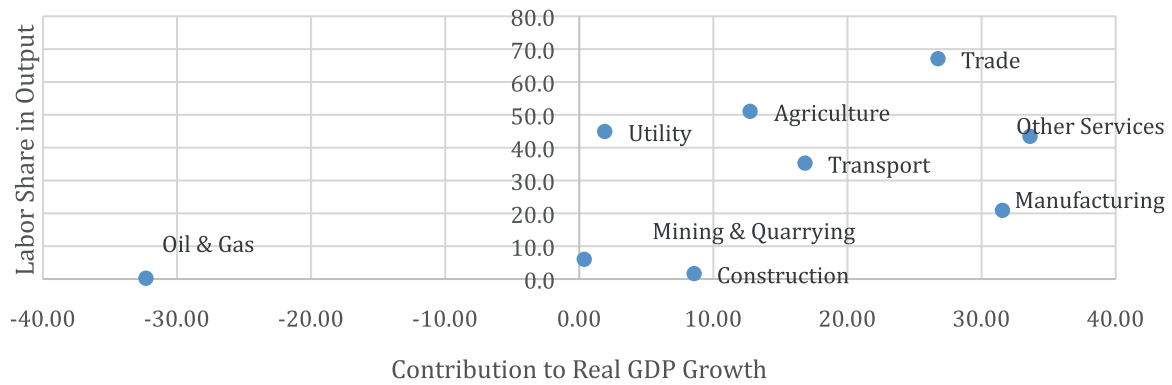
Source: National Bureau of Statistics.

In addition to the labor market dynamics, the structural nature of jobless growth in Nigeria is evident from the nature of production organization in sectors driving GDP growth. Figure 4 gives scatter gram between decomposed sectoral GDP growth contributions and sectors' labor share in output (a measure of labor intensity). It shows that in 2013, 'other services', manufacturing and trade accounted for 34%, 32% and 27% of the 5.4% real GDP growth. However, except trade which is labor intensive, the others are not. Agriculture, the only other labor intensive sector accounted for only 12% of the GDP growth. In general, seven of the nine sectors studied are capital intensive sectors. Together, they accounted for over 61% to 74% of the GDP growth between 2010 and 2013. Thus it can be safely argued that growth in Nigeria has been driven by capital intensive sectors.

The low response of employment to GDP growth can also be qualified by Nigeria's very low employment intensity of growth.

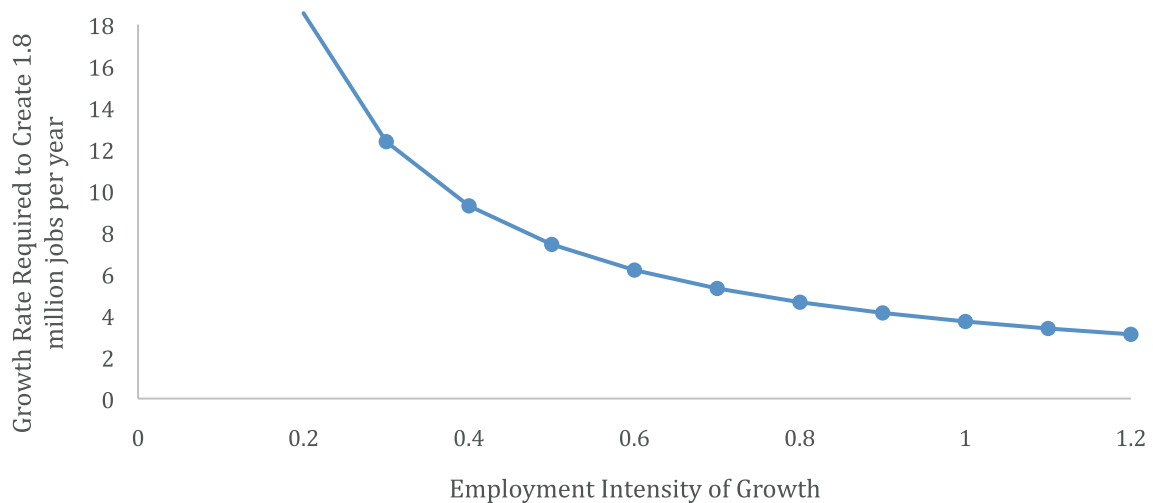
Employment intensity of growth measures the impact on employment of a 1% growth in GDP (i.e. $\Delta E / \Delta GDP \times GDP/E$, where Δ stands for change & E employment). We calculated an employment intensity of growth of 0.3% for Nigeria using average yearly growth in employment of 1.4% and a conservative average GDP growth rate of 5% between 2000 and 2010. This means that for every 1% GDP growth realized during the period, a 0.3% employment growth was achieved. If the 0.3% employment intensity of growth is true, it implies under business as usual assumption, the Nigerian economy has to grow by double digit to create the required number of 1.8 million new jobs a year (Figure 5). This is a difficult task given the 5% average GDP growth performance achieved hitherto. Therefore, the feasible option remains altering the current GDP and employment growth nexus to be able to create the required number of jobs a year using a single digit GDP growth rate. For example, the employment intensity of growth has to be doubled from 0.3% to 0.6%, if the required number of jobs are to be created using a GDP growth rate of 6% (Figure 5).

Figure 4 Labor Intensity versus Growth Contribution of Sectors



Source: Own Computation based on 2006 SAM and NBS Data.

Figure 5 GDP growth versus Employment Creation- projection under business as usual Scenario



Source: Own Computation using data from NBS.

Given that unemployment is a structural problem in Nigeria, what policy options need to be pursued in the short, the medium to the longer term to reverse the jobless growth situation? In the short-run, policy options could focus on supporting sectors with high labor absorptive capacity or with demonstrated high employment multiplier effects. This was pursued, for example, in South Africa to reverse jobless growth experienced in the mid to end 2000s (Alemu, 2011). The program targeted investing in infrastructure in selected sectors with high labor absorptive capacity. Similarly, targeted investments were made by some developed economies to stimulate their economies during recessions and in times of sluggish growth in the years that followed.

Table 2 identifies sectors with high employment multiplier in Nigeria. The multipliers were calculated based on a Social Accounting Matrix developed by the author for Nigeria. Detailed results on multipliers other than employment such as output, demand and GDP are provided in Annex 1a. According to the results found, the trade, agriculture, 'other services' are ranked in the top three. For example, the employment multiplier for agriculture is 8.8 (column 2, Table 2). This means, for every one extra person employed in agriculture, 7.8 additional jobs can be created in other sectors. Combining employment multiplier with total employment (column 4, Table 2) we calculate the total effect of a 1% change in employment on the Nigerian economy (Table 2, column 6). In the case of agriculture, a 1% change in agriculture employment results in a total increase in employment by 1,305,717. Similarly, 1% changes in employment in trade, other services and construction sectors could result in total increase in employment by 1,749,645, 771,443 and 76,552 respectively.

These sectors are also ranked in the top three in the sizes of their output, demand and GDP multipliers (Annex). This could mean that investments in these sectors will have wider socio-economic implications as their effect would be higher on additional output produced, demand created, and household income earned. Thus, given their high level of integration with the domestic sectors (Figure 6) and that they are less import penetrated (Annex 1b) their potential to employment creation through second and higher level round effects would be greater. A 1 million Naira investment in agriculture would cause aggregate supply to increase by N2.9 million and aggregate demand by N3.6 million. The difference N0.7 million, equivalent to 23% of the domestic supply, would be covered through imports. This is much lower than what would be obtained from sectors with lesser employment multiplier.

Policies that promote investment in manufacturing, ranked 5th in employment multiplier, but 4th in total effect due to its size in employment; and transport, ranked 6th in employment multiplier but 5th in total effect could also contribute to creation of more jobs.

In the medium to the longer term, policy support could target addressing structural bottlenecks. This entails, among others, supporting upstream and downstream integration of sectors through Domestic Value Chain (DVC) development. This would ensure that sectoral growth contributes to overall economic growth over and above the direct contribution of sectoral growth.

Figure 6 provides information on the current state of backward linkages and forward linkages among sectors in the Nigerian economy. It lists key sectors, those that are strongly

Table 2 Total Effect of 1% Change in Sector Employment

Sector	Employment Multiplier		Employment		Total Effect		
	Value	Rank	Number	% total	Effect	Rank	% total
Agriculture	8.8	2	14837693	30.6	1305717	2	29.7
Manufacturing	6.3	5	5337000	11.0	336231	4	7.6
Oil & Gas	2	9	21797	0.0	436	9	0.0
Mining	4.2	8	124691	0.3	5237	8	0.1
Construction	6.7	4	1142569	2.4	76552	6	1.7
Utility	4.9	7	239388	0.5	11730	7	0.3
Transport	5.8	6	2478696	5.1	143764	5	3.3
Trade	11.8	1	14827497	30.6	1749645	1	39.8
Other Services	8.1	3	9523988	19.6	771443	3	17.5

Source: Own Calculations based on 2010 NBS employment data.

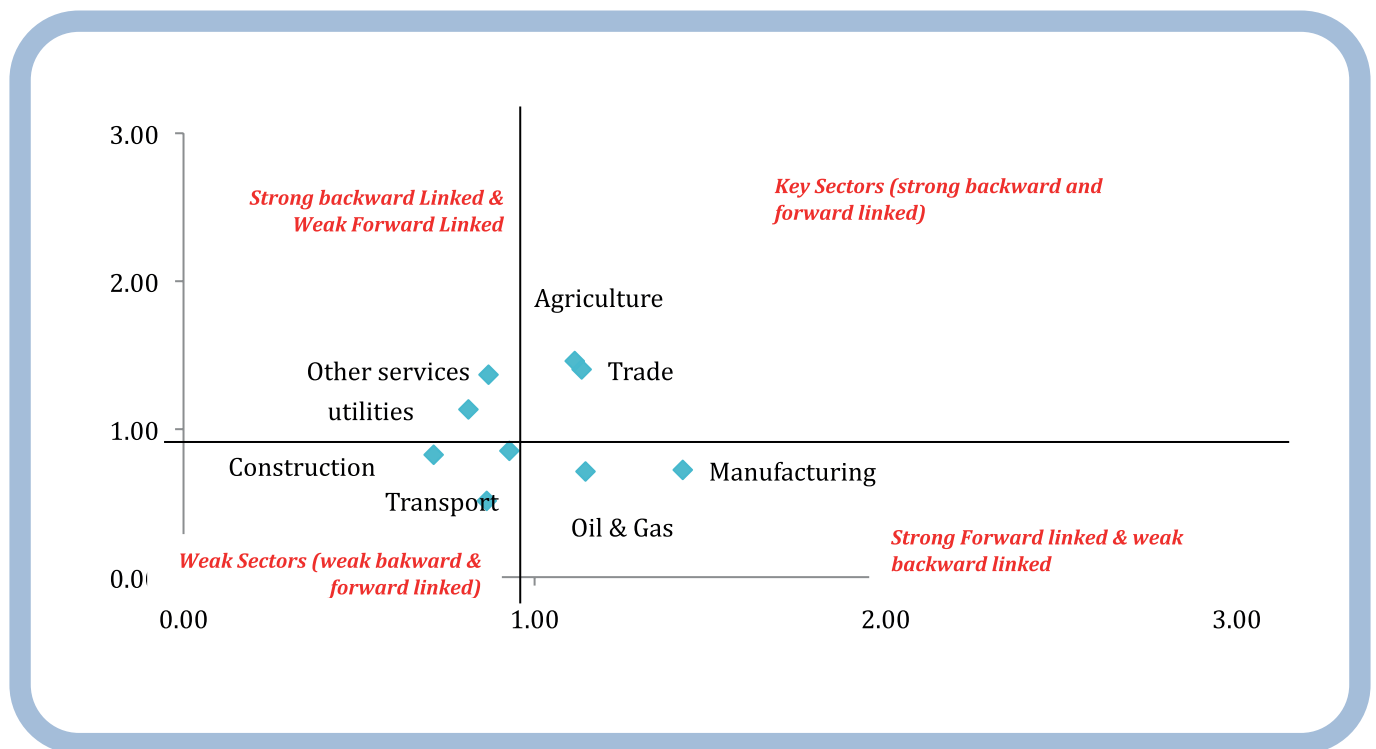
linked with downstream and upstream sectors, in the top right quadrant; those with only strong backward linkages in the top left quadrant; weak sectors, those weakly integrated with upstream and downstream sectors, in the bottom left quadrant; and those only strongly forward linked in the bottom right quadrant. It shows that agriculture and trade are the only key sectors.

Agriculture and trade are also ranked in the top two in employment multiplier; 8.8 for agriculture and 11.8 for trade.

They are characterized by relatively higher value-addition to output ratio, 0.84 for agriculture and 0.73 for trade; and they are less import penetrated, 5.4% in agriculture and almost 0% in trade (Annex 1b). Therefore, support to these sectors, especially agriculture, that capitalizes on existing linkages and that can further strengthen it through value chain development has high potential for broad based growth and job creation.

Figure 6 further shows that the construction, transport and mining sectors are weak sectors whilst the remaining are

Figure 6 Backward and Forward Linkages of Sectors



Source: Own Computation.

either strongly integrated with upstream or downstream sectors. For example, the manufacturing and oil and gas sectors are strongly integrated with downstream but weakly integrated with upstream sectors. On the contrary, the 'other services' and utility sectors are strongly integrated with the upstream but weakly integrated with the downstream sectors. The results point to the need to pursue diverse policy options but with unified objective of broadening sources of economic growth with job creation at the center. For example, in the case of sectors with only forward linkages but no backward linkages such as manufacturing and Oil and Gas (Figure 6), enforcing local content policies for manufacturing and building

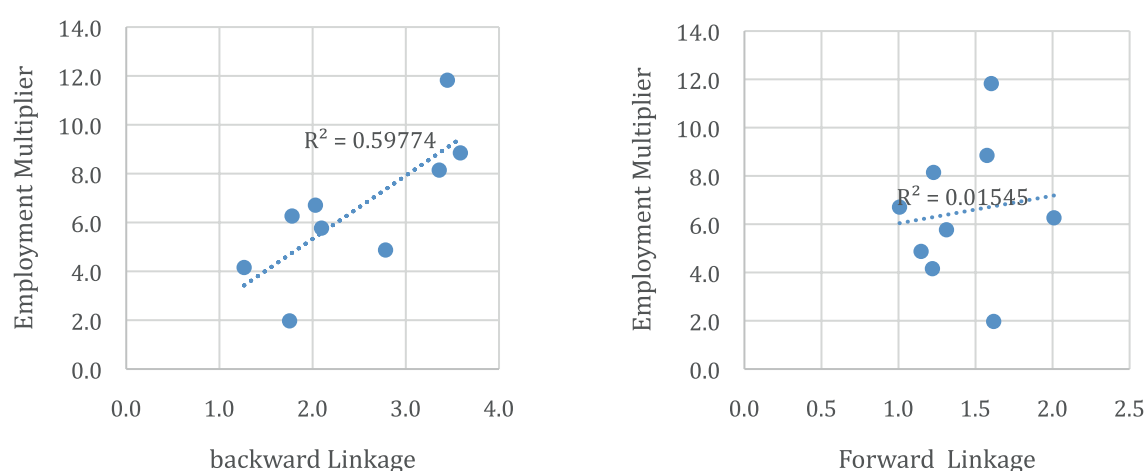
capacity of local refineries could promote value addition and thus Domestic Value Chain Development. In the case of sectors with weak forward linkages, for example mining, policy could target beneficiation.

Figure 7 compares current state of relationships between sectoral linkages and employment. We find positive (but weak) correlation between backward linkages and employment; but result is inconclusive between forward linkage and employment. This is to be expected given that the majority of these sectors are backward linked with agriculture, trade and 'other services', which in turn have

strong backward linkages with other sectors of the economy (Annex 2). The weak or seemingly indeterminate correlation between forward linkages and employment can be explained by the fact that much of the sector's output is not used as intermediate inputs by other sectors but destined for final

consumption. The results once again support the role of structural factors in the poor performance of the Nigerian economy in job creation. Hence, the need for a focused policy that promotes sectoral integration to support domestic value chain development.

Figure 7 Backward and Forward Linkages of Sectors



Source: Own Computation.

4 | Summary and Conclusion

In this paper, attempt is made to analyze the reasons for jobless growth in Nigeria. We find that Nigeria has experienced mild structural transformation. Its path of structural transformation has similarity with comparator countries in that it is service sector led. However, stark differences are apparent in sectoral compositions during structural transformation. We find that in the comparator countries, growth was not confined to service sector alone; industry also played a significant role. However, this was not the case in Nigeria for many years. The share of the service sector rose significantly compared with comparator countries.

This happened without a concomitant rise in industry and manufacturing, sectors touted major drivers of labor-intensive growth at least in the early phases of structural transformation. This is attributed to among others, unfavorable policy environment for industrialization that dominated the period between the implementation of the first National Development Plan in 1962 to 1999.

Having established that sectoral composition played important role for jobless growth, we then attempted to analyze underlying causes of jobless growth from sector perspectives. A look at labor market dynamics indicated that on the supply side, rate of unemployment is in part caused by

demographic factors. Our estimates show that between 2000 and 2010, the number of new entrants into the labor force increased by 2.5% per year. This was much less than the 1.4% average increase in the number of new jobs created, contributing to a 1.1% per year increase in rate of unemployment.

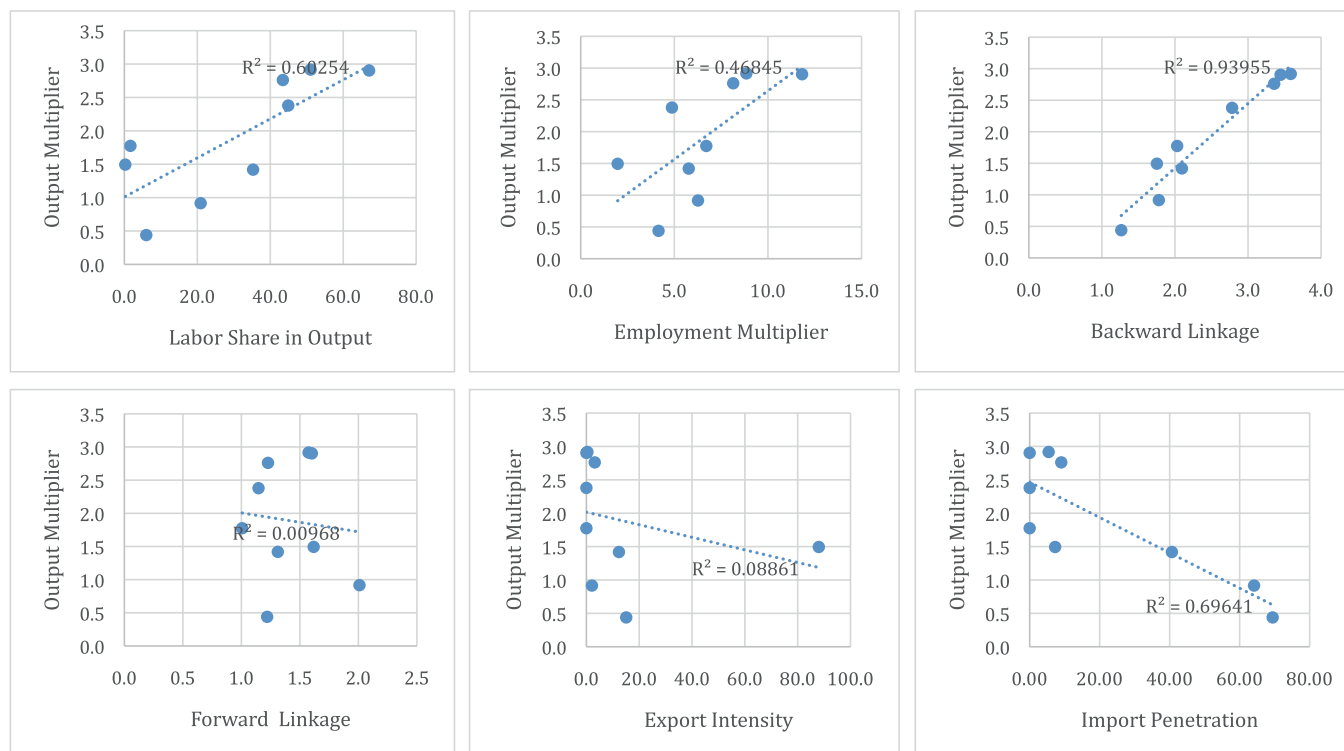
We also looked at the effect of structural factors on job creation potential of sectors. We found that growth in Nigeria has been less of labor intensive sector driven. For example between 2010 and 2013, the period after rebasing of Nigerian GDP, seven out of the nine broad sectors studied are less labor intensive and they accounted for 61% to 74% of the GDP growth realized during the period. In addition, to see the extent of the impact of structural constraints in job creation, we computed employment intensity of growth of 0.3 for Nigeria. A 0.3 employment intensity of growth implies that under a business as usual scenario, Nigeria's GDP must grow by double digit to create at least 1.8 million new jobs a year. This is a difficult task considering the average 5% GDP growth that has been realized since 2000.

Based on the above results, we provide the following policy recommendations to reverse the jobless growth situation and ensure that sectoral growth contributes to overall economic growth over and above the direct contribution of the sectoral growth to output. Firstly, in the short term, policy

should target supporting sectors with proven high employment creation potential. The agriculture sector should be major beneficiary of such programs because of its relatively high output and employment multiplier effects. The latter resulting from its relatively labor intensive production organization and its strong linkage effects, upstream and downstream, with almost all sectors of the economy. Secondly, in the medium term, focus should center on domestic value chain development guided by existing backward and forward linkages. This requires nurturing sectors with proven strong backward and/or forward linkages. Ongoing efforts by the Federal Ministry of Agriculture, guided by its Agricultural Transformation Agenda (ATA), to create Staple Crop Processing Zones (SCPZ) is a move in the right direction. However, such effort need to be sustained and expanded to other sectors of the economy as well. Lastly, in the longer term, support should be extended to less linked sectors due to structural constraints and lack of conducive policy environment by designing policies that address their circumstances to ensure their integration with other sectors of the domestic economy. One policy implemented by many countries, including members of World Trade Organization (WTO), to promote employment creation, is a procurement policy that promotes local content. In Nigeria, there is a local content policy; however, its implementation is limited to certain sectors. In addition, it is one of those policies less enforced.

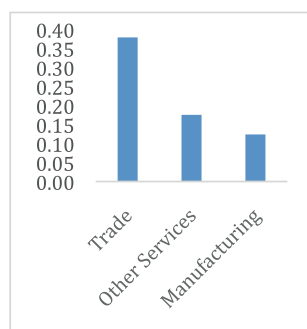
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Annex 2: Relationships – output multiplier, employment multiplier and others

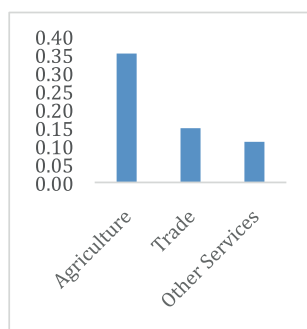


Source: Own Computations Based on 2006 SAM.

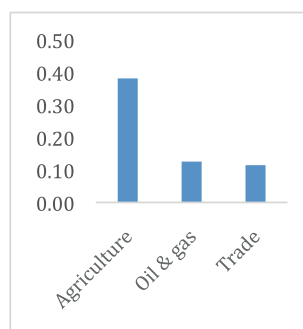
Annex 3: Sources of Backward linkages



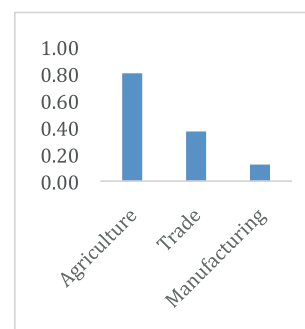
Agriculture



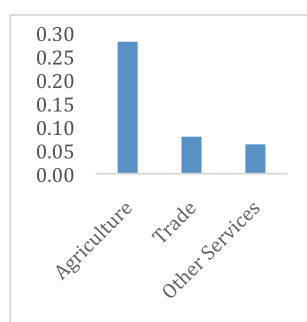
Construction



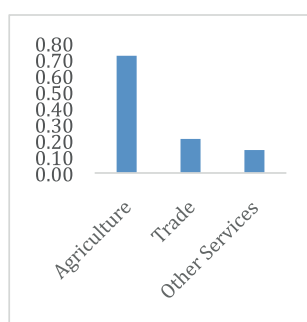
Transport



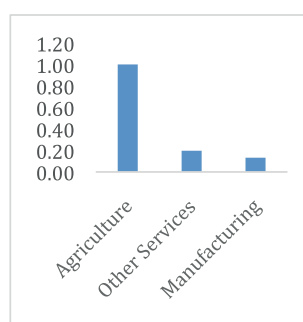
Other services



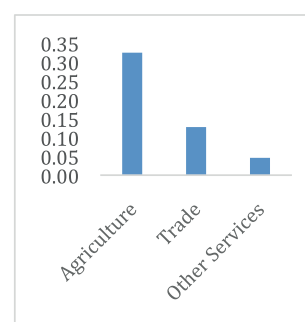
Oil & gas



Utility



Trade



Manufacturing

Source: Own Computations Based on 2006 SAM.

Annex 4: Methodology

Unconstrained multiplier

Assume there are two sectors (A1 and A2) that produce two commodities (C1 and C2) in an economy. The sectors produce two commodities, X1 and X2. Assume also that actual demand for the two commodities is given by Z1 and Z2 respectively. The methodology is adopted from Breisinger et al. (2009).

The demand for products from activities A1 and A2 are given by

$$\begin{aligned} [1] \quad Z_1 &= a_{X11} X_1 + a_{X12} X_2 + c_1 Y + E_1 \\ [2] \quad Z_2 &= a_{X21} X_1 + a_{X22} X_2 + c_2 Y + E_2 \end{aligned}$$

With aggregate demand for the entire economy given by

$$[3] \quad Z = a_{X11} X_1 + a_{X12} X_2 + c_1 Y + E_1 + a_{X21} X_1 + a_{X22} X_2 + c_2 Y + E_2$$

Where a_{X11} and a_{X12} are intermediate input demand to produce C1 and C2 respectively, E_1 and E_2 are household consumption demand of C1 and C2, and c_1 and c_2 are public consumption and investment respectively.

Since the gross output of activities (i.e. X_1 and X_2) is part of total demand (Z_1 and Z_2), the output of each activity could be written as

$$[4] \quad X_1 = b_1 Z_1 \text{ and } X_2 = b_2 Z_2$$

Households' income depends on the share of factor earnings in each sector; thus, it is given by $Y = v_1 X_1 + v_2 X_2$. Substituting [4] into it, it can be written as

$$[5] \quad Y = v_1 b_1 Z_1 + v_2 b_2 Z_2$$

Replacing and in [1] and [2] by [4] and [5] gives

$$[6] \quad Z_1 = a_{X11} b_1 Z_1 + a_{X12} b_2 Z_2 + c_1 (v_1 b_1 Z_1 + v_2 b_2 Z_2) + E_1$$

$$[7] \quad Z_2 = a_{X21} b_1 Z_1 + a_{X22} b_2 Z_2 + c_2 (v_1 b_1 Z_1 + v_2 b_2 Z_2) + E_2$$

Rearranging [6] and [7] and grouping Z terms together give

$$\begin{aligned} [8] \quad (1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2) Z_1 &= E_1 \\ [9] \quad (-a_{X21} b_1 - c_2 v_1 b_1 + (1 - a_{X22} b_2 - c_2 v_2 b_2) Z_2 &= E_2 \end{aligned}$$

Equations [8] and [9] can be written in a matrix algebra format as

$$[10] \quad \frac{1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2} Z_1 = \frac{E_1}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2}$$

The first term in [10] is the identity matrix minus the coefficient matrix (M)

$$[11] \quad \frac{1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2} = M$$

Equation 10 can thus be written as

$$[12] \quad (I - M)Z = E$$

This gives the following multiplier formula

$$[13] \quad Z = (I - M)^{-1} E$$

Constrained multiplier

Next, assume that the first sector (A1) can change its production level but the second sector's (A2) supply is constrained. Also, assume that in sectors that are supply constrained, fixed supply is substituted with imports. This requires redefining components of demand that were previously treated as exogenous (E) to now be endogenous. Regrouping all exogenous components onto the right-hand side gives

$$[14] \quad (1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2) Z_1 = E_1 + a_{X21} b_1 Z_1 + a_{X22} b_2 Z_2$$

Equation [14] can be written in matrix algebra format as

$$[15] \quad \frac{1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2} Z_1 = \frac{E_1 + a_{X21} b_1 Z_1 + a_{X22} b_2 Z_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2}$$

The first term on the left-hand side of equation [15] is the identity matrix (I) minus an adjusted coefficient matrix (M^*)

$$[16] \quad d \frac{1 - a_{X11} b_1 - c_1 v_1 b_1 - a_{X12} b_2 - c_1 v_2 b_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2} = I - M^*$$

The second term on the right-hand side of equation [15] can be written as

$$[17] \quad \frac{a_{X21} b_1 + a_{X22} b_2}{d - a_{X21} b_1 - c_2 v_1 b_1 - a_{X22} b_2 - c_2 v_2 b_2} = B$$

Substituting [16] and [17] into [15] gives

$$[18] \quad (I - M^*) Z_1 = B Z_2 + E_1$$

Rearranging [18] gives

$$[19] \quad Z_1 = (I - M^*)^{-1} B Z_2 + E_1$$

Three scenarios were simulated in this study. The first was based on [13] for the case of unconstrained supply; the second was based on [19], which assumes constrained supply with import possibilities; and the third was based on [19], with no change in imports.