African Development Bank Group

Working paper series

No 206– August 2014

Growth and Distributional Impact of Agriculture, Textiles and Mining Sectors in Lesotho

Edirisa Nseera

Working Paper Series

The Working Paper Series (WPS) is produced by the **Development Research Department** of the African Development Bank. The WPS disseminates the findings of work in progress, preliminary research results, and development experience and lessons, to encourage the exchange of ideas and innovative thinking among researchers, development practitioners, policy makers, and donors. The findings, interpretations, and conclusions expressed in the Bank's WPS are entirely those of the author(s) and do not necessarily represent the view of the African Development Bank, its Board of Directors, or the countries they represent.

Working Papers are available online at http:/www.afdb.org/

Correct citation: Nseera, E. (2014), Growth and Distributional Impact of Agriculture, Textiles and Mining Sectors in Lesotho, Working Paper Series N° ***206*** African Development Bank, Tunis, Tunisia.

AFRICAN DEVELOPMENT BANK GROUP

Growth and Distributional Impact of Agriculture, Textiles and Mining Sectors in Lesotho

Edirisa Nseera[1]

Working Paper No. 206
August 2014

Office of the Chief Economist

[1] Edirisa Nseera is a Senior Country Economist at the Southern Africa Resource Center, AfDB

Abstract

The objective of this study is to understand the relative importance of Agriculture, Textile and Diamond sectors in Lesotho by examining their growth and distributional impact.

The results show that agriculture and textiles are important as key sectors of the economy. These sectors are highly integrated with relatively high forward and backward linkages. Diamonds, however, remains a backward oriented sector mainly having strong linkages as a purchaser of inputs from other sectors which limits its influence on the rest of the economy. This means that investment in highly integrated sectors of agriculture and textiles has a relatively higher potential to spur growth in other sectors of the economy. Additionally, agriculture has the greatest impact on value added further underlining its relative importance and centrality in generating growth.

In terms of distribution, it emerges that there is a huge gap between the rural and urban areas and the greatest benefits accrue to the later. The distribution of income is skewed towards the urban household groups which call for policies to redress the inequalities in order to benefit the rural areas which harbour the majority of the poor households.

Cognizant that unemployment is likely to hit those in the lower income distribution than others, it has an inequality generating effect. In this respect, agriculture which employs majority of the poor has the greatest impact on improving the incomes of the rural households given that it has the highest pure indirect effects. Given that agriculture has high backward and forward linkages as well as a relatively higher impact on value added compared to its counterparts, progressive redistribution and growth are not in conflict.

In view of this, part of the support should be tailored towards removing the critical constraints in the sector. This will allow the sector to quickly respond to exogenous increase in demand. Doing nothing to eliminating constraints to agriculture will have economy wide impact to sectors benefiting from its extensive backward and forward linkages as well as on distribution. Similarly, textile remains better placed compared to diamonds to simultaneously support growth and distribution. The present pattern of sector support tends to make income distribution skewed because it is an outcome of sector spending and not the multiplier system.

1.0 Introduction

Accelerating economic growth and poverty reduction are and continue to be the critical policy challenges in Lesotho. The sluggish growth in agriculture, uncertainty surrounding textile and diamonds as drivers of Lesotho's economic growth raise debates over the relevant direction and emphasis of development interventions in the country. Other concerns are in connection with the relevance of these sectors. This stems from their ability to attain high and inclusive growth which is the country's development objective. Over the last two decades, the Lesotho economy has attained robust economic growth spearheaded by the leading sectors:- agriculture, textile and mining at different times. However, there have been growing concerns that high economic growth has not been inclusive enough.

Consequently, this has been accompanied by worsening income distribution between the rural and urban areas and poverty has remained pervasive particularly in the rural areas where the vast majorities of the population live and work. This has created a nexus between high growth experienced and the increasing inequality. This is also in tandem with ongoing global debate between high growth and declining factor shares. Given the continued commitment of government towards attaining the overall the twin objective of high and inclusive growth articulated in the National Strategic Development Plan (NSDP), it is pertinent that the question of the growth and distributional impact of the agriculture, textile and diamond mining is assessed in order to understand their relative importance in attaining NSDP'S objective. This is expected to contribute towards discussions regarding the country's strategic policy direction in the short to medium-term. In view of the foregoing, the objective of this study is to understand the relative importance of each sector by examining the growth and distributional impact of agriculture, textiles and mining (diamonds).

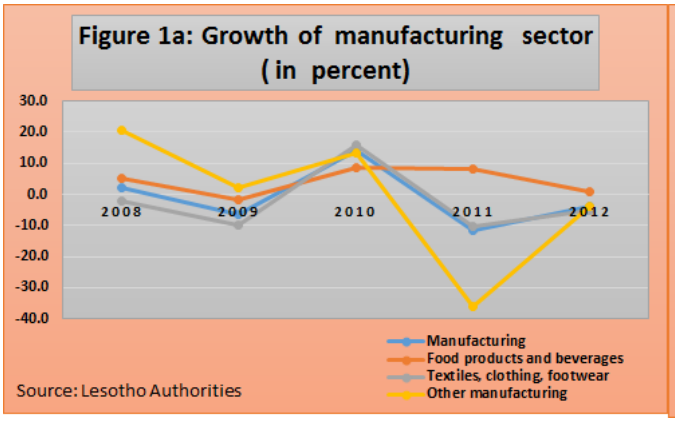
Using constrained and unconstrained Social Accounting Matrix (SAM) multipliers, growth linkages of the three sectors are explored and the sectors that best promote growth and household income distribution are identified. It is argued that the long-term sustainability of economic growth and its welfare improving impact largely depend on the magnitude and strength of inter-sectoral linkages and the manner in which income is distributed. To optimize development strategies and selection of feasible policy instruments, a deeper understanding of the magnitude of growth linkages between sectors and the structure of income is of paramount importance. In this respect, the study provides answers that will contribute to development policy debate in Lesotho.

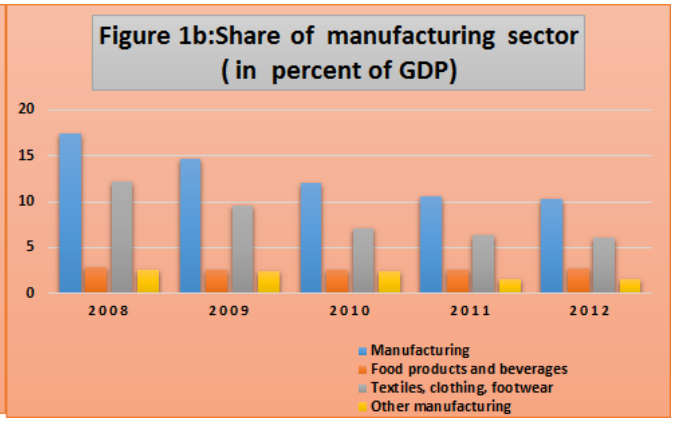
2.0 Background Information

Over the last decade, Lesotho's economic growth was an annual average of 4.1 percent with manufacturing and mining sectors playing a significant role. The former grew by an annual average of 2.3 percent while the sectoral components which include food and beverages; textile clothing, footwear and leather; and other manufacturing recorded average annual growth of 2.8, 0.7 and 4.1 percent respectively during the same period. While growth of the agricultural sector averaged 1.9 percent owing to the teething problems in the sector including weather shocks, mining sector experienced robust growth which averaged 60.5 percent annually. The high growth rate was influenced by an astronomical increase in diamond

production in 2003 from virtually zero, increasing by 236 percent. This was followed by another huge increase in 2005 resulting in growth rate of 196.5 percent.

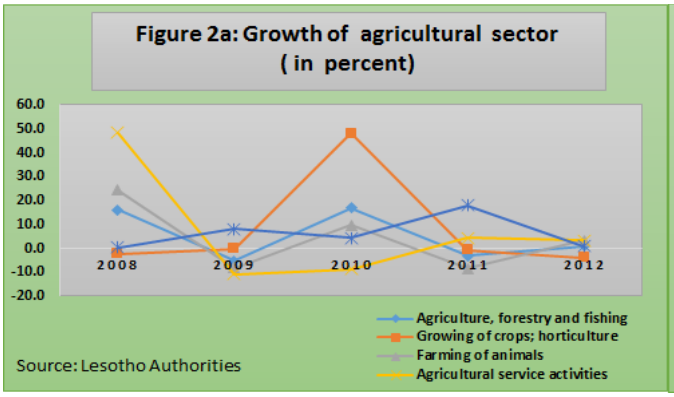
As demonstrated by Figure (1a and 1b), the performance of manufacturing sector dominated by textiles was significantly affected by the aftermath of the global economic crisis which reduced both its growth and contribution to GDP. After strong recovery in 2010, the growth and contribution of the sector to GDP was somewhat affected by the weather shocks through its linkages with agricultural sector which was severely affected by floods. This was in addition to the sluggish global demand. Textile manufacturing is basically a tradable sector which depends on regional and global demand for its products. Given this structural dependence, the drop in the manufacturing sector's performance mainly reflected the demand compression in the country's key trading partners mainly the United States of America and South Africa.

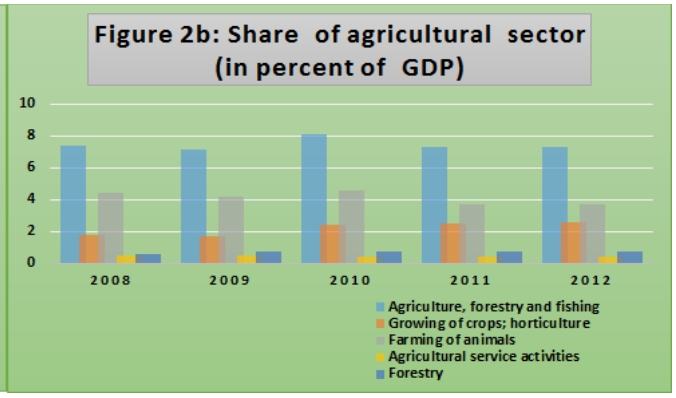




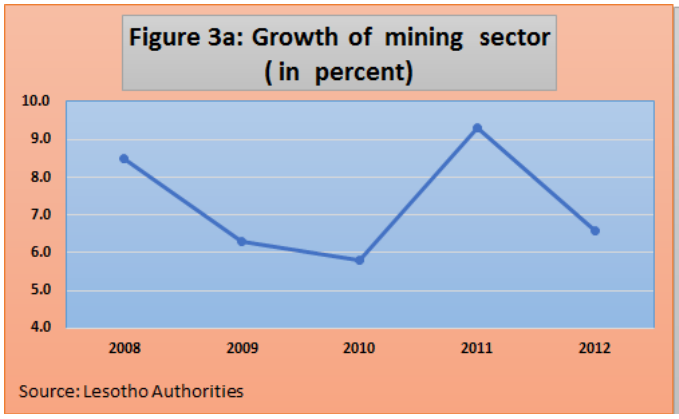
It is pertinent to note that textile manufacturing has been the main engine of growth and job creation over the past decade. Underlying this was the robust growth in textile and apparel which was facilitated by the USA African Growth and Opportunities Act (AGOA) in 2000. However, owing to cessation of quotas in 2005 which allowed competition from Asian producers, the industry has since experienced critical challenges in recent years. This together with the threats of expiry of the third party fabric provision which was recently extended to 2015 reduced the steady growth of the industry.

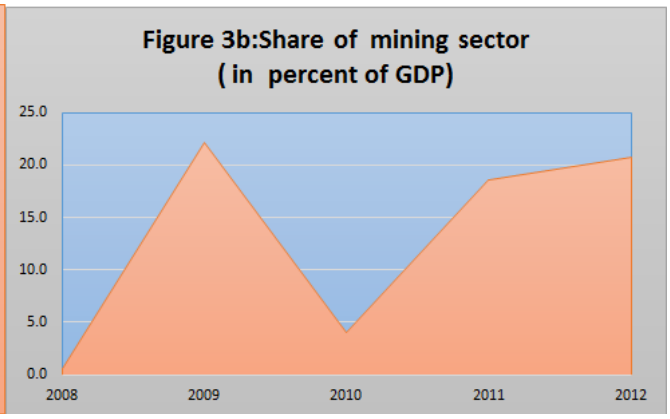
Like manufacturing, the agricultural sector experienced the shake off of the global economic crisis through demand compression and its linkages with other tradable sectors mainly textile and food processing. Despite its strong recovery in 2010, the sector was subsequently affected largely by the negative weather shocks (floods and then drought) since 2011. The floods severely impacted on crops and livestock production. Although the growth and contribution of the agricultural sector to GDP diminished since 2011, it provides livelihoods for the large number of the Basotho (48 percent). As indicated in Figure (2a and 2b), growth and share of the agricultural sector dropped between 2010 and 2012. The sectoral growth dropped from 17 percent of GDP in 2010 to negative 0.8 percent in 2012 and its share in GDP from 8.1 percent to 7.3 percent of GDP in 2012. Nonetheless, the livelihood of the Basotho rural poor remains firmly linked to the performance of agriculture.





Unlike textile and agriculture, the mining sector dominated by diamonds experienced a boom in the aftermath of the global economic crisis owing to good prices for diamonds. Following a negative shock in 2010 occasioned by global diamond demand compression, the share of mining in GDP has since continued to rise. Comparing its share and growth in 2011 and 2012, its weighted contribution to GDP remains higher compared to textile as well as agriculture (figure 3a and 3 b).





In spite of the impressive growth over the last decade mainly underpinned by mining, textile and agriculture, poverty and inequality which are linked to factorial distribution of income remains a challenge. Although the percentage of the population living below US$1.25 per day has dropped from 48 percent in 1995 to 43 percent in 2010; inequality (Gini coefficient of 0.51) and unemployment remain high at 24 percent. There is general consensus within the government that robust growth attained over the last decade has not been inclusive enough.

NSDP attributes this to use of capital intensive approaches in some of these sectors mainly mining which is a factorial distribution issue. Some sectors like textiles and apparels have been applauded for their contribution to employment because they are labor-intensive. However, whether a sector is capital or labour intensive, its contribution to growth and income distribution would depend on the extent of its forward and backward linkages. In view of this, it is difficult to generate consensus on an issue which calls for an empirical answer. Finding an empirical answer to this issue underlines the importance attached to this study.

3.0 Theoretical Perspective and Review of Relevant Literature

The rationale for studying the impact of macroeconomic and meso policies on income distribution is linked to the historical debate on income distribution (inequality) and factor shares. The latter is in turn linked to the Cobb-Douglas production function shares. The central theme which has been of particular importance to most researchers on this topic has been "the determination of the division of national income by factor shares". Under this theme the critical question was why should we be interested in the distribution of national income amongst wages, rent and profits. The response to this question was already provided by Ricardo (1911) when he stated that "…the produce of the earth—all that is derived from its surface by the united application of labour, machinery and capital, is divided among three classes of the community, namely, the proprietor of the land, the owner of the stock or capital necessary for its cultivation, and the labourers by whose industry it is cultivated. . . . to determine the laws which regulate this distribution is the principal problem in Political Economy".2

Since then and until 1960s, research had been conducted on the constancy of factor shares depicted in the Cobb-Douglas production function. The evidence in this area lead to the conclusion that the factor shares remained constant owing to their constant marginal products which guided their payments. Of particular mention among this group of researchers include Kolder (1960), Marchala and Ducos (1968) and Mankiv (2007). The rationale behind the growth economic theory was that real wage and productivity increase at the same rate, while the sum of employment and productivity growth determines the growth of output. In the neoclassical tradition, the Cobb-Douglas production function implied unitary elasticity of substitution between labour and capital. Additionally, the heroic assumption of competitive markets would ensure that the shares are constant irrespective of technical changes (Barro and Sala-i-Martin, 1995).

The importance of distribution of income to factors of production and the debate thereof rebound in the early 1980s precipitated by wide raging claims of reduction in labour shares in the context of globalization, information technology and reforms in labour and product markets. As indicated by IMF (2007), globalization has attracted attention of policy makers with regard to compensation of employees due to ease of factor mobility and location of production. It found that reduction in compensation of employees in advanced countries has largely been due to impact of rapid technological change especially on workers in unskilled sectors. The study also alluded to the importance of labour reforms and flexibility in factor shares with respect to income. Consistent with the latter, Damiani, Pompei and Ricci (2012) underlined the importance of reforms that have favoured the extensive use of temporary contracts as a factor that has caused negative effects on workers' pays. Other studies on factor shares include Serres et al (2001), Collin (2002) which respectively researched on failing wages shares in Europe and getting incomes right.

In pursuant to the issues of distribution of incomes to factors of production, some studies have focused on understanding the causes of inequalities across countries and overtime

[2] Apart from the neoclassical economists, factorial distribution was also present in the minds of the Keynesians. The Keynesian Theory has been referred to a particular theory of distribution as "Keynesian". The Multiplier principle had been introduced by Keynes to explain why an economic system would remain in equilibrium in a state of underemployment (excess capacity).

(Gottschalk and Smeeding, 1997; Gottschalk , Gustafsson and Palmer, 1997) while others have concentrated on single country at single point and overtime (Williamson(1985,1991). What emerges from these studies is the conclusion that many factors affect inequality and these factors are strictly economic and demographic which is also consistent with the findings by (Gustafsson and Johansson, 1997).

The starting point of most of these studies of economic growth and inequality is the Kuznets (1955) inverse U-shaped hypothesis. Kuznets assumed that rural agricultural incomes(less developed) are lower and more equally distributed than urban industrial incomes (more developed). According to this hypothesis as countries develop, income inequality first increase, reach a peak and then decrease. In his conjecture, Kuznets explained that this pattern was a result of dual dynamics which caused a swift from agriculture to the industrial sector. That is, the movement of workers from the low to high paying sectors initially increases inequality but later this decreases as the supply of labour depresses the wages in the high paying sector down. The trends in Lesotho, however, tend to be disturbing. Manufacturing has displayed a monotonic decline as a share of GDP since the financial crisis. The same trend was showed by agriculture with exception of 2010 when there was transitory turn around. During the same period, the share of mining increased at the expense of agriculture and manufacturing save for the 2010 when there was a transitory decline. There is widening inequality. The Gini Coefficient is also high, having increased from 0.52 in 2002/3 to 0.54 in 2010/11. It is yet to be known whether sectoral growth and distribution are in conflict.

Some researchers including (William, 2005) have indicated that there other possible causes for the decline of inequality. These include the impact of technology changes on the wages and returns on capital where the latter increases less compared to the former. As demonstrated by (Aghion and Bolton, 1997), the lower interest rates have enabled the poor to access finance. This has made the poor to invest thereby gradually bridging the gap between them and the rich. The other explanation for swift from agriculture to industry was the falling income from land (Lindert, 1986). It is, however, pertinent to note that the evidence with regard to the Kuznets hypothesis as explanation of the development process is mixed. The same applies to the explanation for the movement of labour from agriculture to industry as economies develop.

Other studies have advanced de-industrialization as the main cause of inequality but mostly in advanced countries where workers (mainly lower caliber workers but not engineers) have been pushed to the service sectors with lower paying jobs (levy and Murname, 1992).

While underscoring the importance of distribution of income at a macro level, it is equally important to understand the link between macroeconomic policies as depicted by the national accounts and the household incomes. I tend to concur with the reasons advanced by Atkinson (2009) as to why factor shares need to be understood by all. He clearly underlines objective of understanding the link between incomes at a macro level–national incomes and the micro level income at the household. Also underlined was the importance of understanding inequality in personal distribution of incomes as well as fairness of various sources of income.

Constructing the link between macroeconomic and meso policies on one hand and household incomes remain relevant to African countries including Lesotho which are still grappling with poverty of immense proportion. Most of the studies designed along the lines proposed by Atkinson(2009) have used A social Accounting Matrix (SAM) framework. This framework was first proposed by Richard Stone and Saffi Stone (1959) and extended by their subsequent work on National accounts in 1961. This pioneering work was further extended by Pyatt and Thorbecke (1976) when they developed SAM as a comprehensive and disaggregated representation of the socio-economic system during the year. A SAM is an important analytical tool as it can simulate the potential impact of future economic policies and the effectiveness of past policies on employment and income distribution through multiplier analysis. A "dynamic SAM" is based on an existing 'static' SAM and the available up-to-date time series of national accounts (SNA) - this makes the model dynamic across time[3].

In terms of application in Africa, several studies have been conducted to study the impact of policies on household and poverty. These include the study by Parra and Wodon (2009), which used the SAM framework to assess how demand shocks in various sectors of the economy affected the factorial distribution of incomes between men and women. Fofana et al. (2009) used the SAM to assess how growth in various sectors affects the income of women and men in Senegal.

4.0 Methodology

The analysis was conducted using Social Accounting Matrix (SAM) framework which quantifies the effect of exogenous changes and injections on the whole social economic system. As indicated by Thorbecke (2006), the use of SAM for estimating multipliers is predicated on:-the existence of excess capacity and unemployed or underemployed labor resources. The level of employed person in Lesotho stands at 52 percent. This confirms the existence of excess capacity which allows the SAM framework to be used. This assumption also implies perfect elasticity of supply and tradability of both goods and inputs. It essentially allows supply to respond to the demand. However, the assumption of excess capacity is sometimes relaxed (Lewis and Thorbecke, 1992 and Parikh and Thorbecke, 1996). In this paper, this assumption was relaxed by assuming that some sectors are constrained (for details see Annex 1).

In order to understand the structure as well as the mechanism through which the injection from the exogenous accounts affects the targeted endogenous accounts, the multiplier was decomposed following the approach recommended by (Thobecke, 2000; Thorbecke and Jung, 1996). Using multiplier decomposition, it was possible to identify the impact of real

[3] More insights can be obtained by multiplier decomposition which requires a decision on endogenous and exogenous accounts. The approach followed by Pyatt and Round (1979) entails assuming that the commodity accounts, non-tax, value-added accounts and the enterprise accounts for each county are endogenous. They assumed that household account is endogenous, while the government and capital accounts are exogenous.

shock on agriculture, textiles and diamonds across the rural and urban household groups. It was also possible to estimate the sectoral income elasticity, intra and inter-household transfers. These were estimated in the framework of both unconstrained (excess capacity) and constrained (no excess capacity) model.

5.0 Data

In terms of data, the study uses the data embedded in the 2010 SAM for Lesotho. It was compiled by the Development and Implementation of a Macroeconomic Model for Lesotho (DIMMOL). The original SAM was a financial SAM but reduced it to a real sector SAM which excludes the detailed financial sector information. The final SAM was balanced using entropy procedure which is commonly used for this purpose to ensure consistence and equilibrium conditions. The SAM has 32 activities and 38 commodities, labour and capital of different categories belonging to households differentiated by urban and rural. It has accounts for government (comprising among others direct taxes, indirect taxes, VAT and subsidies), Saving-Investment account (referred to as capital account) and the rest of the world account. In other words, the SAM represents an open economy model of Lesotho.

Table 1: Technical co-efficient matrix of the macro SAM for Lesotho (in percent)

	Activities	Commodities	Labor	Capital	Households	Institutions	Government	Capital account	Rest of the world
Activities		52.6			12.1		1.7	5.5	
Commodities	53	10.3			79.5	58.3			39.1
Labor	24.2								30.6
Capital	22.7								0
Households			100	37.3		5.6		10.1	6
Institutions				62.7	1.3	3.8	85.5	69.1	1.4
Government		3.3				0.2			
Capital account					6.5	32	12.8		21.4
Rest of the world		33.9			0.5	0.1		15.3	1.6

Source: Computed by author

Table 1 gives us an overall picture of the macroeconomic profile of the Lesotho economy. It is shown that 53.0 percent of the costs of production for activities are accounted for by intermediate inputs, 24.2 percent by labor payments and 22.7 percent by payments to capital. In terms of total supply of commodities, 62.9 percent is satisfied by the marketed domestic output including transport margins and 33.9 percent by imports. Commodities spend 3.3 percent of their income in taxes.

Labor incomes are all used to pay households for their own use. For the capital income, 37.3 percent go to households and the rest (62.7 percent) is transferred to institutions where they have social and economic interests. Households spend 91.6 percent in final consumption, 1.3 percent to institutions where they have social and economic interests, 6.5 percent is put in the capital account (saving-investment) and the rest leaks out in the form of imports. The government spends 1.7 percent of its income on recurrent activities, 85.5 percent in transfers to institutions and saving the rest (12.8 percent) on capital account (savings-investment).In terms of total savings- investment, 5.5 percent is spent on producing sectors, 10.1

percent on households, 69.1 percent on institutions and the rest (15.3 percent) leaks out to the rest of the world.

Total foreign exchange inflow from the rest of the world, 39.1 is generated by commodity exports, 30.6 percent by labour earnings, 1.4 percent by earnings of institutions, 6 percent as private transfers to households, 21.4 percent comes in as foreign savings and the rest as incomes from the rest of the World. The latter is basically SACU and non-SACU transfers from the rest of the World received in relation to tourism and foreign investments.

6.0 Empirical Evaluation

6.1 Unconstrained Multiplier Model

6.1.1 Sectoral Impact on Household Groups

This section examines the relative impact of real shock on agriculture, textiles and diamonds across the rural and urban household groups.[4] As demonstrated in Table 2, agriculture shows the highest multiplier amongst the three sectors and it has the most significant effect on the rural household as well as the urban households. It is noteworthy that this does not include the pure indirect and feedback effects which are considered in Table 4. This initial result means that if the demand for agriculture is exogenously increased (receives an injection) by 1 million maloti, the rural household income will increase by 0.5776 million while urban household income by 0.5555 million. The column total shows the overall real income multiplier effects. This indicates by how much the income of all households' increases in response to a unit increase in the demand for the individual sector. Again, agriculture would have the greatest overall impact on households.

Agriculture impacts on the urban household through its strong linkage effects which induce aggregate demand. This in turn increase employment for urban labour employed in various sectors. This is in addition to its impact on urban workers (households) directly employed in agriculture. There is a prevalence of urban household as beneficiaries of the increase in demand from textiles and diamonds. This largely shows that these sectors demand relatively skilled and urban based labour compared to agriculture.

The results point towards an urban bias in terms of household income effects arising from increases by one unit in agriculture, diamonds and textile demand combined. As indicated in the row total in Table 2, the overall multiplier effects on the income of urban household group (1.1425) is higher compared to Rural Household (0.9620).

[4] This question is addressed using accounting multipliers and its decomposition as well as multipliers as elasticities (see section on methodology for details).

Table 2: Sectoral Multiplier effects on Household income under unconstrained (unconst) model

	Textiles	Agriculture	Diamonds	Totals
Rural Household	0.2030	0.5776	0.1814	0.9620
Urban Household	0.2577	0.5555	0.3293	1.1425
Totals	0.4607	1.1331	0.5107	2.1045

Source: Computed by author

Table 3 gives further insights into the sectorial impact across households using elasticity. Taking the example of agriculture, the highlighted figures in the second column mean that a one percent increase in the demand of agricultural products would increase the rural household group's income by 0.1067 percent and urban household group's income by 0.0955 percent. Consistent with the previous evidence in Table 2, agriculture has the greatest impact among the three on both the rural and urban household, followed by textiles. It is shown that textile and diamonds are more urban oriented than rural and hence a one percentage increase in demand arising from these sectors will impact more on urban household compared to their rural counterpart.

Table 3: Household income elasticity with respect to sector percentage demand changes

	Textiles	Agriculture	Diamonds
Rural Household	0.0721	0.1067	0.0326
Urban Household	0.0852	0.0955	0.0550

Source: Computed by author

The economy wide impact (direct and indirect effects) of an exogenous shock into the individual sector on the household groups provides more intuitive results. These relate to open-loop and close-loop effects of the initial shock[5]. The findings show that compared to textiles and diamonds, agriculture generates a much stronger relationship between factors on one hand and rural as well as urban households on the other hand (open-loop effects, Table 4). This means that a positive shock in the agricultural sector will stimulate more employment and incomes in both the urban and rural areas compared to other sectors. Textile, however, has higher open-loop effects on both rural and urban household groups compared to diamonds.

Additionally, when all the indirect effects including feedbacks in the entire economic systems (close loop effects) are considered, the demand shock from agriculture has the highest effects

[5] Open-loop effects capture the direct and indirect effects from one endogenous account in this case from producing sectors to factor income. Close-loop effects on the other hand are pure indirect effects and ensures that the effect from one account goes through the whole economic system(circular flow) hitting all the endogenous accounts. For-example: - from household, to consumption, to activities, to factor and back to household. The process is repeated.

on rural households (Table 4). In other words, a stimulus from agriculture will not only increase household incomes but will also increase consumption (aggregate demand). This will in turn induce more production, generate more factor employment and again increase the household incomes (in a circular flow manner). Similarly, diamond has the highest close-loop effects on urban households and hence provides the greatest opportunities for increasing urban incomes through a circular flow process. Textiles, however, has higher close-loop effects on urban households compared to agriculture. The latter has limited opportunities for raising urban household incomes through a circular flow process.

In view of the above, it is clear that if the objective is to distribute income to the rural household, agriculture has the greatest impact. However, if the objective is to improve the welfare of the urban household, the selection would be diamonds and then textiles.

Table 4: Decomposing the Multiplier Sectoral Multiplier effects on Household

		Textiles	Agriculture	Diamonds
Rural Household	Open loop effects	0.1204	0.4360	0.0520
	Close loop effects	0.0864	0.1416	0.1294
Urban Household	Open loop effects	0.1270	0.3964	0.0848
	Close loop effects	0.1308	0.0940	0.2445

Source: Computed by author

6.1.2 Income Distribution

Table 5 shows the structural measure of inequality in personal income distribution[6]. It shows how an external stimulus (Injection) into the income of the household translates into higher incomes of its income. The diagonal elements are less than one meaning that a unitary injection into the income of a household group yields less than the initial increase in the incomes of the same household. This is true for both rural and urban households as the direct and indirect effects take place through the system.

Table 5: Intra and Inter-household transfers

	Rural Household	Urban Household	Total
Rural Household	0.1977	0.1303	0.3280
Urban Household	0.2003	0.1615	0.3618
Total	0.3980	0.2918	0.6898

Source: Computed by author

The Urban household group, however, shows a higher level of overall impact arising from the external injection (higher row total in green) compared to its rural household counterpart. This

[6] For details refer to Bottiroli Givardi and Targetti Lendi (2007).

means given the structure of Lesotho's economy, income distribution is skewed towards the urban household group. This gains support from the following feature of the economy. A stimulus on rural household group benefits the urban household more (0.2003) compared to the group itself (0.1977). To the contrary, the same stimulus on the urban household group benefits the rural less (0.1303) compared to the group itself (0.1615).

6.1.3 Growth (Value added) Impact of Sectors

This section addresses the question of the relative importance of sectors in terms of generating value added. The relationship between production sectors (agriculture, diamonds and textiles) and factors is demonstrated in Table 6. The row total shows the overall impact of all the production sectors on the individual factor income while the column total shows the sectoral impact on value added GDP. The results in the column show the multiplier impact of an exogenous increase in the demand of products of the individual sectors by 1 million maloti on the incomes of various factors of production.

Table 6: Sectoral Impact on Value Added GDP

	Agriculture	Diamonds	Textiles	Total
Managers	0.0573	0.0463	0.0280	0.1315
Professionals	0.0701	0.0605	0.0359	0.1664
Technical and associate professionals	0.0359	0.0875	0.0454	0.1687
Clerks	0.0276	0.0375	0.0279	0.0930
Service (sales workers)	0.0125	0.0432	0.0204	0.0760
Skilled agricultural and fishery workers	0.0159	0.0006	0.0006	0.0171
Craft and related Traders	0.0149	0.0394	0.0217	0.0759
Plant and machine operators and assemblers	0.0294	0.0314	0.0906	0.1513
Unskilled workers	0.1197	0.0493	0.1036	0.2726
Operating surplus				
Non-financial domestic Corporate	0.0367	0.0437	0.0456	0.1260
Non-financial foreign corporate	0.0524	0.6694	0.2324	0.9542
Non-fin public	0.0120	0.0229	0.0171	0.0520
Financial domestic	0.0022	0.0027	0.0040	0.0089
Financial foreign	0.0070	0.0084	0.0128	0.0282
Mixed income unincorporated	0.0150	0.0100	0.0086	0.0336
Mixed income informal sector	0.2858	0.0189	0.0190	0.3236
Non-marketed surplus	0.4420	0.0425	0.0408	0.5253
Total	1.2362	1.2141	0.7542	3.2045

Source: Computed by author

For agriculture, the greatest impact will be on non-marketed operating surplus (capital) where the incomes rise by 0.4420 million maloti, followed by mixed income (0.2858 million maloti) and then unskilled workers (0.1197 million Maloti). The exogenous increase in demand for the diamond products impacts most on the non-financial foreign corporate, operating surplus (rise by 0.6694 million maloti). For the textile sector the greatest impact is on the non-financial foreign corporate (incomes rise by 0.2324 million Maloti) followed by unskilled workers whose income increase by 0.1036 million Maloti. Overall the factors which benefit most (row totals)

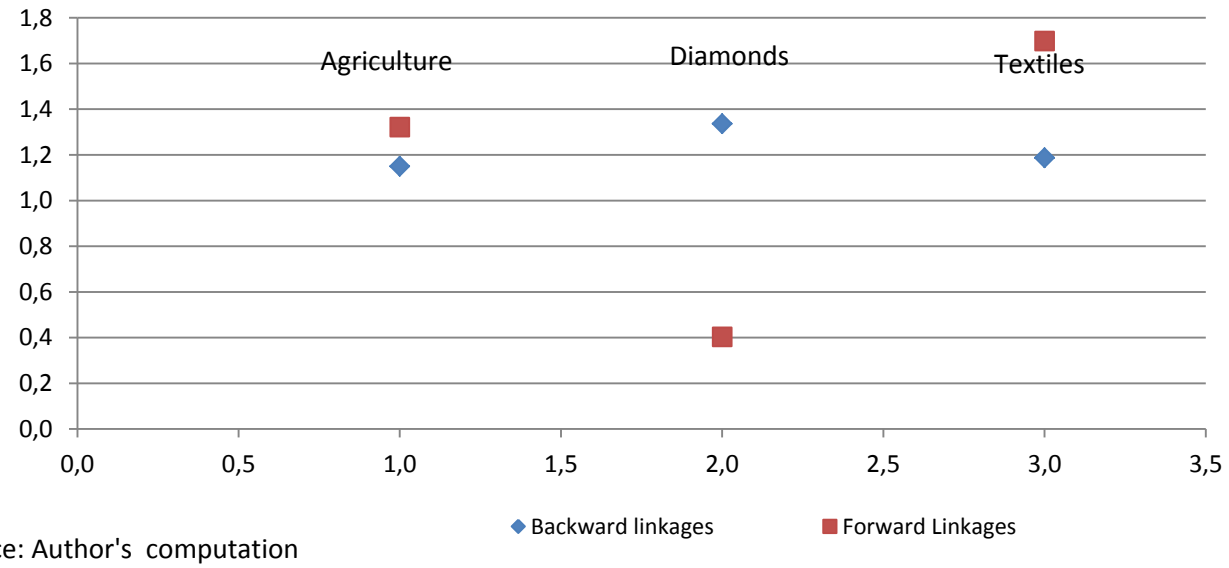
comprise non-financial foreign corporate (capital owners); non-marketed capital owners; mixed income informal sector (capital owners); unskilled workers; technical and associate professionals; and professionals respectively.

In terms of growth, agriculture will have the greatest impact on the value added GDP. Arising from an exogenous increase in demand by Maloti 1 million, agriculture, diamonds and textile will respectively increase value added GDP by maloti 1.2362 million, maloti 1.2141 million and maloti 0.7542 million. The combined impact on value added by the three sectors will be maloti 3.2045 million.

6.1.4 Economic Linkage Effects

This section addresses the question of whether agriculture, textile and diamonds are key sectors of the economy. A sector is considered key if it is strong in both backward and forward linkages. Figure 4 shows the relative importance of the agriculture, textile and diamonds using their linkage effects. As indicated in Figure 4, agriculture and textile have both their backward and forward linkages greater than one. This means, agriculture and textiles are strong in terms of both backward and forward linkages suggesting that they are among the key sectors of the Lesotho economy. The diamonds sector, however, is considered a backward oriented sector. It has strong demand driven effects which indicate its interconnection to those sectors from which it purchases inputs[7].

Figure 4: Weighted backward and forward linkages



Source: Author's computation

[7] The activity of a particular sector has both the supply and demand driven effects (economic effects on other sectors in the economy). The supply driven effects are encapsulated in the forward multipliers. It captures the interrelationship of a sector with those sectors to which it sells its outputs.

6.2 Constrained Multiplier Model

Under the constrained multiplier analysis, the assumption of perfectly elastic supply in section 6.1 is relaxed in some sectors where there are structural constraints which limit their excess capacity. In this respect, agricultural sector was considered supply constrained given the recurring effect of drought, soil erosion, landslides and farm inputs[8]. Additionally, we assumed that the supply elasticity is constrained and hence no excess capacity to respond to increased demand. Finally, the supply of government services (public administration sector) was assumed constrained.

However, government consumption, net exports and investments remain exogenous (see Annex 2 for the derivation of the constrained model). In Tables (7,8 and 9) the results of the constrained model are compared with the previous unconstrained model .

Table 7: Constrained (const) and unconstrained (unconst) household income multipliers for production sectors compared

	Textiles		Agriculture		Diamonds		Total	
	Unconst model	Const model	Unconst model	Const model	Unconst model	Const model	Unconst model	Const model
Rural Household	0.2030	0.1593	0.5776	0.5167	0.1814	0.1124	0.9620	0.7884
Urban Household	0.2577	0.1820	0.5555	0.4841	0.3293	0.1906	1.1425	0.8567
Total	0.4607	0.3413	1.1331	1.0008	0.5107	0.2757	2.1045	1.6451

Source: Computed by author

As indicated in Table 7, the sectoral impacts on household incomes under the constrained model are much lower compared to the unconstrained model. This is due to the limited linkage effects occasioned by the structural impediments in the supply constrained sectors. The unconstrained model does not consider supply rigidities which explain its higher linkage effects on household incomes and growth[9]. It is pertinent to note that the constrained multipliers can be interpreted in the same way as unconstrained ones. For example, under the constrained model, rural household income would respectively increase by 0.1593, 0.5167 and 0.1124 million maloti following a 1 million maloti increase in demand for textiles, agriculture and diamonds. These are much lower increases compared to the unconstrained model.

In terms of growth, a 1 million maloti increase in demand for textile, agriculture and diamonds will increase value added by 0.6100, 1.0861 and 0.9622 million maloti respectively. The combined effect of this increase in demand would lead to increases in value added by 2.6584 million maloti compared to 3.2045 million maloti in the unconstrained scenario (see Table 8). Noticeably, the largest increases in income in response to the demand increase will be in the category of non-marketed surplus (capital), mixed income informal (capital), unskilled workers, plant and machinery operators and assemblers, technical and associate

[8] In a supply constrained sector, increase in demand will result in reduction in net exports as imports substitute for domestic production. This is a leakage which reduces the linkage effects (increases incomes of foreign producers). This underlines the need for interventions to reduce the impact of these structural impediments.
[9] For details see Haggblade, Hammer and Hazell(1991)

professionals as well as professionals (see row totals const). These are the same groups that benefit most under unconstrained multiplier model.

Table 8: Constrained and unconstrained value added multipliers for production sectors compared

	Textiles		Agriculture		Diamond		TOTAL	
	Unconst	Const	Unconst	Const	Unconst	Const	Unconst	Const
Managers	0.0280	0.0142	0.0575	0.0477	0.0463	0.0188	0.1318	0.0807
Professionals	0.0359	0.0227	0.0701	0.0598	0.0605	0.0347	0.1665	0.1172
Technical and associate professionals	0.0454	0.0348	0.0359	0.0290	0.0875	0.0665	0.1688	0.1303
Clerks	0.0279	0.0190	0.0276	0.0221	0.0375	0.0192	0.0930	0.0603
Service(sales workers)	0.0204	0.0046	0.0125	0.0057	0.0432	0.0081	0.0761	0.0184
Skilled agricultural and fishery workers	0.0006	0.0000	0.0159	0.0145	0.0006	0.0000	0.0171	0.0145
Craft and related traders	0.0217	0.0162	0.0149	0.0114	0.0394	0.0303	0.0760	0.0579
Plant and machine operators and assemblers	0.0906	0.0869	0.0294	0.0257	0.0314	0.0250	0.1514	0.1375
Unskilled workers	0.1036	0.0917	0.1197	0.1058	0.0493	0.0302	0.2726	0.2277
Operating surplus								
Non-financial domestic corporate	0.0456	0.0381	0.0367	0.0309	0.0437	0.0307	0.1260	0.0998
Non-financial foreign corporate	0.2324	0.2234	0.0524	0.0449	0.6694	0.6531	0.9542	0.9213
Non-financial public	0.0171	0.0102	0.0120	0.0082	0.0229	0.0107	0.0520	0.0291
Financial domestic	0.0040	0.0033	0.0022	0.0018	0.0027	0.0013	0.0089	0.0064
Financial foreign	0.0128	0.0106	0.0070	0.0056	0.0084	0.0042	0.0282	0.0204
Mixed income unincorporated	0.0086	0.0068	0.0150	0.0132	0.0100	0.0069	0.0336	0.0268
Mixed income informal sector	0.0190	0.0072	0.2858	0.2594	0.0189	0.0054	0.3237	0.2719
Non-marketed surplus	0.0408	0.0205	0.4420	0.4004	0.0425	0.0171	0.5253	0.4380
Value added	**0.7544**	**0.6101**	**1.2366**	**1.0861**	**1.2142**	**0.9622**	**3.2052**	**2.6584**

Source: Computed by author

Therefore, there is no difference in the overall income distribution between the unconstrained and constrained multiplier models. In both scenarios, the distribution of overall benefits is skewed towards the urban household groups. However, the increases in household incomes arising from increase in the injection are much higher under a constrained multiplier model:- incomes of rural household group increase from 0.3280 million maloti (unconstrained) to 1.1995 million maloti (constrained) in response to 1 million cash injection to this account.

Similarly, the incomes of Urban household group increase from 0.3618 million maloti (unconstrained) to 1.2147 million maloti (constrained). For instance, an increase income transfers to the rural household of 1 million maloti will increase incomes of rural household by 1.1092 and 0.1977 million maloti under constrained and unconstrained multiplier model respectively (Table 9).

Table 9: Constrained and unconstrained household (within account) income multipliers compared

	Rural Household		Urban Household		Total	
	Unconst model	Const model	Unconst model	Const model	Unconst model	Const model
Rural Household	0.1977	1.1092	0.1303	0.0901	0.3280	1.1995
Urban Household	0.2003	0.1040	0.1615	1.1107	0.3618	1.2147
Total	1.2132	1.2132	0.2918	1.2008	0.6898	2.4140

Source: Computed by author

7.0 Policy discussion, recommendations and conclusions

The study intended to provide empirical evidence on the relative importance of the agriculture, textile and diamonds sectors as instruments for attaining the country's overarching objective of high and inclusive growth while reducing income inequality. Underlying this objective, is the realization that growth generates employment for the factors of production, increases household incomes which affords them dissent living through consumption spending and savings. This in turn leads to increased investment in various activities which demand more factors of production and the process goes on and on.

The findings of the study have underlined the importance of agriculture and textiles as key sectors of the economy. These sectors are highly integrated with relatively high forward and backward linkages. Diamond sector remains a backward oriented sector mainly having strong linkages as a purchaser of inputs from other sectors which limits its influence on the rest of the economy. This means that investment in agriculture and textile has a relatively higher potential to spur growth in other sectors of the economy.

Agriculture has the greatest impact on value added further underlining its relative importance and centrality. In terms of distribution, it emerges that there is a huge gap between the rural and urban areas and the greatest benefits accrue to the later. That is, the distribution of income is skewed towards the urban household groups which call for policies to redress the inequalities in order to benefit the rural areas which harbour the majority of the poor. In this respect, agriculture has the greatest impact on improving the incomes of the rural households given that it has the highest pure indirect effects. Given that agriculture is identified as a key sector of the economy and has relatively higher impact on value added compared to its counterparts, progressive redistribution and growth are not in conflict.

Supporting agriculture is in tandem with the current thinking which argues for rapid agricultural growth to precede general economic growth. This is required in order to support a shift to industrial growth as development progresses. This is also cognizant of the fact that factors which affect agricultural growth might be linked to economy wide social and economic policies such as the underlying need for increasing agricultural productivity through technical

change. Even under this extreme scenario, agriculture continues to play a significant role as a consumer of a wide range of industrial products.

To realize full benefit of agriculture, the present weight given to the sector in terms of the exogenous impulse (including government budget) should be commensurately raised. This might be guided by the sectoral multiplier impacts. Equally, given the constraints in the agricultural sector, part of the support should be tailored towards removing these constraints in order to allow the sector to quickly respond to exogenous changes in demand.

Doing nothing will have economy wide impact to various sectors benefiting from agriculture's extensive backward and forward linkages as well as on distribution. As already alluded to, the industrial sector will be one of the severely affected sectors. If growth and distribution is the objective, the rest of the sectors would be supported guided by their multiplier effects on growth and distribution.

While agriculture and textiles remain among the key sectors of the economy, the distributive impact of textiles remains low. Diamond remains backward oriented sector with a central role as a purchaser of inputs from other sectors. However, its forward linkages are very low and hence not considered amongst the key sectors of the economy. Notwithstanding this, the distribute impact of diamonds on both the rural and urban household groups remain moderate.

In view of the foregoing, the present pattern of sector support tends to make income distribution skewed because it is an outcome of sector spending and not the multiplier system. This study has contributed on three important policy issues: - providing advice on the how to select the key sectors of the economy including suggesting some of the key sectors (agriculture and textile). It has made suggestions on the issue of income distribution between the rural and urban households including identifying the potential sector (agriculture) for addressing the issue of growth and redistribution. It has also made a case why supporting agriculture remains relevant even if a shift towards industrialization becomes inevitable as technical change takes place.

References

Aghion, F. and Bolton, P. (1997), "A Trickle-Down Theory of Growth and Development", Review of Economic Studies 64:151-72.

Atkinson, A.B.(1997), "Measurement of Trends in Poverty and Income Distribution". DAE Working Paper No. 9701. Department of Applied Economics, University of Cambridge, Cambridge, United Kingdom.

Atkinson, A.B. and Søgaard, J. E. (2013), "The long-run history of income inequality in Denmark Top Incomes from 1987 to 2010", http://web.econ.ku.dk/eprn_epru/Workings_Papers/WP-13-01.pdf.

Boston, A.and Unwin,T.(1991), "Inequality, Poverty, and History", Oxford: Basil Blackwell Cambridge: Department of Applied Economics Working Papers No. 9712.

Fotana,I.et al (2009), “Exports and Labour Income by Gender: A social Accounting Matrix Analysis of Senegal”, in Bussolo,M. and R.de Hoyos (2009), Gender Aspects of Trade and Poverty Nexus, Pulgrave Macmillan and the World Bank.

Gustafsson, B. and Johansson, M.(1997), “In Search for a Smoking Gun: What Makes Income Inequality Vary Over Time in Different Countries?”, Working Paper No. 172, November.

IMF (2007), “The Globalization of Labor”, Ch. 5 in World Economic Outlook, April.

Kaldor, N. (1961), “Capital Accumulation and Economic Growth”, in F. A. Lutz (ed.), The Theory of Capital, London, Macmillan.

Kuznets, S. (1955), “Economic Growth and Income Inequality”, American Economic Review 45:1-28.

Levy, F. and Richard, J. M.(1992), “U. S. Earnings Levels and Earnings Inequality:A Review of Recent Trends and Proposed Explanations”, Journal of Economic Literature XXX (September):1333 - 1381.

Lewis, B.and Thorbecke, E.(1992), “District-Level Economic Linkages in Kenya: Evidence Based on a Small Regional Social Accounting Matrix”, World Development, 20 (6): 881-897.

Lindert, P.H.(1986), “Unequal English Wealth since 1670”, Journal of political economy 94: 1127-62

Mankiw, N. G. (2007), Macroeconomics, New York, sixth edition.

Marchal, J. and Ducros, B. (1968), The Distribution of National Income, London, Macmillan.

Parra,J.c. and Woodon,Q.(2010), “A tool for the analysis of input-output tables and social accounting matrices”, the World Bank, October.

Pansini,V.R.(2008), “Multiplier Decomposition, Poverty and inequality in income distribution in SAM framework: the Vietnamese Case”.

Pyatt, G., and Thorbecke, E.(1976), “Planning Techniques for a Better Future”, Geneva, ILO.

Ricardo, D.(1911), Principles of Political Economy, first published 1817, London, Dent.

Richard, S.and Giovanna, S.S.(1961), National Income and Expenditure.

Richard S.and Giovanna S.S.(1959), Social Accounting and Economic Models.

Serres, A. de. et al (2001), “Falling Wage Shares in Europe and the United”

Thobecke, E. (2006), “Social Accounting Matrices in Modeling”, Cornell University.

Thobecke, E.(2000), “The Use of Social Accounting Matrices in Modeling”, Paper prepared for the Twenty Sixth General Conference of the International Association for Research in Income and Wealth, Cracow, Poland, August 27–September 2.

Thobecke, E.and Hong-Sang, J.(1996), “A Multiplier Decomposition Method to Analyze Poverty Alleviation”, Journal of Development Economics 48 (2): 279–300.

Williamson, J.G. (2005), Did British Capitalism Breed Inequality?, McGraw Hill Professional, 03 November.

Williamson, J.G.(1985), Did British Capitalism Breed Inequality?, Allen & Unwin, London, 1985.

Annex 1: SAM Multiplier Model

From table below the endogenous accounts comprise production activities (activities), factors of production (factors) and Institutions which include households. The derivation of the unconstrained SAM multipliers was based on the standard assumptions including the existence of excess capacity in all sectors.

	Activities	Commodities	Factors	Households	Exogenous demand	
	A1 A2	C1 c2	Fac	H	E	Total
A1 A2		X1 X_2				X_1 X_2
C1 C2	Z_{11} Z_{12} Z_{12} Z_{22}			C_1 C_2	E_1 E_2	Z_1 Z_2
Fac	F_1 F_2					F
H			$F_1 + F_2$			Y
E		L_1 L_2		S		
Total	X_1 X_2	Z_1 Z_2	F	Y	E	

Source: Construction followed Breisinger et al (2010) with some modifications.

However, in the constrained model and following (Lewis and Thorbecke, 1992 and Parikh and Thorbecke, 1996), the assumption of excess capacity was relaxed in some sectors.

Where
X is the gross output
Z is total demand for each commodity
F is total factor income (household income)
Y is total household income
E is exogenous demand (government, investment and exports)
The coefficients used in the equations (1-18) were derived from Table 1 as follows:
$a_{11}=Z_{11}/X1$, $a12=Z_{12}/X2$, $a21= Z_{21}/X_1$, $a22=Z_{22}/X2$, $v1=F_1/X_1$, $v2= F2/X_2$
$b_1=X_1/Z_1$, $b_2=X_2/Z_2$, $c_1=C_1/y$, $c_2=C_2/Y$,

Unconstrained SAM Multiplier
From Table above, it is shown that total demand(Z_1, Z_2) is composed of intermediate demand (X_1,X_2) , Household consumption (C_1,C_2) AND Exogenous demand(E_1, E_2).
$Z_1 =a_{11}X1+a_{12}X_2+C_1Y+E_1$……1
$Z_1=a_{21}X1+a_{22}X_2+C_2Y+E_2$…… ……2
From the Table 1 above, it is possible to construct a relationship between X_1 and Z_1; and X_2 and Z_2 as in 3 and 4 below. They are based on the premise that output X is part of the final demand Z.

$X_1=B_1Z_1$……..……3
$X_2=B_2Z_2$…… …..……..…… ……...……4

It is also possible to relate household income to factor earnings from individual activities as in 5.

$Y =V_1X1+V_2X_2$…….……..……..……..……5

By substitution of 3 and 4 into 5, equation 6 and 7 are obtained.

$Y =v_1 B_1Z_1+v_2 B_2Z$ …….……..…….……6

Using 3,4 and 6 , we can replace X and y in 1 and 2 to get 7 and 8.
$Z_1 =a_{11} b_1Z_1+b_{12} b_2Z_2+C_1 (v_1 b_1Z_1+v_2 b_2Z_2) +E_1$……7
$Z_2 =A_{21} b_1Z_1+A_{22} b_2Z_2+C_2 (v_1 b_1Z_1+v_2 b_2Z_2) +E_2$……..……..……8

After re-arranging we obtain 9 and 10
$Z_1-A_{11}B_1Z_1-A_{12}B_2Z_2-C_1 (v_1B_1Z_1+v_2B_2Z_2) =E_1$……..……9
$Z_2 -A_{21}b_1Z_1-A_{22}b_2Z_2-C_2 (v_1b_1Z_1+v_2b_2Z_2) =E_2$……..…..……10

Putting like terms together we obtain 11 and 12
$Z_1(1-a_{11} b_{11} - C_1 v_1 b_1) + Z_2 (-a_{12}b_2-C_1v_2b_2) =E_1$…….……..….11
$Z_1(-a_{21}b_1Z_1- C_2v_1b_1) + Z_2 (1-a_{22}b_2-C_2 v_2b_2Z_2) =E_2$…….……12
By converting 11 and 12 into a matrix, we obtain 13
$\begin{bmatrix} 1-a_{11}b_1-C_1v_1b_1 & -a_{12}B_2-C_1v_1b_2 \\ -A_{21}b_1-C_2v_1b_1 & 1-a_{22}b_2-C_2v_2b_2 \end{bmatrix}\begin{bmatrix} Z_1 \\ Z_2 \end{bmatrix}=\begin{bmatrix} E_1 \\ E_2 \end{bmatrix}$……..…….……...…..……13
From equation 13, it is clear that matrix $\begin{bmatrix} 1-a_{11}b_1-C_1v_1b_1 & -a_{12}B_2-C_1v_1b_2 \\ -A_{21}b_1-C_2v_1b_1 & 1-a_{22}b_2-C_2v_2b_2 \end{bmatrix}$ is equivalent to subtracting the coefficient matrix from the identity matrix (1). If we represent the co-efficient matrix by M , $\begin{bmatrix} Z_1 \\ Z_2 \end{bmatrix}$ by Z and $\begin{bmatrix} E_1 \\ E_2 \end{bmatrix}$ by E, then it is possible to rewrite 13 as in 14 below.
(1-M)Z=E…….……..14

By re-arranging 14, we can obtain 15.
Z= (1-M)$^{-1}$ E…….……..…….……..15

By letting Z , M and E equal to V, A and X respectively we can rewrite 15 as in 16

V = (I – A)$^{-1}$ X= M$_a$X…….…….…….……16

Where **M$_a$** is the SAM multiplier matrix or the inverse matrix which captures the direct and the indirect effects of the exogenous shock (X). In this respect, equation 16 determines the equilibrium total outputs and incomes of **V** consistent with any set of injections X.
In order to understand the structure as well as the mechanism through which the injection from the exogenous accounts affects the targeted endogenous accounts, **M$_a$** is decomposed following the approach recommended by (Thobecke, 2000; Thorbecke and Jung ,1996). In this respect, the decomposition adapted in this study is closely linked to that of (Pansini, 2008) and in some respect Cohen (2013) who followed a similar approach.

In this study, the decomposition follows the approach recommended by Pyatt and Round(1979) and in many respects followed by other researchers including Thorbecke and

Jung ,1996, Thobecke, 2000;. (Pansini, 2008) and Cohen (2013). By exploring the SAM structure and using endogenous accounts namely activities, factors and households, it is possible to decompose the Ma multiplier as follows[10]:

dy= $\mathbf{M_a}$ dy =M3M2M1 dx ……..……17

where $\mathbf{M_1}$ is the transfer multiplier which captures the intra account effects of one variable to another within the same production account. N For the activity to activity account this is referred to as the Leontief multiplier and for the household to household this is referred to as interdependence (rural –urban). $\mathbf{M_2}$ is a measure of the open-loop effects or the spillover effects which capture the effect of the exogenous shock or injection from one variable belonging to one account to another belonging to a different account (refers to SAM accounts) without feedback. It captures the inter-account effects from the production account to factors and then to household. Finally, $\mathbf{M_3}$ measures the closed-loop or the full circular flow effects which captures the effects of an injection from one account walking its way through all the endogenous accounts. In this respect, $\mathbf{M_3}$ captures the effect from household income , to consumption, to production activity, to factor income and back to household as the process is repeated. For formal derivation of M1, M2 and M3 (see Pansini, 2008 and Cohen (2013). Additionally, some researchers have proposed using the additive decomposition (Stone, 1985).

Dy= (1+(1-M1)+(1-M2)+(1-M3)) M1 M2 DX

Constrained SAM Multiplier

For the constrained Multiplier model, equation 13 would look like 18 below.

$$\begin{bmatrix} 1 - A_{11}B_1 - C_1V_1B_1 & 0 \\ -A_{21}B_1 - C_2V_1B_1 & -1 \end{bmatrix} \begin{bmatrix} Z_1 \\ E_2 \end{bmatrix} = \begin{bmatrix} 1 & A_{12}B_2 + C_1V_2B_2 \\ 0 & -1 + A_{22}B_2 + C_1V_2B_2 \end{bmatrix} \begin{bmatrix} E_1 \\ Z_2 \end{bmatrix} \quad \ldots\ldots 18$$

From equation 16 above, sector Z_1 remain unconstrained while sector Z_2 is now constrained and is exogenously determined.

By representing $\begin{bmatrix} 1 - A_{11}B_1 - C_1V_1B_1 & 0 \\ -A_{21}B_1 - C_2V_1B_1 & -1 \end{bmatrix}$ which is a coefficient matrix as M* and the first term on the right hand side of 16 as N, we are able to obtain the expression in equation 19.

$$(1 - M*) * \begin{bmatrix} Z_1 \\ E_2 \end{bmatrix} = N \begin{bmatrix} E_1 \\ Z_2 \end{bmatrix} \quad \ldots\ldots 19$$

By re-arranging 19 we can obtain 20.

$$\begin{bmatrix} Z_1 \\ E_2 \end{bmatrix} = \mathbf{(1-} \boldsymbol{M*}\mathbf{)^{-1}\ N} \begin{bmatrix} E_1 \\ Z_2 \end{bmatrix} \quad \ldots\ldots 20$$

Equation 18 is the final constrained sector Multiplier equation which states that increases in demand for the unconstrained sectors represented by E1 will result into increases in the final demand for these sectors(commodities produced) while the increase in the demand for the constrained sector Z_2 will negatively impact on the exports in these sectors which might consequently call for imports to satisfy the demand thereby negatively affecting net-exports.

[10] For detailed exposition on the multiplier decomposition see Pyatt and Round(1979), (Pansini, 2008) and Cohen (2013).

Annex 2: Decomposition of SAM multiplier

$\mathbf{V = (I - A)^{-1} X = M_a X}$……21

Where $\mathbf{M_a}$ is the SAM multiplier matrix or the inverse matrix which captures the direct and the indirect effects of the exogenous shock (X). In this respect, equation 4 determines the equilibrium total outputs and incomes of **V** consistent with any set of injections X.
In order to understand the structure as well as the mechanism through which the injection from the exogenous accounts affects the targeted endogenous accounts, $\mathbf{M_a}$ is decomposed following the approach recommended by (Thobecke, 2000; Thorbecke and Jung ,1996). In this respect, the decomposition adapted in this study is closely linked to that of (Pansini, 2008) and in some respect Cohen (2013) who followed a similar approach. Ma can be decomposed starting from equation 21:

$\mathbf{M_a}$ X= $\mathbf{M_3\ M_2\ M_1}$ X……..……22

Where $\mathbf{M_1}$ is the transfer multiplier which captures the intra account effects of one variable to another within the same production account. It is referred to as the Leontief multiplier. $\mathbf{M_2}$ is a measure of the open-loop effects which capture the effect of the exogenous shock or injection from one variable belonging to one account to another belonging to a different account (refers to SAM accounts). It captures the inter-account effects from the production account to factors and then to household. Finally, $\mathbf{M_3}$ measures the closed-loop effects which captures the circular flow of the injection from one account walking its way through all the endogenous accounts. In this respect, it captures the effect from household income , to consumption, to production activity, to factor income and back to household(the process is repeated). Below is the formal derivation of M1, M2 and M3.

By reformulating equation 2, it is possible to derive M1 as follows.

$\mathbf{V=AV+X=AV+A_0V-A_0V+X=AV-A_0V+A_0V+X}$…….……..…….23

By re-arranging and manipulating equation 23, equation 24 is obtained**.**
$\mathbf{V= (A-A_0)\ V\ (1-A_0)^{-1}+ (1-A_0)^{-1}X}$……..……..……..24

From the above, $\mathbf{(1-A_0)^{-1}}$ is identified as M1 (transfer matrix) and thus,

$\mathbf{V=M1\ (A-A_0)^{-1}\ V+M1X}$……..……25

M1 can further be defined as indicated in 8 below:-which is a matrix representation in a SAM framework.

$$M1=\begin{bmatrix} M_{11} & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & M_{33} \end{bmatrix}$$……..…….……..26

Where moving along the diagonal is activity to activity (M_{11}), factor to factor (I) and Institution to Institution (M_{33}). M_{11} is equal to ($1-A_{11}$)-1 and evaluates transfer effects from one activity to another (Leontief multiplier effects). M_{33} is equal to ($1-A_{33}$)-1 which is identified with Institution to Institution transfers. However, in the SAM framework, no transfers are

expected from one factor of production to another and this element is captured by an identity matrix (I).

Using the M1 definition, and assuming the inverse of matrix $(A-A_0)$-1 of matrix $A-A_0$ (equation 10) exists, it is possible to introduce A* in 11:

$$\mathbf{A} - A_0 = \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32}0 & 0 \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 27$$

Where $\mathbf{A_{21}}$ captures payments to factors by activities and $\mathbf{A_{32}}$ represent transfers from factors to institutions and A13 are consumption expenditures on commodities (activities).

$$\mathbf{A^* = M1\ (A-A_0)^{-1} = (1-A_0)^{-1}\ (A-A_0)^{-1}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 28$$

From the previous equations, it is also possible to write

$$\mathbf{V = ((1-A^*)^{-1}\ M1)\ X} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 29$$

By assuming that $\mathbf{(1-A^*)^{-1}}$ exists and again using the previous definition of M1, equation 12 is obtain from equation 11**.**

$$\mathbf{V = ((1-A^*)^{-1}\ M1)\ X = (1-A^*)^{-1}\ (1-A_0)^{-1}\ X = MX} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 30$$

From equation **13,** $\mathbf{(1-A_0)^{-1}}$ still refers to the transfer effects matrix. What remains to be decomposed is the $\mathbf{(1-A^*)^{-1}}$ which is done as follows.

$$\mathbf{(1-A^*)^{-1} = (1-A^{*n})^{-1}\ (1+A^{*}+A^{*2}+\ldots+A^{*n-1})} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 31$$

Where n refers to number of endogenous accounts. In this respect these are three and hence the derivation proceeds as:

$$\mathbf{V = (1-A^{*3})^{-1}\ (1+A^{*}+A^{*2}+A^{*3})M1X} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 32$$

Where $\mathbf{A^{*2}}$ is a matrix indicated in 33 below.

$$A^{*2} = \begin{bmatrix} 0 & A*_{13}\,A*_{32} & 0 \\ 0 & 0 & A*_{21}\,A*_{13} \\ A*_{32}\,A*_{21} & 0 & 0 \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 33$$

Similarly **A*3** is as defined in 16.

$$A^{*3} = \begin{bmatrix} A*_{13}\,A*_{32}\,A*_{21} & 0 & 0 \\ 0 & A*_{21}\,A*_{13}\,A*_{32} & 0 \\ 0 & 0 & A*_{32}\,A*_{21}\,A*_{13} \end{bmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 34$$

From the above, it is clear that 31 can be rewritten as in 35.

As indicated before matrix M1 captures the transfer effects, matrix M2 is identified with $\mathbf{(I+A^{*}+A^{*2}+A^{*2})}$ in 14 and captures the open-loop effects. $\mathbf{(1-A^{*3})^{-1}}$ in 14 is defined as matrix M3 and captures the closed-loop effects (pure indirect effects). It captures the circular flow of the exogenous shock travelling through all endogenous accounts including feedbacks.

Recent Publications in the Series

nº	Year	Author(s)	Title
205	2014	Mthuli Ncube, Dawit B. Tessema and Daniel Zerfu Gurara	Volatility and Co-movement in Commodity Prices: New Evidence
204	2014	Mthuli Ncube, Zuzana Brixiová, and Thierry Kangoye	Skills and Youth Entrepreneurship in Africa :Analysis with Evidence from Swaziland
203	2014	Ousman Gajigo and Audrey Verdier-Chouchane	Immigrants, Skills and Wages in The Gambian Labor Market
202	2014	Jacob Oduor, Moses Muse Sichei, Samuel Kiplangat Tiriongo and Chris Shimba	Segmentation and efficiency of the interbank market and their implication for the conduct of monetary policy
201	2014	John C. Anyanwu	Does Intra-African Trade Reduce Youth Unemployment In Africa?
200	2014	Nadège Désirée Yaméogo	Analysis of Household Expenditures and the Impact of Remittances and Migration using a latent class model: the Case of Burkina Faso
199	2014	Emmanuel Mutisya and Masaru Yarime	Microcredit for the Development of the Bottom of the Pyramid Segment: Impact of Access to Financial Services on Microcredit Clients, Institutions and Urban Sustainability
198	2014	Mthuli Ncube, Zuzana Brixiova, and Quigwei Meng	Can Intra-Regional Trade Act As a Global Shock Absorber in Africa?
197	2014	Mthuli Ncube, Basil Jones, and Zorobabel Bicaba	Estimating the Economic Cost of Fragility in Africa
196	2014	Guy Blaise Nkamleu and Bernadette Dia Kamgnia	Uses and Abuses of Per-diems in Africa- A Political Economy of Travel Allowances

African Development Bank

Angle de l'avenue du Ghana et des rues Pierre
de Coubertin et Hédi Nouira
BP 323 –1002 Tunis Belvédère (Tunisia)
Tel.: +216 71 333 511 – Fax: +216 71 351 933
E-mail: afdb@afdb.org – Internet: www.afdb.org