Public Spending in Agriculture and poverty reduction linkages analyses for fiscal planning. Case of Eastern Cape Province

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Abstract

The efforts to meet the Millennium Development Goal 1 (MDG1) and the demands of democratization in South Africa have directed attention at the potential of the agricultural sector for reducing poverty. Expectedly, the sector has attracted considerable fiscal policy interest and public investments. This paper explores the linkages between public spending in agriculture, agricultural growth and poverty in the Eastern Cape Province of South Africa. The identification of the critical linkages in the agricultural development framework allows for effective strategic planning, effective decision making and appropriate policy formulation. The outcome of the analyses will contribute to improved decision making on the use of public funds in agriculture. Methodologically, the study simulates the required agricultural investment and required agricultural growth rate that is sufficient to meet MDG1 by 2025 by employing partial equilibrium modelling based on the System Dynamics Analyses approach. This entailed the application of growth decomposition technique and growth elasticity of poverty concepts with a specific emphasis on policy interventions for promoting agricultural growth. The drivers and cause-effect relationships between agriculture and poverty reduction were investigated. The employed models allowed for an exploration of plausible future growth in public spending in agriculture, agricultural growth elasticity of poverty and the possibility of reducing poverty levels in the province while evaluating strategies for meeting the MDG1 by 2025. Estimates for the required agricultural growth rate and the increase in public spending on agriculture required in order to reach MDG1 by 2025 were calculated for each district municipality in the Eastern Cape Province. All the district municipalities were then evaluated in terms of their need to increase public investment in agriculture and the ability to achieve MDG1 by 2025 and beyond. Estimates for both the required public spending and the required agricultural growth were then calculated following both the business-as-usual scenario and the best-case scenario.

Key words: Agricultural growth, public agricultural expenditure, rural development, growth, poverty

Table of Contents

1. Introduction 3
2. Agriculture and poverty reduction 5
3. Research Approach 6
3.1 Model Description 7
3.2 Costing Millennium Development Goal 1 9
4. Results and Discussion 9
4.1 Trends in the incidence of poverty and progress towards MDG1 10
4.2 Required agricultural growth rate to meet MDG1 10
5. Conclusion 17
REFERENCES 19
APPENDIX A: Data Description and Sources 22
Appendix B: Multi-step GDP Costing Equations 23
Appendix C: Simulated trend for the incidence of poverty until 2025 25
Appendix D: Variables used in Costing MDG1 26

1. Introduction

The Millennium Development Goal 1 (MDG1) emphasizes the challenge of reducing by half the proportion of the population living below the poverty line by 2015 (UNDP, 2010). Agriculture has since occupied the centre-stage in meeting MDG1. Haggblade (2007) in Uganda; Govereh, Malawo, Lungu, Jayne, Chinyama and Chilonda (2009) in Zambia; Fan, Zhang, and Zhang (2002) in China; and Akroyd and Smith (2007) in six developing countries, strongly agree that rural economic growth and wide-spread poverty reduction require increased production in agriculture. Machethe (2004), Fan *et al*. (2002), Organisation for Economic Co-operation and Development (2006), and Van Zyl (2009), provide evidence that buttress this important linkage among agriculture, income growth and poverty). The agricultural sector has both the direct and indirect impacts on economic development (Van Zyl, 2009). In China, it was agricultural growth that enabled significant reduction in poverty during the period 1978 to 1997 (Fan *et al.*, 2002). The importance of the agricultural sector goes well beyond its direct impact on rural incomes as it has both upstream or backward linkages on the supply side and downstream or forward linkages on the manufacturing side (Hirschman, 1958 and 1977; Machethe, 2002 and Van Zyl, 2009).

The agricultural sector has a high degree of interrelatedness with the other sectors that emerges as a consequence of both the demand and supply effects of inputs and outputs. Growth in agriculture does not only benefit the rural folks; increased output in the rural areas has a direct bearing on the urban sector through its food price decreasing effect and creation of employment. Summing both the direct and indirect effects of agricultural growth, Van Zyl (2009) revealed that the relative contribution of agriculture to South Africa's Gross Domestic Product (GDP) is only about 4 per cent to 5 per cent. Considering the associated multiplier effects, this sector contributes much larger share than it directly provides. Van Zyl (2009) mentioned that in 1994, agricultural exports resulted in foreign exchange to the tune of R7 240 million. During that same year, the manufacturing industry contributed about 37% to the GDP, of which 25 per cent from agro-processing. Agriculture has a direct bearing on income growth, poverty reduction and overall economic growth. The sector's real contribution is far more substantial and crucial for sustained wealth creation, poverty alleviation, and welfare.

Economic growth in the former homelands of South Africa, where more than 70 per cent of the population is regarded as poor and land is abundant, will definitely require significant improvements in agricultural production. Thus, there is need for studies analysing the linkages between agriculture and agricultural growth and consequent reductions in poverty. With the objective of proposing a methodology for estimating the required investment to achieve any specified development target, this study presents an analysis of the linkages between public investment flows, agricultural growth, rural income levels and the level of poverty in Eastern Cape Province of South Africa. It examined the nature and dimensions of poverty in the province and how the two relate to public spending and the state of agriculture since the dawn of democracy. More specifically, this study aims:

(a) To analyse and establish the influence of public investment in agricultural production in Eastern Cape,
(b) To analyse the empirical relationship between agricultural growth and poverty in Eastern Cape Province
(c) To estimate the agricultural investment growth rate required to reach MDG 1 of reducing by half the level of 1990 poverty in Eastern Cape.

This paper is based on the premise that agricultural spending across Eastern Cape's district municipalities has the largest impact on agricultural production growth. Since governments frequently face budget constraints, Fan *et al.* (2002) argue that enquiries of this nature help them to quantify the required spending. The findings of the analysis will rationalize the employed methodology by providing lessons regarding the level and composition of public spending that can be useful for economic development.

It is every government's desire to have spending that produces the highest impact on GDP growth. Populists advocate for increase in public spending, but simply increasing the level of spending is unsustainable as this will likely result in misallocation of government funds and inefficient spending. There are various macroeconomic models and methodologies that have applications in the sphere of public investment, growth and poverty reduction. This model evolved from the World Bank's 1991 study of the impact of post-Apartheid policies in South Africa. Using time series data, the World Bank simulated the macroeconomic impact of public investment on GDP. More gains

can be achieved by using similar macro-economic models to analyze and address misallocation of resources across and within subsectors (Govereh *et al.,* 2009).

2. Agriculture and poverty reduction

The slow rate of progress towards the reduction of poverty to levels stated by the MDGs in Africa is quite worrying. Thus, governments are facing substantial pressures to reduce poverty. One school of thought agrees without reservations that agricultural expenditure is the key driver of agricultural growth and poverty (Fan *et al.*, 2002; Fan and Rao, 2003 and Hall and Aliber, 2010). The other school of thought agrees, but with reservations. For instance, Tanzi (2008) argues that not all countries that allow their public spending to grow significantly score better quantitative results. Johnson (2001) further debated that the public goods and services by the government will only impact positively on poverty if these goods reach the targeted population. Misallocation or "corruption" of these services often results in inefficiencies (World Bank, 2000; the Economist, 2001). Table 1 below shows a meta-analysis that summarises the relationship between public agricultural expenditure and its influence on agricultural GDP.

Table 1 Elasticity of Agricultural GDP and GDP growth with respect to agricultural expenditure

Region	Value for Elasticity	Source and Period
43 Developing countries: Elasticity of agricultural GDP growth w.r.t government agricultural spending	0.052	Fan and Rao (2003)
43 Developing countries: Elasticity of agricultural Output w.r.t government agricultural spending	0.037	Fan and Rao (2003)
South Africa's elasticity of real GDP w.r.t real public expenditure	0.0157	Ashipala, J. and N. Haimbodi. 2003
98 Developing countries: Elasticity of agricultural GDP w.r.t ODA	0.03	Schuh, G. E., and G. W. Norton. 1991

A change in public agricultural expenditure positively impacts on agricultural GDP. The above figures for elasticities and remarkable decrease in poverty following agriculturally-led structural transformations in Asia and other countries strengthen the development economists' theoretical understanding of the causal mechanisms underlying public agricultural expenditure and agricultural growth.

Poverty decreases recorded in the modern history of England, India and China started with increased productivity amongst smallholder farmers (Lipton, 2005). Mwape (2009) came up with almost similar findings for African states. A meta–analysis with illustrations of the relationship between agricultural growth and the incidence of poverty is presented in Table 2.

Table 2 Elasticity of poverty with respect to agricultural GDP

Country	Value for Elasticity	Source
Ghana	-1.78	Diao et al., 2007
Kenya	-1.25	
Uganda	-1.58	
Zambia	-0.58	
Ethiopia	-1.66	

The table explains agricultural growth's conduciveness to poverty reduction. Increased agricultural production reduces poverty. It is agricultural productivity that has allowed the poor countries to prosper. Almost none of the poor countries has achieved economic prosperity without first increasing agricultural production (DFID, 2005).

All the above discussed information revealed a unidirectional relationship, where causality ran from government expenditures to growth. However, in discussing intergovernmental fiscal relations and poverty alleviation in Vietnam, Bird, Jennie, and Govinda Rao (1995) argue for greater decentralisation of spending and improved pro-poor expenditures. Thus, the above perception should be treated with caution as the whole process is dynamic. The outcome sometimes depends on the needs and fiscal abilities of different localities.

3. Research Approach

The research approach involved developing detailed econometric model for the agricultural sector for the Eastern Cape, including the collection and processing of historical economic data, and construction of substantial, System Dynamics partial equilibrium agricultural sector model. This modelling approach enables examination of complex, dynamic economic interrelationships at the industrial sector level, which

enable simulations of the required resources to meet MDG1 by each district municipality in the Eastern Cape. Few traditional economic models are capable of demonstrating the impact of public expenditure on agriculture and how this translates to poverty reduction. Several studies find an important association among public agricultural expenditure, agricultural growth and poverty reduction (Govereh *et al.,* 2009 and Hall and Aliber, 2010). Despite these revelations, this notion does not translate into budget allocations. In the light of this background, this paper presents a tentative methodology and the evidence that the agricultural sector contributes to and is a major determinant of economic growth and could reduce poverty.

3.1 Model Description

The adopted methodological approach supports the linkages among government spending on agriculture, agricultural and non-agricultural income growth and poverty reduction. It summarizes the main components and develops the set of models that draws simple relationships among the variables. Following these channels, this study is therefore designed around the conceptual principles relating to the two sources of income; agricultural income and non-agricultural income. Part of the framework was adapted from Fan *et al.,* 2008. The marginal impact of agricultural and non-agricultural income on poverty can be presented by calculations of the equation that captures the elasticity of poverty reduction with respect to both agricultural and non-agricultural growth, (see Appendix A: Equation (1) and (2)).

In order to capture the essence of the Eastern Cape's agricultural sector, the study developed a system dynamic model for the sector. System Dynamic modelling is appropriate for a dynamic system characterised by interdependence, mutual interaction, information feedback, and circular causality (Xi and Poh, 2013). Poverty levels, agricultural income, non-agricultural incomes and public expenditure are highly integrated components and therefore system Dynamics Analyses was used to capture the interdependencies and feedbacks between various subsystems. Since the MDG1 goal will expire in 2015, the model was adjusted to run from the year 1995 to 2025, so as to reveal the long-term impacts of public spending on poverty. The model was developed with Vensim Personal Learning Edition, which helps to conceptualise, build and test system dynamics models (Xi and Poh, 2013). The mechanism at work is as

follows: An increase in public agricultural investment causes an increase in agricultural output/GDP, which spills over to non-agricultural output/GDP through a multiplier effect. These changes in agricultural and non-agricultural GDP increase incomes and reduce the poverty rate. A Stock and Flow Diagram presented in Figure 1 captures the key elements of the system.

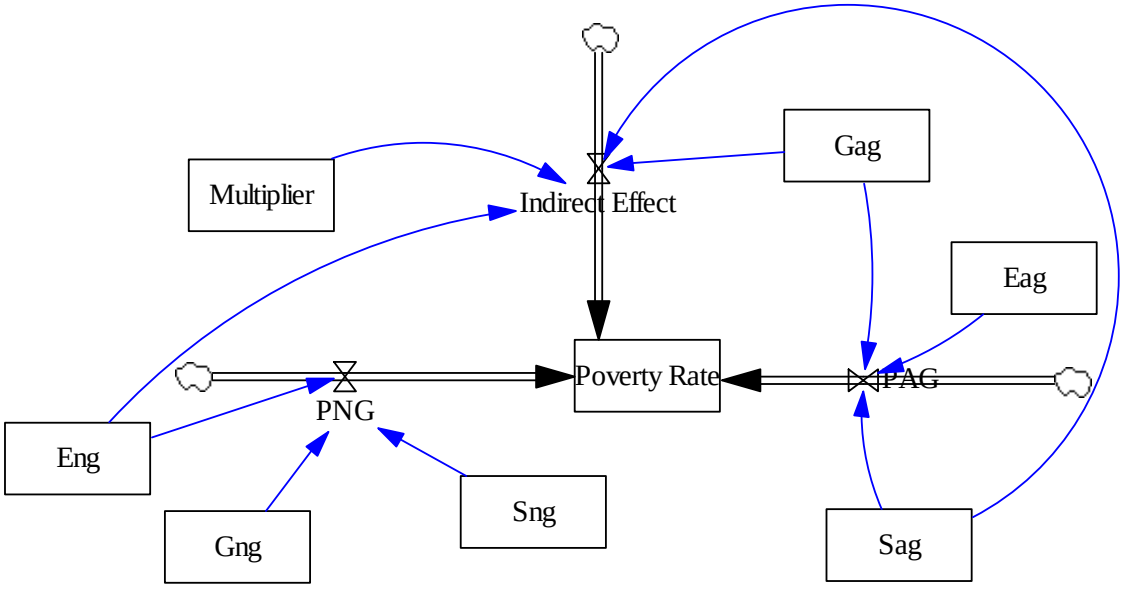

Figure 1: Stock and Flow Diagram

(See Appendix A for variable explanation)

Figure 1 presents the set of variables important when undertaking an analysis of the impact of agriculture on poverty reduction. It tracks the whole chain of causality between Agricultural GDP (G*ag*), Non-agricultural GDP (G*ng*), the indirect effects and poverty rate. Key parameter values emerge as important: poverty elasticity of agricultural growth, poverty elasticity of non-agricultural growth, the elasticity of agricultural growth to public agricultural expenditure increase and the multiplier connecting non-agricultural growth to agricultural growth. Thus, the diagram provides information on interlinks in the whole system. This framework prompts the analysis as it lays the basis for equation 1 and 2 (Appendix A) developed to estimate the relationships among the variables in this study. Any positive effect on the immediate macroeconomic determinants, namely Agricultural GDP (G*ag*), Non-agricultural GDP (G*ng*) and the indirect effects are likely to cause a decrease in poverty with fiscal policy being the main driver (Bourguignon, 2003 and Pasha and Palanivel, 2004).

3.2 Costing Millennium Development Goal 1

Each MDG requires an assessment of the range of interventions available and appropriate to meet the target and should provide a transparent framework for budgeting to meet the MDGs. It is therefore important to establish what increase in agricultural public investment would be needed to reduce the poverty rate sufficiently to meet MDG1. The adopted methodology and the series of derived equations in Appendix A seek to estimate what increase in agricultural public investment would be needed to reduce the poverty rate sufficiently to meet MDG1. Thus, the above string of causation is converted to rates of change, so the ultimate question becomes what changes in agricultural expenditure growth rate will induce changes in the growth rate of output to meet MDG1. Three rates of change equations emerge from the string of causation namely: agricultural growth to GDP growth; GDP growth rates to change in poverty rates and public agricultural expenditure to agricultural growth rate. They are quantified by equations (3), (4) and (5).

The simulations are done in reverse order for each district in the Eastern Cape Province. The rates of growth of agricultural output needed to reduce poverty rates to MDG1 levels by 2025 are calculated. Then, the rates of increase in agricultural public investment needed to achieve the required rates of growth in agricultural output are calculated. These simulated values are compared with business-as-usual rates.

4. Results and Discussion

The results presented in this paper summarize the trends in the incidence of poverty across all the seven district municipalities of the Eastern Cape Province and further draw attention to the distribution of the benefits of agricultural growth by tracing the response of agricultural GDP to public spending on agriculture, and how growth in agriculture translates into poverty reduction over the years. Part of the results assesses the progress made by all the seven district municipalities towards the MDG1 and further estimates the required growth in public spending necessary to reach MDG1.

4.1 Trends in the incidence of poverty and progress towards MDG1

Table 3 shows the extent of poverty by district municipality for the Eastern Cape Province. The observed trends suggest that the Province's ability to meet the Millennium Development Goal (MDG) of halving poverty by 2015 is in serious doubt.

Table 3: The incidence of poverty across Eastern Cape

Year				
District municipality	1995 (%)	2000 (%)	2005 (%)	2009 (%)
Amatole district	53.1	63.0	64.98	55.1
Chris Hani district municipality	62.0	75.8	82.0	74.3
Alfred Nzo district municipality	67.4	81.9	88.9	72.7
Cacadu District Municipality	62.0	75.8	82.0	74.3
Nelson Mandela Metropolitan	62.0	75.8	82.0	74.3
O. R. Tambo District Municipality	65.5	74.1	76.1	63.3
UKhahlamba District	63.8	76.4	79.0	62.8

Source: Eastern Cape's Socio-Economic Consultative Council (ECSECC), (2010).

Based on their past performance, results in Appendix B show the outcome of the results of the Exponential Smoothing for each district municipality.

All the district municipalities of the province are either off-track and slow or off-track and retrogressing as far as progress towards the MDG1 is concerned. Except for Nelson Mandela Metropolitan, all the district municipalities have been making progress, albeit slowly. The results of the estimates show that all seven districts may not reach the MDG1 target before 2015 or even 2025. The situation is even worse in the case of Nelson Mandela Metropolitan. In that district, poverty is even increasing, implying retrogression and moving further away from the set target. The observed slow progress in the Eastern Cape Province suggests that the global goal of halving poverty by 2015 is unattainable in the province.

4.2 Required agricultural growth rate to meet MDG1

The question addressed by this section is what is the estimated agricultural growth rate required to meet MDG1 in the Eastern Cape Province? Growth-poverty elasticity values are used to determine the extent to which poverty declines as agricultural

production grows (Fan and Rosegrant, 2008 and Fan *et al.,* 2008). Data for missing variables was supplemented for by estimates from previous studies and explanations are provided for the choice of selected estimates. Table 3 provides the list of variables used and the estimated statistics for each variable.

Table 3: Variables used in Costing Millennium Development Goal 1

District municipality	**Required change in poverty for each year**	ε_{ag} = **elasticity of poverty reduction with respect to (w.r.t.) agricultural GDP growth**	g_{ag} = **agricultural GDP growth rate**	s_{ag} **= share of agriculture in GDP**	ε_{ng} = **elasticity of poverty reduction w.r.t. non-agricultural GDP growth**	s_{ng} **= share of non-agriculture in GDP**	g_{ng} **= non-agricultural GDP growth rate**
Amatole	5.52	-0.24	1.85	0.01	-0.07	0.97	0.04
Alfred Nzo	3.30	-0.26	2.93	0.03	-0.13	0.93	0.10
Cacadu	4.60	-0.41	0.55	0.11	-0.05	0.89	0.06
Chris Hani	3.10	-0.31	2.98	0.05	-0.003	0.95	0.05
Nelson Mandela Metropolitan	14.60	-0.13	6.94	0.004	-0.39	0.99	0.03
O R Tambo	11	-0.23	5.96	0.026	-0.37	0.97	0.08
UKhahlamba	4.03	-0.39	1.32	0.10	-0.012	0.90	0.08

Source: Authors' calculations based on data from ECSECC (2010) database and following the methodology.

Fan and Rosegrant (2008) and Fan *et al,* (2008) successfully estimated the amount of resources required to meet MDG1 in sub-Saharan Africa (SSA), Asia and the Pacific, respectively, using similar variables. By adopting the same procedures, the methods employed here estimate the Required Annual Agriculture Growth Rates to Achieve MDG1 and the Required Agricultural Expenditure Growth Rates to Achieve MDG1 across all district municipalities of the Eastern Cape Province of South Africa. Estimates for the above variables were calculated from the Eastern Cape Province's data, Figures for both agricultural and non-agricultural elasticity of poverty were calculated using Equation (4).

Fan *et al.* (2008) proposed an important argument concerning the values for the multiplier used in studies of this nature. They noted that the results of studies of costing poverty reduction are sensitive to the choice of the multiplier and therefore proposed the use of values derived from systematic research. But municipal data on public expenditure on agriculture is scarce. In order to accommodate this, a careful review of the literature was undertaken to determine the most appropriate values for elasticity of agricultural growth with respect to public agricultural expenditure to be adapted for this study. The calculated values, the multiplier and expenditure elasticity, were considered flawed due to lack of appropriate data. The use of values from previous studies will make the results comparable to previous outcomes. Further, the use of values from previous studies is relatively common in the literature on costing poverty reduction (Fan *et al.,* 2008). Table 4 shows the values for agricultural elasticity of public agricultural expenditure and the multiplier effect as founded in the literature, the respective authors and the reason for adoption of those variables. Furthermore, these same figures were used by Fan *et al.* (2008) for similar studies in sub-Saharan Africa. The multiplier effect is assumed to be 1.5, which suggests that for each rand of gain in agricultural GDP, non-agricultural GDP rises by a factor of 1.5 in the same region. The multiplier effect has its greatest impact when idle resources exist. The figure for the multiplier is high and this is based on reasoned expectation that the Eastern Cape's agricultural economy is operating below natural GDP as there are idle resources like land, labour and agricultural equipment. Therefore, for each spending round, idle resources are always available to be brought into production. The value for the multiplier was however supplemented with sensitivity analyses.

Table 4: Adapted values for the multiplier and expenditure elasticity of growth

Variable	Elasticity Value	Source	Reason
Multiplier effect	1.5	Christian Delgado *et al.* (1998); Fan and Rao (2003); Fan *et al*., (2008)	-Recent and comparable to other values from Africa -Founded using data from Africa
Expenditure Elasticity of Growth	0.32		

Following equation 1 and the subsequent equation for poverty reduction due to non-agricultural growth, it is possible to calculate the value of the required agricultural growth rate. To estimate the agricultural growth rate required to meet the MDG1 in the Eastern Cape Province, we assume that growth rates will follow the business-as-usual trend. This scenario assumes that the economy follows similar growth as that observed during the period 1995 to 2010. The estimated figures for both the required annual agricultural growth rates to achieve MDG1 and the required agricultural expenditure growth rates needed to attain this growth rate are then calculated.

Table 5 shows the per cent increase in public investment requirements based on growth-poverty elasticity methodology. All the district municipalities of the Eastern Cape Province will need to boost their annual agricultural growth to figures shown in Table 5, respectively, in order to achieve MDG1. The calculated values are higher than the observed municipal averages shown in column 2 of the same table. There is a huge gap between the required agricultural growth rate and the observed averages for the period 1995 to 2010. To reach this target, government agricultural spending will have to increase by the indicated percentage points for each respective multiplier value from (See Table 5) from an average of three per cent per annum observed from 2000 to 2010. However, there is a large variation in required investment increases across the province's district municipalities.

Table 5: Agricultural growth and Expenditure required reaching MDG1by 2025

District municipality	Assumed Annual Non-Agricultural Growth Rates, 2004 – 2025(percent)	Agricultural growth rate since 1995	Required Annual Agriculture Growth Rates to Achieve MDG1(percent)			Required Agricultural Expenditure Growth Rates to Achieve MDG1(percent)		
			Low Multiplier (0.5)	Medium Multiplier value (1.0)	High multiplier (1.5)	Low Multiplier (0.5)	Medium Multiplier value (1.0)	High Multiplier (1.5)
Amatole	0.04	2.04	14.27	13.11	12.14	44.58	40.98	37.92
Alfred Nzo	0.10	2.93	3.69	3.46	3.25	11.55	10.81	10.17
Cacadu	0.05	0.55	0.99	0.98	0.98	3.09	3.07	3.06
Chris Hani	0.05	2.98	2.06	2.06	2.06	6.44	6.43	6.42
Nelson Mandela Metropolitan	0.03	6.94	59.53	33.30	23.11	186.04	104.06	72.23
O R Tambo	0.08	5.96	14.20	11.58	9.78	44.38	36.20	30.56
UKhahlamba	0.04	1.32	1.00	1.00	1.00	3.12	3.12	3.12

Presenting the exact current level of public spending and the required increases is more informative but because of data scarcity, results on the required increase in public finance for agriculture per municipality were presented in percentages only. Estimates indicate that in order to achieve MDG1, all the municipalities are expected to increase public spending on agriculture. Cacadu and Ukhahlamba have the least expected increase of 3 per cent per annum. Nelson Mandela Metropolitan, OR Tambo and Amatole have the highest required percentage increase in agricultural expenditure, in that order. Therefore, almost all district municipalities will need to increase their financial outlays in order to reach the MDG1 target. The inability of the Eastern Cape Province to substantially raise the level of their agricultural investments may have serious implications for poverty reduction and the achievement of the MDG1.

Important findings emerge from the estimates found using the growth elasticity of poverty (GEP) estimates for Eastern Cape Province's district municipalities. Increased growth rate in agricultural production is paramount to reducing poverty in the province and increased investment in agriculture is key to the achievement of this required growth. Computation of GEP has demonstrated that all the district municipalities of Eastern Cape will need to boost their annual agricultural growth to 3.2 per cent on average in order to achieve MDG1. To reach this target, government agricultural spending will have to increase to an average of 10 per cent per annum. However, there is a large variation in required investment increments across the Eastern Cape Province's district municipalities. These gaps between the 2010 level and the target poverty level can still be bridged by meeting the required increases and in all the cases this will imply stepping up investment by few percentage points (Table 5). Municipalities will need to increase agricultural spending significantly in order to achieve MDG1.

The overall outcome of both the fore-going findings and reviewed literature advocate for increased public investment in agriculture and increased agricultural productivity for poverty to be reduced significantly. With regard to poverty reduction through increased public expenditure in agriculture, previous studies strongly recommended a growth path which is pro-poor in character. The feasibility of attaining the MDG1 and all the other goals can be improved by a growth path that takes into account the nature of Eastern Cape's economy. Agriculture is relatively labour intensive, low wage, and

low skilled activity compared with manufacturing or services. It follows that increase in public investment into agriculture might increase output and hence employment of low skilled low wage workers. And these are likely to be the populations below the poverty datum line - hence the result that poverty is more effectively relieved by expanding agricultural output relative to spending the funds in another sector of the economy which might have fewer (or no) workers living in poverty. Therefore, effort should be made to promote policy intervention and increased public spending that contribute to enhanced pro-poor growth. If poverty reduction and the achievement of MDG1 prove unattainable through increased public expenditure in agriculture, non-agricultural activities could be promoted in selected district municipalities as they have been considered essential in some parts of the province (Ndhleve and Obi, 2011).

Rather than maintaining the status quo, the government needs to commit to a new, more radical course of action that clearly puts the agricultural sector at the forefront. Agricultural transformation requires fiscal policy adjustment on various aspects of public agricultural investment, including size of public spending, type of public spending, efficiency of public spending, and even investments in non-agricultural sector.

Our results illustrate the considerable utility of the partial equilibrium framework based on the System Dynamics Analyses, as a tool for estimating the required resources to meet specified poverty levels but with limitations. The model assumes some parameters from literature and adopts partial equilibrium analyses and ignores the general equilibrium effects that might however have a much clearer outcome. While agricultural development is prioritised in the province, analyses of other sectors allows us to explicitly recognize the beneficial impact of a dynamic poverty reduction system in the province without ignoring other important sectors. However, a quantitative assessment of this aspect is beyond the scope of this paper

5. Conclusion

The broad objective of the study was to evaluate the methodology that links public spending in agriculture and agricultural growth; agricultural growth and poverty reduction and agricultural growth. Statistical methodologies can be used as powerful tools for decision making if coupled with availability of data. Accurate and realistic policy frameworks for agriculture provide coherent plans government departments can

use to evaluate progress towards MDG1. Estimates from the adapted model are close to reality and they rely on the reasonable expectation that intervention to meet MDG1 by provincial and national governments in poor economies is possible, as demonstrated by the string of causation in the Eastern Cape. The progress is slow in the Eastern Cape Province, with the targets seemingly unachievable during the set timeframe. Although showing some significant stride towards the set target, the province is seemingly faltering in reducing poverty. Furthermore, the Eastern Cape Province would require increased investment in agriculture accompanied by robust and pro-poor growth well above historical rates.

Future research would involve developing a CGE model that can consider the spill over effects of other sectors. Similarly, adopted parameters should be replaced by realistic and primary data acquired in the study area and will be supported by sensitivity analyses based on actual macro-economic indicators as employed by the statutory authorities such as Statistics South Africa and the Reserve Bank of South Africa.

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APPENDIX A: Data Description and Sources

Variable	Description	Data Sources
GDP constant 2005 prices	GDP is calculated using the output approach, the total value of goods and services, measured in constant prices, produced in a region with labour employed in that region.	National GDP data are compiled by the ECSECC and National and Various Provincial Departments.
Real Agricultural GDP Constant 2005 prices	Total value of agricultural goods and services, measured in constant prices, produced in a region with labour employed in that region.	Statistical Abstracts, ECSECC database
Non Agricultural GDP constant 2005 prices	The total market value of all non-agricultural goods and services, measured in constant prices, produced within the political boundaries of an economy during the year	ECSECC database
Incidence of poverty	The proportion of the population that lies beneath the official poverty line	ECSECC database
Public agricultural Expenditure	Spending by the government to pursue agricultural and rural development activities with the expectation of greater future benefits or rewards.	National treasury, National and Provincial Departments of agriculture and miscellaneous government publications
GDP growth rate	The percentage change in GDP from one year to the next. How much GDP grows over time.	STATS SA, Reserve Bank Data, World Bank
Share of agriculture in GDP	Share of agricultural GDP in total GDP	Authors' calculations based on data from ECSECC and various other sources
Share of non-agricultural GDP in total GDP	Share of non-agricultural GDP in total GDP	Authors' calculations based on data from ECSECC and various other sources

Appendix B: Multi-step GDP Costing Equations

The marginal impact of agricultural and non-agricultural incomes on poverty is assessed using the following equation:

$$\frac{dP}{P} = \left(\varepsilon_{ag}\right)\frac{dY_{ag}}{Y_{ag}}s_{ag} + \varepsilon_{ng}\frac{dY_{ng}}{Y_{ng}}s_{ng} + \left\{\left(\frac{dP}{P}\frac{Y_{ng}}{dY_{ng}}\right)\left(\frac{dY_{ng}}{Y_{ng}}\frac{Y_{ag}}{dY_{ag}}\right)\frac{dY_{ng}}{Y_{ng}}s_{ag}\right\} \text{---------(1)}$$

Equation 1 captures the elasticity of poverty reduction with respect to both agricultural and non-agricultural growth. Where for each of the district municipality and the Eastern Cape Province,

P = the incidence of poverty
Y_{ag}= agricultural GDP
Y_{ng}= non-agricultural GDP
s_{ag}= share of agriculture in GDP
s_{ng}= share of non-agriculture in GDP.
$\dot{P}$ = change in poverty for each year
ε_{ag} = elasticity of poverty reduction with respect to (w.r.t.) agricultural GDP growth
ε_{ng} = elasticity of poverty reduction w.r.t. non-agricultural GDP growth
g_{ag} = agricultural GDP growth rate
g_{ng} = non-agricultural GDP growth rate
$\phi_{ng,ag}$ = multiplier effect or linkage between agricultural GDP growth and non-agricultural GDP growth.

Thus, equation (1) can be rewritten as:

$$\dot{P} = \{\varepsilon_{ag} * g_{ag}\} * S_{ag} + \{\varepsilon_{ng} * g_{ng}\} * S_{ng} + \left\{\left(\varepsilon_{ng} * \phi_{ng,ag}\right) * g_{ag}\right\} * S_{ag} \text{----------(2)}$$

Strong growth linkages and multiplier effects of agricultural growth to the non-agricultural sectors have been identified by many researchers. These linkages and their effects on poverty levels are captured in equation (2) above. The first and second coefficients capture the effect on poverty generated by both agricultural and non-agricultural growth respectively. The third coefficient captures the elasticity of poverty generated by multiplier effect due to growth in the agricultural sector. Partitioning the

expected reduction in poverty among each of the terms in equation (2) and solving for the required agricultural growth rate yields the following equation:

$$g_{ag} = \{\dot{P} - \dot{P}_{ng}\} \Big/ \{\varepsilon_{ag} * S_{ag} + (\varepsilon_{ng} * \phi_{ng,ag}) * s_{ng}\} \text{ ---------- } (3)$$

Where:

$\dot{P}_{ng}$ = the rate of poverty reduction emanating from a given non-agricultural growth rate, which is calculated from the second term in equation (3), i.e.

$$\dot{P}_{ng} = \varepsilon_{ng} * g_{ng} * S_{ng} \text{ ---------- } (4)$$

Equation (3) represents the agricultural growth rate that is required to reduce poverty annually from its direct effect. The level of public expenditure needed for agriculture to grow is calculated in equation (5) and once the required agricultural growth rates are known, the corresponding annual changes in expenditure needed to achieve these growth rates can be calculated as:

$$\dot{E}_{ag} = g_{ag} \Big/ \delta_{ag} \text{ ---------- } (5)$$

Where:

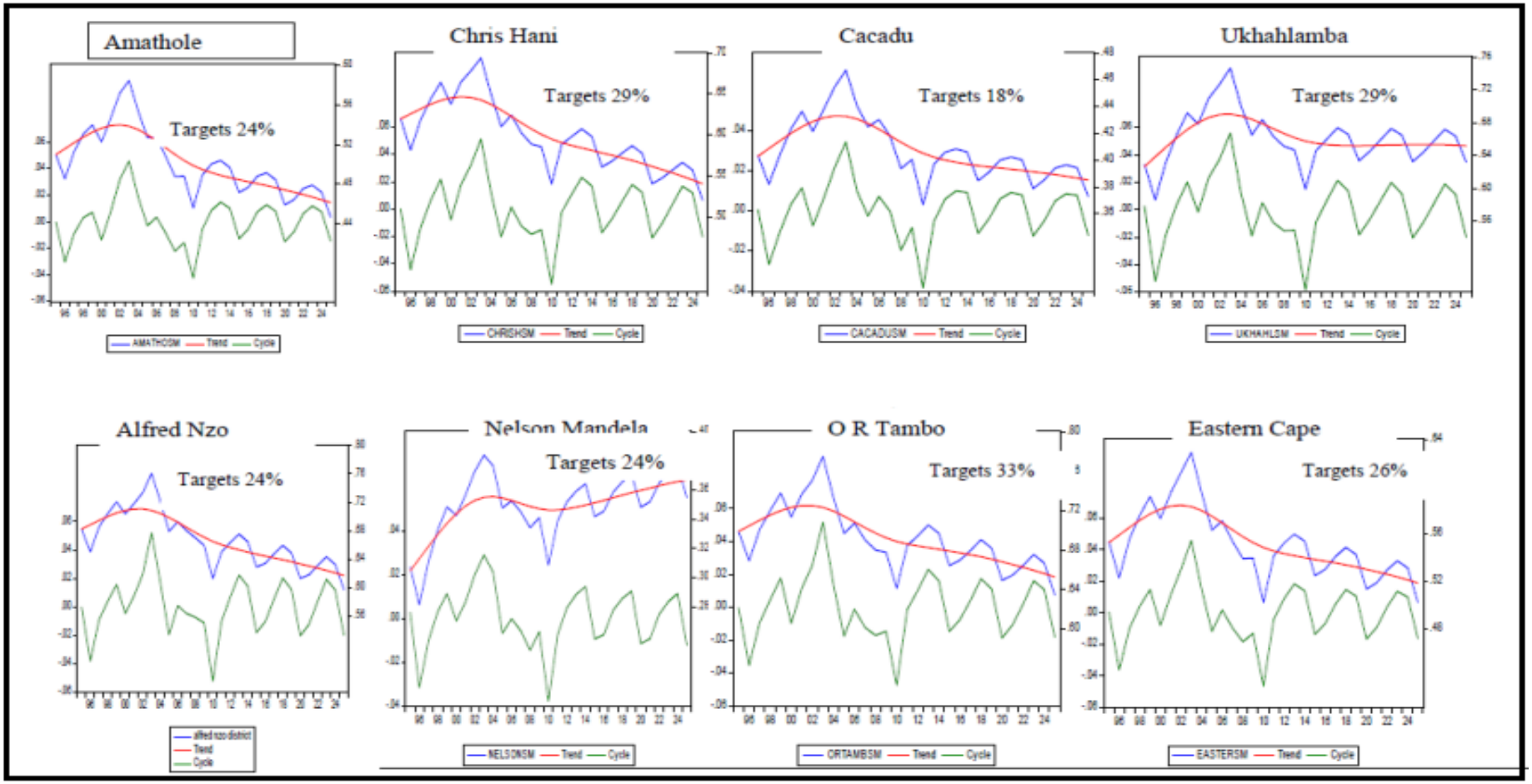
$\dot{E}_{ag}$= the annual growth rate in agricultural expenditures, or

δ_{ag} = elasticity of agricultural growth w.r.t. agricultural expenditure growth which is calculated as:

$$\frac{dY_{ag}}{dE_{ag}} * \frac{E_{ag}}{Y_{ag}}.$$

The annual agricultural expenditure required between 2011 and 2025 can be easily calculated from the baseline data on actual agricultural expenditure in 2010 from equation (5).

Appendix C: Simulated trend for the incidence of poverty until 2025



Appendix D: Variables used in Costing MDG1

	$\dot{P}$	$\dot{P}_{ng}$	$\dot{P}-\dot{P}_{ng}$	$\varepsilon_{ag} * S_{ag}$	$(\varepsilon_{ng} * \phi_{ng,ag}) * s_{ng}$	$\{\varepsilon_{ag} * S_{ag} + (\varepsilon_{ng} * \phi_{ng,ag}) * s_{ng}\}$	g_{ag}	ε_{ag}	ε_{ng}	**Adopted multiplier** $\phi_{ng,ag}$	S_{ag}	g_{ng}	S_{ng}	$\dot{E}_{ag}$
Alfred Nzo	5.52	1.23	4.29	0.83	0.63	1.46	2.93	0.26	0.13	1.50	3.19	0.10	93.00	9.15
Cacadu	3.30	0.25	3.05	4.67	0.85	5.52	0.55	0.41	0.05	1.50	11.30	0.06	89.00	1.73
Chris Hani	4.60	0.01	4.59	1.52	0.02	1.54	2.98	0.31	0.00	1.50	4.85	0.05	95.00	9.33
Nelson Mandela Metropolitan	3.10	1.12	1.98	0.05	0.23	0.28	6.94	0.13	0.39	1.50	0.40	0.03	99.60	21.68
O R Tambo	14.60	2.80	11.80	0.59	1.39	1.98	5.96	0.23	0.36	1.50	2.60	0.08	97.00	18.63
UKhahlamba	5.71	0.08	5.63	4.06	0.19	4.25	1.32	0.39	0.01	1.50	10.33	0.08	90.00	4.14
Amatole	4.03	0.26	3.77	0.36	1.49	1.85	2.04	0.24	0.07	15.00	1.47	0.04	97.00	6.38

Source: Source: Authors' calculations based on data from ECSECC (2010) database and following the methodology presented