Land Redistribution and Poverty Alleviation in South Africa

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Abstract: Land is viewed as the main source of livelihood for the majority of rural households in developing countries. However, the majority of the rural households do not have access to productive lands as land is finite and therefore a scarce resource and its distribution is largely attributed to historical land imbalances, hence the problem of rural poverty is more prevalent among the rural households. There has been increased demand for land for livelihoods and various land policies have been implemented in developing countries to stimulate growth in the agricultural sector and alleviate rural poverty. The question that remains is how does land redistribution policies and agriculture growth affect poverty alleviation? To answer the question, this study employed a multiplier decomposition approach using the 2010 IFPRI SOCIAL accounting matrix as the data base. The multiplier decomposition approach revealed that land redistribution and agriculture growth can alleviate poverty in South Africa. However, for significant poverty alleviation, only long- term land reform policies geared toward improving agricultural productivity and growth should be implemented.

Keywords: Multiplier decomposition, Land policies, Poverty alleviation, rural household

1. Introduction

Natural resource ownership plays an important role in promoting economic growth, reducing income distribution inequalities, and alleviating poverty, especially in developing countries. Recent empirical research in both developed and developing countries have demonstrated that equality in natural resource ownership among the population can have significant impacts on poverty alleviation and income distribution among citizens (Deninger *et al*., 2000; World Bank, 2004; Cousins, 2004; Lahiff & Cousins, 2005). With agricultural land being viewed as a key natural resource for wealth generation in many developing countries, rural land redistribution can be an important strategy for alleviating poverty and improving household welfare mainly because poor people have strong ties to agriculture. The rationale behind poverty alleviation is that poor households can now share in profits as co-owners of the land rather than only as wage workers. In light of this, several developing countries have recently started the redistribution of natural resources, especially land, to create opportunities for earning higher incomes and employment creation for resource poor households. The main focus of these redistribution policies is the agriculture sector because the importance of this sector for growth and poverty alleviation is widely recognised (Cockburn *et al*., 2013). Access to productive land improves the asset base and income of the poor households whom are the intended beneficiaries of the rural land redistribution programme. Thus, agriculture rural land redistribution reform is widely viewed as an effective and most important way to reduce poverty especially in developing countries where poverty and income inequalities are often a norm than an exception (Datt & Ravallion, 1996).

Numerous empirical studies have shown that equality in the land ownership can be an effective tool in fighting poverty and promoting growth (IFAD, 2001; Negrao, 2002; DFID 2003:5; Borras, 2006; World Bank, 2006). With several developing countries now emphasising on rural land redistribution, there has been an increasing interest in the relationship between land ownership, agriculture productivity, poverty reduction and income distribution. An analysis of whether and how these redistributive policies impact on the overall economy, poverty and income distribution provides a better understanding of the long-term effects. Rural land redistribution

programmes can be potentially attractive policies for poverty reduction and improvement of income distribution; hence, an empirical demonstration of the effectiveness of these programs is of great importance. In addition, the empirical demonstration of the welfare effects will provide evidence and tools to the government to assess the relevance and effectiveness of these alternative poverty reduction policies in the country.

However, the question of whether these rural land redistribution policies are justified and can be effective as tools for reducing unemployment and poverty, by contributing towards the overall improvement of rural household welfare still remains unanswered. Therefore, this study applies a multiplier decomposition approach model in an attempt to answer this question by assessing the impact of rural land redistribution policies on poverty reduction.

2. Literature Review

In the neoclassical theory, land is treated as a marketable commodity which should be priced and allocated according to its marginal productivity. This implies that the theory is appropriate for dealing with complex practical questions for agricultural productivity and land reform. According to this theory, land reform is essential for economic growth and to improve agricultural productivity which is important for economic, greater security of title to land is essential. In developing countries, agricultural development plays a vital role in economic development as agricultural is not only a major form of employment, but the rural population depends on the sector for livelihood. Therefore, economic growth strategy should focus on distributional factor of the income generated by the growth. Thus poverty, unemployment and inequality in the economy should be taken into account in policy making. The land redistribution and the associated growth opportunities have strong implications for long-term development (World Bank, 2005). Access to land reduces vulnerability to hunger and poverty, influences capacity to invest in their productivity activities and enhance prospects for better livelihoods.

Moreover, empirical and theoretical findings indicate that there exists a variety and complementary paths that can secure access to land for the rural poor (de Janvry, 2002). However, the most common approaches to land redistribution are the state-led and market-assisted land reform. Under the state-led reform, the government/state plays a central role in promoting land reform programs. This form of land reform consists of a central authority that dispossesses and redistributes land to selected beneficiaries. The state-led reforms are most common in countries with high land property concentration, great social and economic inequality, abject rural poverty and widespread landlessness (Ciamarra, 2003).

The market-assisted land reform affirms that, under certain conditions, markets can endogenously lead to equal and efficient land asset distribution, hence can be a substitute for state-led reform. In the market-assisted land reform, the beneficiaries receive a combination of grants and loans which they use to negotiate the purchase of the land from willing sellers. This form of land reform depends on the fact that there exists an inverse relation between farm size and output per unit of land and the land market is regressive for the resource poor.

Land redistribution is considered the 'flagship' of the land reform programme in South Africa Department of Agriculture (2005). The primary objective of the land redistribution programme was to transfer about 24 million hectares of agricultural land to black ownership by 1999. As the bulk of agricultural land in South Africa is held under commercial agriculture which is dominated by the minority White people, the expectation was that 3 million Black people would benefit from the redistribution which was based on willing buyer willing seller principle.

With about 1% of the land transferred in the first 5 years of the programme Department of Agriculture (2005), and the target redistributable land at 30%, the duration of the redistribution was extended to 15 years. The process of land redistribution was deemed to be slow and due to the lack of realism in the targeted goal. Various steps were taken which include increasing the levels of cash grants provided to prospective beneficiaries for them to acquire land and productively use it. However, farm land prices were above the R16000 per beneficiary household provided by the government. The slow process rendered the Settlement and Land Acquisition Grant (SLAG) unsustainable, leading to the establishment of the on-going Land Redistribution for Agriculture Development (LRAD) in 2000. The LRAD was however, viewed

as limited to previously disadvantaged black individuals since there is no significant improvement in the pace and process of land redistribution. The programme did manage to redistribute only about 14.6% of the target with 4.8% of the target population.

The land reform process in South Africa is largely based on the willing-buyer, willing-seller arrangement where the government assists in the purchase of land (Department of Land Affairs, 1997). These arrangements were mainly based on the operations of the existing land market. The land redistribution policy has undergone a series of shifts since 1994, but the focus is mainly on agricultural purposes. Until 2000, the land redistribution was targeting the poorest of the poor. However, the act of providing access to productive land to the poor without farming skills or resources for facilitating productivity and efficiency of these farms was criticised. This led to the introduction of the LRAD that explicitly aimed to promote commercially-oriented agriculture by the black people. Under this new program, higher grants were paid to individuals with the potential to use land productively. A number of empirical studies have applied SAM multiplier framework to analyse growth and distributive impacts of different government policies (Nseera, 2014; Juana & Mabugu, 2005; Sadoulet & de Janvry, 1995). Though these input-output and social accounting matrix models have been extensively used in the early literature to analyse growth linkages between various economic sectors, especially to investigate the role of agriculture and industry as engines of economic growth (Hassan & Olbrich, 1999; Bautista *et al*., 2002; Delgado *et al*., 1998) however, detailed and effective analysis of land redistribution requires SAM decomposition and structural path framework which captures intersectoral effects (Sadoulet & de Janvry, 1995). This study adopted this framework to analyse the impact of an exogenous shock in the agricultural sector on the income of poor households in South Africa.

3. Method and Materials

To analyse the intersectoral impact of land redistribution on South African economy, this study adopted the IFPRI 2009 SAM which was built using official supply-use details, national accounts, state budgets and balance of payments accounts, therefore the SAM provides a detailed representation of the South African economy. The social accounting matrix records the transactions between different economic accounts; therefore, it is an ideal data base for conducting economy wide impact assessments such as SAM based multiplier analysis and computable general equilibrium models. The IFPRI 2009 SAM consists of 49 activities, 85 commodities, 14 household types, a government sector, enterprise and the rest of the world. The SAM has 5 factors of production, namely capital, labour with primary education, labour with middle school education, labour with completed secondary school education and labour with tertiary education. Given the nature of multiplier decomposition and structural path analysis, activity and commodities accounts are aggregated into single production accounts. For the purpose of this study, the SAM was aggregated into 41 production activities (and in this case production activities are a combination of 49 activities and 85 commodities), 4 factors of production and private institutions which combine 5 household categories and the enterprise accounts. The private institutions, activities and factor accounts form the endogenous account while the exogenous account will combine the government account, saving and investment as well as the rest of the world (Pyatt & Round, 2006). This SAM framework can be quite effective in capturing the linkages between these different production accounts and institutions in the economy and as such have been widely employed to explore the impact of different exogenous shocks in the economy (Civardi *et al*., 2006; Pansini, 2008).

Therefore, the economic model adopted for this study is as shown below:

$$S_{11}S_1 + S_{12}S_2 = Z_1 \quad (1.1)$$

$$S_{21}S_1 + S_{22}S_{22} = Z_2 \quad (1.2)$$

$$a_{11}Z1 + a_{12}Z_2 + C_1E + JD_1 = S_1 \quad (1.3)$$

$$a_{12}Z_1 + a_{22}Z_2 + C_2E + JD_2 = S_2 \quad (1.4)$$

$$v_1Z_1 + v_2Z_2 = J \quad (1.5)$$

$$hJ = Y \quad (1.6)$$

Following the methodology by Pyatt (2001) the system of equations (Equations 1.1–1.6) can be converted into a matrix. The resultant matrix is as follows:

$$\begin{bmatrix} 0 & 0 & s_{11} & s_{12} & 0 & 0 \\ 0 & 0 & s_{21} & s_{22} & 0 & 0 \\ a_{11} & a_{12} & 0 & 0 & 0 & c_1 \\ a_{21} & a_{22} & 0 & 0 & 0 & c_2 \\ v_1 & v_2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & h & 0 \end{bmatrix} \times \begin{bmatrix} Z_1 \\ Z_2 \\ S_1 \\ S_2 \\ J \\ Y \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ D_1 \\ D_2 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} Z_1 \\ Z_2 \\ S_1 \\ S_2 \\ J \\ Y \end{bmatrix}$$

The matrix shows that gross output from the economy can be represented by the product of technical coefficient matrix and output from different sectors of the economy. On the other hand, the level of activity in the economy in real terms is determined by the vector of intermediate demand and the total final demand for inputs.

The SAM multiplier enables the quantification of the different ways in which the impact of the exogenous is distributed across the economy. This multiplier analysis also indicates the effects of an exogenous shock on the distribution of income and sectoral output (Round, 2003). However, to examine the nature of the linkages in the economic system, it is imperative to decompose the SAM multipliers. For a detailed analysis of the intersectoral linkages due to land redistribution in South Africa, the study adopted SAM multiplier decomposition as proposed by Pyatt and Round (2006).

This multiplier decomposition allows the assessment of the linkages between households and different components of the economic system affecting the distribution of income (Civardi *et al*., 2008). The total multiplier can be decomposed into three components which are the transfer multiplier, the open-loop multiplier and the closed loop multiplier. The transfer multiplier captures the effects on the same set of account, the open-loop multiplier identifies the spill-over effects and the closed loop captures the full circular flow from the exogenous shock into the endogenous accounts. Thus, using the multiplicative decomposition proposed by Pyatt and Round (2006), the total multiplier from Equation 3.9 can be rewritten as:

$$(I - A)^{-1} = M_3 M_2 M_1 \tag{2.2}$$

where $(I - A)^{-1}$ represents the total multiplier and M_1 is the transfer multiplier, M_2 is the spill-over effects and M_3 represents the full circular flow.

To derive the multiplier matrix, we first divide elements in each column of define the T matrix by its column total (y) to get average propensities (Round, 2003). The matrix of average propensities which is obtained by dividing each element in the transaction matrix of endogenous account by the corresponding column sum vectors can be represented as:

$$A_n = \begin{vmatrix} A_{11} & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32} & A_{33} \end{vmatrix}$$

and the diagonal matrices of the average propensities can be represented as:

$$A_0 = \begin{vmatrix} A_{11} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & A_{33} \end{vmatrix}$$

The multiplier that will capture the transfer elements M_1 will be given by:

$$M_1 = \begin{vmatrix} {}_1M_{11} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & {}_1M_{33} \end{vmatrix}$$

and the open loop multiplier will be given:

$$M_2 = I + (I - A_0)^{-1}(A_n - A_0) + \left[(I - A_0)^{-1}(I_n - A_0)\right]^2 + \left[(A_n - A_0)(I - A_0)^{-1}\right]^3$$

$$= \begin{vmatrix} I & {}_2M_{12} & {}_2M_{13} \\ {}_2M_{21} & I & {}_2M_{23} \\ {}_2M_{31} & {}_2M_{32} & I \end{vmatrix}$$

The closed loop multiplier which captures the full circular flow from exogenous shock to endogenous account will be represented by:

$$M_3 = \begin{vmatrix} {}_3M_{11} & 0 & 0 \\ 0 & {}_2M_{22} & 0 \\ 0 & 0 & {}_3M_{33} \end{vmatrix}$$

If we let $A^* = (I - A_0)^{-1}(A_n - A_0)$, then the multiplier will be given as $M = (I - A^{*3})^{-1}(I + A^* + A^{*2} + A^{*3})(I - A_0)^{-1}$. As in Pansini (2008), the focus of multiplier decomposition is on household income distribution. From Table 2, the equation is given by:

$$Y_4 = (M_{33} M_{32} M_{31})x \tag{2.3}$$

$$Y_4 = M_{31} x_1 M_{32} x_2 M_{33} x_3)x \tag{2.4}$$

where

$$M_{31} = {}_3M_{32}\, M_{31}\, {}_1M_{11}$$
$$M_{32} = {}_3M_{33}\, {}_2M_{32}$$
$$M_{33} = {}_3M_{33}\, {}_1M_{33}$$

To disentangle the three effects namely the transfer multiplier, open loop and closed loop, we consider the single element m_{ij} of matrix of the global multipliers. The single element m_{ij} can be expressed as:

$$m_{ij} = d_i^{'} M_3 M_2 M_1 d_j = i^{'}(r^{'} A s^{'}) i \qquad (2.5)$$

where $d_i^{'}$ and d_j are vectors in the *ith* element and *jth* element which are equal to one and all others are equal to zero (Pyatt & Round, 2006; Pansini, 2008; Civardi & Targetti, 2008). The matrix A and vectors r' and s' are defined as:

$$r^{'} = d_i M_3 \qquad A = M_2 \qquad s^{'} = M_1 d_J$$

This implies that each m_{ij} must be equal to the sum of all elements of an $r^{'}As^{'}$ type transformation of the matrix M_2 when the vector r' is formed from the i^{th} row of M_3 and the vector s is formed from the j^{th} column of M_1 (Pyatt & Round, 2006). This approach of multiplier approach allows the decomposition of direct-direct effect, indirect-direct effect, direct-indirect effect effects and indirect-indirect effects (Pansini, 2008). In this study, i represent the poor rural household in South Africa and j is the agriculture sector, it follows that the element m_{ij} becomes a sub-matrix M_{HA} of M and the element m_{ij} is given by $m_{ij} = (d^{'}{}_3 M_{HH})_2 M_{HA} ({}_1M_{AA}\, d_j)$.

This approach enables the assessment and identification of microeconomic detail about the nature of the linkages in the economy. In order to capture and assess both the direct and indirect effects of land redistribution on different sectors of the economy which is the main focus of this study, the social accounting multiplier decomposition and structural path analysis were adopted as in Round (2008).

This decomposition shows clearly the way the consequences of an exogenous of in the j^{th} activity on the i^{th} household. Using the block matrices ${}_2M_{HA}$, ${}_2M_{HF}$ which represent the cross effects and explain how the original injection into the activities/factor accounts effects in the household account (Civardi *et al*., 2008). An injection or a shock in an activity account of the production sector will be directly translated by the A part of the $r^{'}As^{'}$ transformation into the income for the endogenous institutions. The main focus of this decomposition is the block matrix M_{HA}, where the column totals of this matrix indicate the effects of each sector of production on the household account of a shock on the agriculture sector where as the row totals indicate the total effect on each household group due to shock on the agricultural activity account. These column and row totals enable the identification of the four different effect in the single multiplier m_{ij}.

Though the multiplier decomposition enables the distribution of the global effects on the endogenous accounts of the SAM into three microscopic effects, the analysis alone does not highlight the paths/channels through which these influence is transmitted and show which path is better than other in transmitting the influences. Based on multiplier decomposition results, the structural path analysis is adopted so as to identify the transmission mechanism of the interactions among different accounts in the SAM.

4. Simulation Technique

The main purpose of this study is to investigate whether redistribution of agricultural land from large commercial farmers to small scale farmers will promote land use social equity. Social equity in this context refers to job creation and income generation and redistribution in favour of the low-income households. As the SAM entries are in millions on rand and the proposed land redistribution are in physical quantities, the land transfers are first converted into land income (revenue shares). This conversion is essential as transfer of land from commercial farmers to small scale farmers means transfer of land income. The land revenue shares are then use to shock the social accounting matrix. This SAM multiplier approach enables the tracking of among demand-driven shocks, economic growth, income generation and distribution. Furthermore, a multiplier decomposition analysis was applied to show the distributional mechanism across the economy with the focus on the household component of the global multiplier matrix which are M_{31}, M_{32} and M_{33}. The multiplier decomposition shows the capacity of an activity to stimulate household income.

5. Multiplier Analysis and Results

The study seeks to analyse and assess the direct and indirect effects of land redistribution which represent a shock in the agriculture sector on poor

Table 1: Sam Household Multiplier

Sector	Total HH multiplier	Rich	Poor
Agriculture	1,107	0,59	0,78
Manufacturing	0,204	0,515	0,15
Mining	0,24	0,450	0,125
Service	0,228	0,670	0,116
Trade	0,353	0,671	0,153
Transport	0,253	0,634	0,162
Enterprise	0,78	0,723	0,464

Source: Authors' computation from South African SAM (2010)

Table 2: Intra and Inter-Household Transfer

	Poor household	Rich household	Total
Poor household	0,13	0,125	0,255
Rich household	0,158	0,146	0,304
Total	0,288	0,271	

Source: Authors' computation from South African SAM (2010)

Table 3: Summary of M_{31}, M_{32}, M_{33}

	M_{31}	M_{32}	M_{33}
Hhd1	0.026	0,133	0,022
Hhd2	0,053	0,25	0,046
Hhd3	0,084	0,303	0,074
Hhd4	0,151	0,38	0,132
Hhd5	0,595	0,70	0,552
Note: Hhd1 represents the poorest rural household, Hhd3 represent rich rural households, Hhd4 -represents poor urban households			

Source: Author's computations from (2010)

household income in South Africa and for this study we assumed a progressive 30 percent land transfer from the large.

Household multipliers measure the total effect of a unit change in income of a particular household group on the incomes of all households in the economy. Agriculture exhibits the highest aggregate multiplier signifying the important role for consumption and livelihoods for rural households. The SAM multiplier established the importance of the agricultural sector hence increase in agricultural output generate the largest increases in household incomes. The multiplier for the poor household is greater than of the rich households (0,78 compared to 0,59) signifying the dependent of poor household on agriculture for their livelihoods. Thus the multiplier analysis supports the implementation of agricultural-based policies to alleviate rural poverty.

Table 2 shows how a shock in aggregate demand translates into higher income. For both the two groups of households (rich and poor), an injection into the income of a household group yields less than the initial increase in the income of the same household. However, the overall impact is higher for rich households compared to poor households which are evidenced by higher row totals. These higher row totals mean that income distribution in South Africa is skewed towards the rich households' groups.

M_{31} represents household income and it shows the income effect on household income as a result of a unit increase in agricultural aggregate demand due to land redistribution. The income of rural households increases by a multiplier of 0,163 in total for all the rural households and 0,746 for the urban households. The factor income (M_{32}) measures the impact on household incomes from an increase in

Table 4: Decomposition of the Global Multiplier Matrix

Column j	Row i	Household group	Direct-direct effect	Indirect-direct effect	Total effect for A1	Direct-indirect effect	Indirect-indirect effect	Total effect	Multiplier
Agric	hhd1	hhd1	0.0087	-0.00587	0.002827	0.00089	-0.00083	0.00006	0.0028874
Agric	hhd1	hhd2	0.0001	-0.00008	0.000022	0.00949	-0.00662	0.00287	0.0028874
Agric	hhd1	hhd3	0.0001	-0.0006	0.000023	0.00950	-0.00664	0.00286	0.0028874
Agric	hhd1	hhd4	-0.000	0.00007	0.000022	0.00964	-0.00677	0.00286	0.0028874
Agric	hhd1	hhd5	-0.001	0.00110	-0.000001	0.0107	-0.00781	0.00289	0.0028874
Note: hhd1 represents the poorest rural household decile, hhd3 represents the richest rural household decile, and hhd4 represents the poorest urban household decile, Agric represent the agriculture sector									

Source: Authors' computation from South African SAM (2010)

aggregate demand to factor account. The rural household incomes increase by a multiplier of 0.686 due to the effect of land redistribution on factors of production. The redistribution of factor incomes among households represented by M_{33} shows the effects on household income from an increase in aggregate demand into income of household groups. All the diagonal elements are less than one, meaning that an injection into the income of household group result in an increase of less that one of income of the same household group due to the multiplicative effects of income circulation in an economic system.

The results showed the different effects which are the direct-direct, indirect-direct, direct-indirect and indirect-indirect as explained in the methodology. The corresponding element of the global multiplier for a unit injection in the agriculture on poor rural households (hhd1) is 0.0028874 which is further decomposed in Table 4 above. The results show that the poor household benefits more compared to other household groups due to an exogenous shock; this is because the direct effect of an exogenous injection or shock in the agriculture sector to the poor household income represents about 98% of the total effect on the household. The direct effect of agriculture on the poor household is higher (0.0087) compared to other different categories of households indicating a strong link between agriculture and the rural poor (Thorbecke, 2000). Like in other studies, (Civardi & Targetti, 2008; Pansini, 2008), direct effects on households have been found to be higher than the indirect effect. However, the indirect-direct effect, which captures the effects from other sector on poor household welfare, is the minimum for the poor household compared to other groups. This implies that the poor households do not benefit much from the other sectors

Concerning the rich households, who are mostly urban households, the direct effect of agriculture is almost zero; it implies that these households benefit from agriculture mainly through the indirect channel (which is about 98% of the total effects). In the case of South Africa where according to Economic Research Division, SA (2010), agriculture contributes less than 4% of the total GDP we expected a minimal direct effect on rich household income from an exogenous shock in the agriculture sector. The shock in the agriculture sector generates intermediates demand for agriculture products, which in turn generates income for the rich households.

The decomposition has shown that an injection into the agricultural sector in South Africa will have different results for different households' groups. The results show that poor households received higher direct effects of agriculture when compared to richer households; however, the indirect effects are much higher for the richer households. This indicates a strong link between poor households and agriculture, but this link is weak for the richer households. The results might be attributed to the fact that poor households depend more on agriculture for livelihoods when compared to richer households (Pansini, 2008). These results imply that the stimulus to the agricultural sector will benefit the poor households when compared to the richer, which might be a good policy for rural poverty reduction.

6. Conclusion and Recommendations

This study adopted a SAM multiplier decomposition and structural path analysis to analyse and track the channels through which an exogenous shock in agriculture will affect the income poor households. This approach enables the disentangling different effects that is, both direct and indirect effects of

an exogenous shock on the agricultural sector in South Africa. From the study different set of results emerged which have different policy implications for the government.

The results show that although the contribution of the agriculture sector to the overall economy which is only 4% of the GDP in South Africa, the sector influence household income through different paths and sectors. This can be explained by the existence of strong backwards and forwards linkages in the economy. Thus, the proposed land redistribution will significantly alter the production structure of the agriculture sector which means that the income of the households will be altered.

In addition, the results also show that land income transfer increases the income of poor households and these results also identified the different path through which income is distributed from the origin (agriculture sector) to the destination poor household income. These results can be very important in articulation of the impact of land redistribution policy of poverty and income distribution; however, more emphasis can be achieved through the relaxation of the assumption of linearity and fixed prices. This will allow for the analysis of long run and redistributive effects of land redistribution policy in South Africa. This analysis then requires the application of a dynamic computable general equilibrium micro simulation model.

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