TMD DISCUSSION PAPER NO. 84

LAND REFORM IN ZIMBABWE: FARM-LEVEL EFFECTS AND COST-BENEFIT ANALYSIS

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Abstract

There is widespread agreement on the need for land reform in Zimbabwe as a means of reducing poverty. This paper assesses the potential consequences of a land-reform scheme that draws on proposals from Zimbabwe's government in 1998 and 1999. We analyze the impact of the reform on resettled farm households and as a development project for which we conduct cost-benefit analysis. The analysis, which considers costs and benefits during a 15-year period, relies on a set of models of family farms that are typical of those that would benefit from land redistribution. The cost-benefit analysis is more comprehensive, also considering the different costs and benefits that affect the government. The results of our analysis indicate that a government-supported land reform could be economically viable under what we consider as realistic assumptions regarding the performance of the beneficiaries and the costs that will be faced by the government and other stakeholders. Land reform can generate sustainable livelihoods for the beneficiaries. If viewed as a project, the NPV of the reform is positive for a discount rate that is as high as 20%. The project can also increase employment in the agricultural sector. The analysis takes a long-run perspective, covering a 15-year period. During the first resettlement years, some disruption of agricultural production should be expected. These results are preliminary and based on a partial equilibrium perspective. They are driven by the assumption that the land reform is carried out in a manner that allows farmers on the resettled lands to achieve their productive potential. Such an outcome depends critically on the assumption that the farmers are able to operate in an enabling environment, including critical government support, especially during years 1-5.

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Introduction[1]

There is widespread agreement on the need for land reform in Zimbabwe as a means of reducing poverty – in 1997, 25.5% of the population lived below the national poverty line (UNDP, 2000) – and mitigating a high degree of inequality, including a highly unequal distribution of land, between the white minority and the black majority. However, there is little agreement on how the reform should be designed and implemented, in part because of limited knowledge of the economic consequences of alternative schemes. Given that agriculture accounts for a substantial share of value-added, employment, and export earnings, it is of crucial importance for economic performance and poverty alleviation that the land reform be implemented in a manner that minimizes economic and political disruption while maintaining and if possible further improving agricultural productivity.[2]

This paper provides a preliminary assessment of the potential consequences of a land-reform scheme that primarily is based on documents and proposals from Zimbabwe's government in 1998 and 1999. More specifically, we analyze the impact of the reform on the farm households that are resettled and as a development project for which we conduct cost-benefit analysis. The analysis relies on a set of models of family farms that are typical of those that would benefit from the redistribution of land. The cost-benefit analysis is more comprehensive, also considering the different costs and benefits that affect the government.[3]

The preliminary nature of the analysis primarily stems from its partial equilibrium nature (which is typical of most cost-benefit analysis) – it analyzes land reform without taking into account its wider repercussions through the links between resettled farmers and the

[1] The authors would like to thank Professors Bill Kinsey, Sam Moyo, and Kay Muir-Lereshe for useful discussions on the issue of land reform. They also gratefully acknowledge valuable comments from Stéphanie Lévy and Sherman Robinson on earlier versions of this paper.

[2] Although it accounts for only 16% of GDP, the agricultural sector plays a central role in Zimbabwe's economy, providing employment for 70% of the population and accounting for 40 to 45% of the country's merchandise exports (World Bank, 1995).

[3] As part of a follow-up study, which will draw on the information presented in this paper, a Social Accounting Matrix (SAM) and a general equilibrium model of Zimbabwe will be constructed and used to analyze alternative land reform scenarios. This analysis will consider land reform in its broader economywide context.

rest of the economy (both agricultural and non-agricultural), foreign trade, and the government budget.

In outline, in the first section we present the land resettlement scheme in the context of Zimbabwe's agricultural sector, disaggregated farm budgets (divided into crop and livestock components) for the representative farms, and the assumed evolution of farm-level activities during a 15-year period. The second section is devoted to economic and financial analysis, drawing on the information presented in the first section and supplementary data on government costs and benefits. We generate farm-level net income flows and conduct a project cost-benefit analysis, testing the sensitivity of the results of the cost-benefit analysis to alternative values for the discount rate.

The Land Resettlement Scheme

The agrarian structure in Zimbabwe is characterized by the coexistence of four different land tenure systems (communal areas, resettlement areas, large-scale commercial farms, and small-scale commercial farms) operating in five natural regions.[4]

The proposed land reform scheme involves redistributing land from the large-scale commercial sector to "poor households from the overcrowded communal areas, displaced farm workers, special groups such as women, agricultural graduates, master farmers and persons of means and ability who intend to engage in agriculture" (GOZ, 1998).

Table 1 summarizes the general characteristics and the distribution of land and tenure system for Zimbabwe's agriculture, disaggregated into five agro-ecological zones (Ashworth, 1990). Commercial farming is dominant in Natural Regions I and II. Extensive agriculture and livestock husbandry dominate Natural Regions IV and V, which are characterized by relatively poor soil and unreliable rainfall. For the purposes of

[4] It should be kept in mind that the different land tenure systems did not emerge as a result of agrarian differentiation per se but as a result of state intervention in the allocation of land to different groups of the population. Freehold titles only apply to two land tenure systems out of four, and subdivision of land still needs to be approved by the Ministry of Lands and Agriculture.

this study we merged Natural Regions I and II into one group, and Natural Regions IV and V into another group given that each pair, for the purposes of our analysis, is relatively homogeneous. Moreover, Natural Region I represents a very small share of total area.

Table 1. Land Distribution and Precipitation by Natural Region and Tenure Type

		Commercial				Resettlement		Communal		Total	
		Large Scale		Small Scale							
NR	Rainfall	Area	%	Area	%	Area	%	Area	%	Area	%
I	>1000 mm	338	3.0	7	0.5	28	0.9	115	0.7	488	2.6
II	700-1000 mm	3,223	28.6	249	17.8	664	21.5	1,423	8.7	5,559	14.5
III	650-800 mm	1,972	17.5	531	37.9	1,270	41.1	2,797	17.1	6,569	20.1
IV	450-650 mm	2,840	25.2	517	36.9	771	24.9	7,785	47.6	11,912	35.6
V	<450 mm	2,896	25.7	97	6.9	358	11.6	4,236	25.9	7,587	27.2
Total ('000 ha)		11,270	100.0	1,400	100.0	3,090	100.0	16,355	100.0	32,115	100.0
Share in Total Area		35.1		4.4		9.6		50.9		100.0	

Source: Ashworth, 1990

The total area that should be redistributed is set at 5 million hectares in the document "Land Reform and Resettlement Program Phase II" (Government of Zimbabwe, 1998). The same document sets, the average areas per beneficiary range from 30 hectares in Natural Region II to 180 hectares in Natural Regions IV and V. The total number of beneficiaries was 91,000. In another document, "Inception Phase Framework Plan" (Government of Zimbabwe, 1999), the average area was set at a lower value, with regional values varying from 30 hectares in Natural Region I and II to 90 hectares in Natural Region IV and V.

Table 2 summarizes the assumptions that we selected regarding the areas distributed, the number of beneficiaries, and the values per holding. The total redistributed area is kept at the level of 5 million hectares. However, we assume a total of close to 120,000 beneficiaries. In each region, the area received by each beneficiary was set so that, given different regional land prices, the holding values would be the same across the different regions. Thus, households from Natural Regions IV and V are resettled on larger holdings than households from Natural Regions I and II.

Table 2. Redistributed Land Allocation and Number of Program Beneficiaries

	NR I & II	NR III	NR IV & V	Total
Land Price (US$/ha)	79	53	32	57
Total Area Redistributed ('000 ha)	2,105	1,180	1,730	5,015
Average Area per Beneficiary (ha)	30	45	75	42
Number of Beneficiaries	70,167	26,222	23,067	119,456
Value of Holding per Beneficiary (US$)	2,370	2,385	2,400	2,379

Source: GoZ (1998); GoZ (1999); authors' calculations.

The economic and financial analysis is based on models of representative family farms typical of those that would benefit from the redistribution of land. Each farm model describes the evolution of five crop activities and two livestock activities over a 15-year span. Following Kinsey (1999), we believe that a long term perspective is needed and that "any attempt at comprehensive evaluation of the benefits of land reform in less than a generation is ill-advised" (Kinsey, 1999). The data for the models consist of crop budgets for all major crops and farm-level data on land use and livestock. Both crop and livestock budgets are based on Sukume (2001). All monetary data in this paper are in US dollars at 1994-95 prices. Throughout the analysis, we use the prices that prevailed in this year. Crop budgets include information on average yield, prices, input quantities and costs for seeds and fertilizers, family labor use (quantity and opportunity cost) for the major crops cultivated in the different systems of production and the different natural regions. Livestock budgets provide average growth rates, prices, and costs for the major animal types bred in the different systems of production and natural regions.

Table 3. Livestock Budgets by Natural Region

	NR I & II		NR III		NR IV & V	
Carrying Capacity (LSU/ha)*	0.20		0.17		0.14	
	Cows	Goats	Cows	Goats	Cows	Goats
Weight (kg/head)	300	50	300	50	300	50
LSU equivalent	0.6	0.1	0.6	0.1	0.6	0.1
Cash Cost (US$/head)	5	1	5	1	5	1
Family Labor (US$/head)	50	10	50	10	50	10
Growth Rate (%)	6	32	12	32	20	32
Meat Price (US$/kg)	1	1	1	1	1	1
Milk Production (liters/milking cow)	2,100		1,890		1,680	
Milk Price (US$/liter)	0.15		0.15		0.15	
Proportion of Milking Cows	0.75		0.75		0.75	
Value Added (US$/head)	249	15	315	15	307	15
Value Added (US$/ha)	83	30	87	25	73	21
Profit (US$/head)	199	5	265	5	257	5
Profit (US$/ha)	66	10	73	8	61	7

Source: Sukume, 2001 and authors' calculations.

Notes: 1. LSU = Livestock Units.

2. Value Added (VA) = Growth Rate*Weight*Meat Price + Proportion of Milking Cows*Milk Production*Milk Price - Cash Cost

3. Profit = VA - Labor Cost

Cash cost include all costs incurred by the farmer during the year. It is assumed that carrying capacity differs across Natural Regions and that livestock growth is limited by the available size of pasture and the carrying capacity in each region. When the carrying capacity constraint becomes binding, no further growth of the livestock is allowed.

Crop budgets for resettled households are based on surveys of the communal sectors (Sukume, 2001). Coming up with representative models for the communal sector is problematic due to a high degree of differentiation within the sector (Rohrbach, 1988; Stanning, 1989; Chasi *et al.*, 1994). Surveys show three broad groupings of communal farmers: a high-productivity group, a medium-productivity group, and a low-productivity group. Those in the high-productive group use cash inputs at rates close to large-scale commercial farmers and have all the complementary resources (cattle, ploughs, cultivators etc). Most farmers in this group have undergone on-farm training activities run by the Extension Services (Master Farmer training). At the other extreme are farmers who produce mainly for subsistence with little resources and little cash inputs (Chasi *et al.*, 1994).

For the purpose of the analysis, we assumed newly resettled farmers achieve initial levels of production and technology corresponding to those of the low performance group in communal areas. Then, from the first to the fifth year, their technology and crop allocation would converge towards those of the medium performance group. Finally, they would reach the high performance group performances. We believe this corresponds to a rather conservative assumption on the accumulation and growth path of resettled farmers over time. Moreover, as noted below, our analysis assumes that the resettled farmers receive startup grants and subsidized credit, and have adequate access to input and output markets.

In Tables 4 and 5, the budget for each crop is disaggregated by natural region, and performance group. Budgets include information on yield, variable cash costs and labor input.

Table 4. Price and Labor needs by Crops -All Performance levels

	Maize	Rapoko	Cotton	Groundnuts	Sunflower
Labor Days	48	36	111	55	36
Price/ton	$110	$62	$382	$215	$176

Source: Sukume, 2001 and author's calculation.
Note: Opportunity cost of labor: 1 US$ per day

Table 5. Farm-Level Crop Budgets by Natural Region and Performance Group (US$1994-95)

Per hectare	Natural Region I & II					Natural Region III					Natural Region IV & V				
Low Performance	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton†	Ground.	Sunfl.
Cash Costs	$29	$10	$96	$71	$52	$20	$10	$80	$65	$38	$15	$9	NA	$68	$29
Yield (tons)	1.0	0.4	0.5	0.5	0.5	0.6	0.3	0.5	0.4	0.4	0.4	0.3	NA	0.3	0.3
Value Production	$110	$25	$191	$107	$88	$66	$19	$191	$86	$70	$44	$16	NA	$64	$53
VA/labor day	$1.7	$0.4	$0.9	$0.7	$1.0	$1.0	$0.3	$1.0	$0.4	$0.9	$0.6	$0.2	NA	-$0.1	$0.7
Profit	$33	-$21	-$16	-$18	-$1	-$2	-$27	$0	-$34	-$4	-$18	-$30	NA	-$59	-$12
Medium Performance	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton	Ground.	Sunfl.
Cash Costs	$121	$12	$231	$122	$76	$55	$11	$191	$105	$62	$22	$10	NA	$91	$43
Yield (tons)	3.3	0.5	1.5	0.7	0.8	1.5	0.5	1.2	0.6	0.7	0.6	0.4	NA	0.5	0.5
Value Production	$363	$31	$572	$150	$140	$165	$28	$458	$129	$114	$66	$25	NA	$113	$79
VA/labor day	$5.0	$0.5	$3.1	$0.5	$1.8	$2.3	$0.5	$2.4	$0.4	$1.4	$0.9	$0.4	NA	$0.4	$1.0
Profit	$189	-$17	$230	-$26	$28	$57	-$19	$156	-$30	$16	-$9	-$21	NA	-$33	$0
High Performance	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton	Ground.	Sunfl.	Maize	Rapoko	Cotton	Ground.	Sunfl.
Cash Costs	$165	$17	$286	$209	$124	$126	$14	$239	$174	$91	$37	$14	NA	$105	$67
Yield (tons)	4.5	0.7	1.8	1.2	1.3	3.5	0.6	1.5	1.0	1.0	1.0	0.6	NA	0.6	0.7
Value Production	$495	$43	$687	$258	$228	$380	$37	$572	$215	$167	$110	$37	NA	$129	$123
VA/labor day	$6.9	$0.7	$3.6	$0.9	$2.9	$5.3	$0.6	$3.0	$0.7	$2.1	$1.5	$0.6	NA	$0.4	$1.6
Profit	$277	-$9	$289	-$6	$68	$200	-$13	$222	-$14	$40	$20	-$13	NA	-$30	$20

Source: Sukume, 2001 and author's calculation.

Notes: 1. Budgets for Mhunga and Sorghum in NR IV and V are close to the budget of Rapoko.
2. Cash costs include purchased inputs (seeds, fertilizer, pesticides)
3. Profit = Value of Production – Cash Costs – Opportunity Cost of Labor (with labor valued at $1/day)
4. VA (Value Added)/labor day = (Value of Production – Cash Costs)/Labor Days
5. NA = not applicable. Due to the agricultural ecosystem, cotton is not a major crop in Natural Regions IV and V.

Given an average opportunity cost of $1 per day, some crops show a negative profit value per hectare. This may be due to the fact that input prices are overestimated or that the opportunity cost of labor for these crops is lower, which could be the case if labor for these crops is required at low peak season.

In terms of cropping pattern (the area shares for each crop), we assume that the resettled farmers in the first year replicate the area shares of low-performance communal farmers. During years 2-5 they gradually move toward the medium-performance behavior, at which they stay throughout years 6-10. During years 11-15, they operate like high-performance farmers. Land allocation over time for each farm model is shown in Table 6.

Table 6. Farm-Level Land Allocation by Natural Region and Year (hectares)

NR I & II	**Farm Size**	**30 ha**		**Land Price**	**79 US$/ha**		
Year	**1**	**2**	**3**	**4**	**5**	**6-10**	**11-15**
Maize	1.0	1.0	1.0	1.0	1.0	1.2	2.1
Rapoko	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cotton	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Groundnuts	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Sunflower	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Total Crop	**1.6**	**1.7**	**1.8**	**1.9**	**2.0**	**2.6**	**3.5**
Pasture	28.4	28.3	28.2	28.1	28.0	27.5	26.5
NR III	**Farm Size**	**45 ha**		**Land Price**	**53 US$/ha**		
Year	**1**	**2**	**3**	**4**	**5**	**6-10**	**11-15**
Maize	0.8	0.8	0.8	0.8	0.8	0.8	1.0
Rapoko	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Cotton	0.0	0.2	0.4	0.6	0.8	1.0	1.2
Groundnuts	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Sunflower	0.0	0.0	0.0	0.0	0.0	0.3	0.3
Total Crop	**1.1**	**1.3**	**1.5**	**1.7**	**1.9**	**2.6**	**3.0**
Pasture	43.9	43.7	43.5	43.3	43.1	42.5	42.1
NR IV & V	**Farm Size**	**75 ha**		**Land Price**	**32 US$/ha**		
Year	**1**	**2**	**3**	**4**	**5**	**6-10**	**11-15**
Maize	0.5	0.5	0.5	0.5	0.5	0.5	0.7
Sorghum	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Mhunga	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Rapoko	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Groundnuts	0.2	0.2	0.2	0.2	0.2	0.4	0.4
Sunflower	0.1	0.1	0.1	0.1	0.1	0.3	0.3
Total Crop	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**2.3**	**2.5**
Pasture	73.3	73.3	73.3	73.3	73.3	72.7	72.5

Source: Sukume, 2001 and authors' calculations.

Farm-level budgets, which combine crop and livestock budgets, are based on the data on land use and livestock growth specific to the each of household.

Economic and Financial Analysis

The combination of crop budgets and crop allocation on one hand, and livestock budgets and livestock growth parameters on the other, make it possible to compute the different revenue flows from farm activities and to estimate the costs incurred by the farmers. In order to estimate the evolution of total income (revenue minus costs) at the farm level, additional information and assumptions are needed.

Cash flows (revenues and costs) from farm activities are summarized in Table 7. In order to smooth the process of resettlement, it is assumed that farmers benefit from startup grants as well as subsidized credit (see details below). The values of output (including family self-consumption), purchased inputs (including animal purchases), and family labor are derived from the combination of crop budgets and crop allocation on one hand, and livestock budgets and livestock growth parameters on the other. Off-farm work income is assumed to diminish over time, from $300 in year zero (before the start of the project) to $150 in the first year and $75 in the second, reflecting an increased involvement in farm activities. After the third year, family members are assumed to work exclusively on farm. Infrastructure building requires family labor participation. It is assumed that the value of family labor participation amounts to 20% of the non-labor cost of infrastructure.

Table 7. Income per farm by Natural Region and Year (US$1994-95)

Years	1	2	3	4	5	…	15
NR I & II							
Output Value (+)*	$172	$495	$767	$810	$909		$2744
Purchased Inputs (-)	$41	$731	$507	$118	$150		$667
Startup Grant (+)	$75	$0	$0	$0	$0		$0
ADAF Credit (+)	$0	$600	$300	-$89	-$89		$0
Farm Income	$206	$364	$561	$604	$671		$2,078
NR III							
Output Value (+)	$72	$403	$677	$747	$880		$2200
Purchased Inputs (-)	$14	$697	$479	$97	$134		$546
Startup Grant (+)	$75	$0	$0	$0	$0		$0
ADAF Credit (+)	$0	$600	$300	-$89	-$89		$0
Farm Income	$133	$306	$498	$561	$658		$1,654
NR IV & V							
Output Value (+)	$69	$348	$574	$627	$686		$1916
Purchased Inputs (-)	$41	$699	$465	$67	$72		$202
Startup Grant (+)	$75	$0	$0	$0	$0		$0
ADAF Credit (+)	$0	$600	$300	-$89	-$89		$0
Farm Income	$104	$249	$410	$471	$525		$1,714

Source: Farm models.

Note: Output Value is a sum of cash revenue from sold output and family consumption. Cash revenue for each crop is estimated as [hectares * value production (from Table 5) * (1-proportion of self consumption)]. Similarly, family consumption is equal to [hectares * value production (from Table 5) * Proportion of self consumption].

Government administration costs include all types of costs necessary to smooth the process of resettlement. Administration costs include both costs specific to the resettlement ($200 in the first year) and farmer support costs ($50 per year). Startup grants of $100 are received by each family during the first year for current expenses including living costs, farm inputs, and so on. Infrastructure costs cover electricity, water, sanitation, farm road construction, building schools, clinics, and animal health facilities. Their cost amounts to $350 in the first year, $200 in the second year, and $100 in the third year. The government assisted credit program, ADAF, for land reform beneficiaries is included. The amount of loan covers the cost of purchasing animals. It is $600 for the second year and $300 for the third year. Half of the loan is subsidized and the other half is repaid over a ten-year period at a 10% interest rate. Borrowers start repaying after a two-year grace period. The value-added tax on inputs and outputs (sales of animals and milk), assumed to be at 10%, is also considered, representing a revenue flow for the government.

Table 8 details all the costs taken into account in the Inception Phase Framework Plan. In our analysis, we deviate slightly from these costs since the farm level analysis reveals a need for more credit to smooth the settlement process. Total credit distributed to each beneficiary is US$900 (see above).

Table 8. Summary of Costs per Beneficiary (US$1994-95)

	Natural Region			
(US$)	I & II	III	IV&V	Source
Land Allocation (ha)	**30**	**45**	**90**	**GOZ, 1999**
Farm Acquisition	**2,370**	**2,385**	**2,880**	**Valuation Dept, MLGNH**
Land Assessment	**6.45**	**9.68**	**19.35**	
Transport	4.2	6.3	12.6	
Land Valuation	2.25	3.38	6.75	Valuation Dept, MLGNH
Land Distribution	**308**	**383**	**608**	
Land Use Plan	150	225	450	DDF
Demarcation	26	26	26	AGRITEX
Title Survey	132	132	132	Surveyor Generals Department
Farmer Support	**119**	**119**	**119**	
Training	18	18	18	AGRITEX
Inputs	53	53	53	DDF
Land Prep	22	22	22	DDF
Extension	26	26	26	AGRITEX
Credit Support	**478**	**478**	**478**	AGRITEX
Infrastructure Support	**763**	**763**	**763**	
Water	95	95	95	DDF
School	592	592	592	DDF
Clinic	19	19	19	DDF
Dip Tanks	39	39	39	DDF
Roads	18	18	18	DDF
All costs				
Program Cost/beneficiary*	**4044**	**4137**	**4867**	
Program Cost/ha	135	92	54	
Excluding credit, inputs and land preparation				
Program Cost/beneficiary	3491	3584	4314	
Program Cost/ha	116	80	48	

Source: GOZ, 1999.

Given farm income, off farm activities and support flows from the government, household level income flows can be derived over time for the representative household in each region. These flows are summarized in Table 9. The results indicate that the land reform can generate a sustainable income flow for the beneficiaries, in year 15 reaching 570-690% of their incomes before the project.

Table 9. Household-Level Income by Natural Region and Year (US$1994-95)

Years	0	1	2	3	4	5	…	15
NR I & II								
Off-farm Employment	$300	$200	$100	$0	$0	$0		$0
Farm Income	$0	$206	$364	$561	$538	$605		$2,078
Total Income	$300	$406	$464	$561	$604	$671		$2,078
% of Base Year Inc.		135.2	154.7	186.9	179.3	201.8		692.6
NR III								
Off-farm Employment	$300	$200	$100	$0	$0	$0		$0
Farm Income	$0	$133	$306	$498	$561	$658		$1,654
Total Income	$300	$333	$406	$498	$561	$658		$1,654
% of Base Year Inc.		111.0	135.4	165.9	165.2	197.2		551.4
NR IV & V								
Off-farm Employment	$300	$200	$100	$0	$0	$0		$0
Farm Income	$0	$104	$249	$410	$471	$525		$1,714
Total Income	$300	$304	$349	$410	$471	$525		$1,714
% of Base Year Inc.		101.4	116.3	136.6	135.3	153.1		571.3

Source: Farm models.
Note: Farm Income is defined in Table 7.

In Table 10, we contrast our data on revenue per hectare with numbers derived from a panel survey of resettlement farms (Kinsey, 1999). As shown, the results are quite similar.

Table 10. Hectares Planted and Revenues per Hectare

	Kinsey (1999)		Farm Models Year 15		
	Communal Areas	Resettlement Areas	NR I & II	NR III	NR IV & V
Hectares planted	1.7	3.5	3.5	3.0	2.5
Revenue per hectare planted (US$)	57	287	254	360	51

Source: Kinsey (1999), farm models.

In order to estimate the benefit from the land redistribution, the without-project return to land needs to be evaluated. This is obviously a crucial element in the analysis. In the following, the without-project return to land, i.e. the opportunity cost of land in Net Present Value (NPV) terms is set at the present value of the annul rental value of land during the project period (15 years).[5] Hence, the project is viewed as having a lifetime of 15 years during which we fully account for costs and benefits. The discount rate used

[5] For an asset that gives rise to a perpetual income stream, the value is equal to the annual asset income (or rent) divided by the discount rate. Using this formula, we first computed the annual land rent given the assumed land price and the discount rate. After this, we computed the PV of these annual land rents during the 15-year project period.

reflects the real rate of return that the owner of a piece of land might expect. It is set at 5%. This approach may lead to an underestimation of project net benefits if the true land opportunity cost is lower, for example if the resettlement lands would have been unutilized. Project net benefits would also be underestimated if the investments that are made in the beginning of the project have a lifetime that exceeds 15 years. If the project analysis were replicated for additional periods in the future, the net benefits would be higher assuming that the farmers throughout these periods would belong to the high-performance group.

Table 11 presents internal rates of return and the NPV of the project for alternative discount rates. Benefit items include Family Net Benefits after Financing, Incremental Tax Revenues and Transfers to Owners (equal to without-project revenue). Costs include Government Program Costs. Since this estimate applies to the total project, we then multiply the NPV of Net Benefits for each farm model, disaggregated by region, by the number of families in each region and sum over the three regions.

Table 11. Project Cost-Benefit Analysis with alternative discount rates (million US$1994-95)

	NR I & II	NR III	NR IV & V	Total
Internal Rate of Return (%)	23%	19%	15%	21%
5% discount rate				
Family Benefits after Financing	$502	$151	$121	$774
Incremental Tax Revenue	$48	$20	$18	$86
Transfer to Previous Owners	-$125	-$47	-$42	-$213
Government Program Costs including ADAF	-$133	-$52	-$49	-$234
Net Benefits	**$326**	**$85**	**$60**	**$471**
10% discount rate				
Family Benefits after Financing	$328	$99	$78	$505
Incremental Tax Revenue	$34	$14	$13	$62
Transfer to Previous Owners	-$125	-$47	-$42	-$213
Government Program Costs including ADAF	-$120	-$47	-$45	-$212
Net Benefits	**$172**	**$40**	**$23**	**$235**
15% discount rate				
Family Benefits after Financing	$222	$67	$52	$341
Incremental Tax Revenue	$26	$11	$10	$46
Transfer to Previous Owners	-$125	-$47	-$42	-$213
Government Program Costs including ADAF	-$111	-$44	-$42	-$197
Net Benefits	**$81**	**$14**	**$1**	**$95**
20% discount rate				
Family Benefits after Financing	$154	$47	$35	$236
Incremental Tax Revenue	$20	$8	$8	$36
Transfer to Previous Owners	-$125	-$47	-$42	-$213
Government Program Costs including ADAF	-$104	-$41	-$40	-$184
Net Benefits	**$24**	**-$3**	**-$13**	**$9**

Source: Farm models.
Notes: Values reported are Net Present Values given the discount rate. As a result, figures in columns do not add up.

Results indicate that the land reform is economically viable with regional internal rates of return ranging from 15% for NR IV & V to 23% for NR I & II, and an average value of 21%.

The total NPV ranges from US$9 million to US$471 million for discount rates in the range from 5% to 20%. At the regional level, with a 5% discount rate, the NPVs are positive for all regions, with values ranging from US$49 for Natural Regions IV and V to US$133 for Natural Regions I and II. In Cost-Benefit analysis, an NPV that is positive at a 10% discount rate is often considered acceptable (Gittinger, 1982). It should also be noted that the equity impact of the project is not included in our calculations,

Production and Employment

Another important issue in the debate on land reform is linked to its impact on production and employment. These questions are central because they are related to the pressure on the balance of payments on one hand, and on unemployment on the other hand. In Table 12, we present the production numbers derived from the farm level analysis.

Table 12. Production of Resettled Farmers on year 15

	Farm Models Year 15				Total National Production in 1996 (tons)	Resettled Farmer Production as % of National 1996 Production
Kg per farm	NR I & II	NR III	NR IV & V	Total (tons)		
Maize	9,225	3,500	650	754,059	2,082,414	36
Sorghum/Mhunga/Rapoko	0	0	480	11,072	74,249	15
Cotton	1,350	1,800	0	141,925	229,324	62
Groundnuts	325	250	280	35,818	66,143	54
Sunflower	455	300	210	44,637	28,180	158
Meat	358	376	519	46,900		
Milk (liters)	4,725	4,253	7,909	625,478		

Source: Farm models, CSO (1996).

The numbers in Table 11 suggest that the production achieved by the resettled farmers after 15 years would be significant. As a point of reference, the last two columns show total national production in 1996 and the production of the resettled farmers as a share of this production. The reader should note that the redistributed land corresponds to 16% of the total agricultural area (see Table 1). Some of these numbers might need to be qualified, particularly those for cotton and sunflower. Assumptions on the dynamic and technological achievement in the farm models might be too optimistic for these two crops, since we assumed that *all* resettled farmers achieve high performance group production levels. It should also be noted that the reported production levels would only be achieved 15 years after resettlement. During the first resettlement years, some disruption of the agricultural production should be expected. This possible although temporary consequence of the resettlement should be taken care of since it could cause political unrest and undermine the resettlement process.

In Table 12, we present the employment numbers by farm and the aggregates derived from the farms models.

Table 12. Employment on Resettled Farms on year 15

Per farm	NR I & II	NR III	NR IV & V	Total
Days	767	667	503	
Job Equivalent	3.2	2.8	2.1	343,962 jobs

Source: Farm models.
Note: Job equivalent is based on a 5-day workweek and 20 annual leave days.

Results show that in the land redistribution project creates the equivalent of 343,962 jobs. As a point of reference, formal employment in agriculture (by both Large and Small Scale Commercial Farms) was equal to 347,000 workers in 1996 (IMF, 2001, p.52). Since the scheme is redistributing close to 50% of the total area for the large-scale commercial farms (5 million hectares out of 11 million hectares), these numbers show that the resettled farms are much more labor-intensive.

To contrast these results, alternative assumptions on without-project production and employment will be needed.

Conclusions

In summary, the results of our analysis indicate that a government supported land reform could be economically viable under what we consider as realistic assumptions regarding the performance of the beneficiaries and the costs that will be faced by the government and other stakeholders; the impact of alternative assumptions can easily be simulated.

Land reform can generate sustainable livelihoods for the beneficiaries. If viewed as a project, the NPV of the reform is positive for a discount rate that is as high as 20%. The overall internal rate of return is 21%. The project can also increase employment in the agricultural sector – relative to large-scale commercial farms; the farm operations of the beneficiaries are more labor-intensive.

It should be noted that the reported results would only be achieved 15 years after resettlement. Following Kinsey (1999), we believe that a long term perspective is needed and that "any attempt at comprehensive evaluation of the benefits of land reform in less than a generation is ill-advised." During the first resettlement years, some disruption of the agricultural production should be expected. This possible although temporary consequence of the resettlement should be taken care of since it could cause political unrest and undermine the resettlement process.

These results are preliminary and based on a partial equilibrium perspective. They are driven by the assumption that the land reform is carried out in a manner that allows farmers on the resettled lands to achieve their productive potential. Such an outcome depends critically on that the farmers are able to operate in an enabling environment, encompassing adequate access to input and output markets and critical government support (including startup grants and subsidized credit), especially during years 1-5.

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