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SIMULATED RESPONSES TO CHANGES IN RELATIVE PRICES AND OFF-FARM EMPLOYMENT LEVELS: SOME POLICY IMPLICATIONS FOR KWAZULU

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A mathematical programming model of rural KwaZulu, excluding three northern districts, was developed to simulate agricultural production in regions of high and low cropping potential. This (regional) model aggregates enterprise levels predicted for four representative households of which two are in the high potential region and two in the low potential region. To some extent, the effects of off-farm wage employment opportunities, risk, leisure and food consumption requirements on (profit maximizing) household resource allocation are accounted for by the model.

Six economic scenarios are simulated with the model to predict responses to changes in crop prices, input subsidies, changes in off-farm employment and a rental market for crop land. The paper concludes with an assessment of policy implications.

Introduction

KwaZulu, homeland of the Zulu tribes, accommodates more than 360 000 rural households. In general, these smallholders have access to communal grazing and arable land allotments of less than two hectares in size. Geographically, KwaZulu comprises several landlocked islands within the province of Natal on the eastern seaboard of South Africa. Consequently, members of many rural households are often within commuting distance of wage employment opportunities in urban areas or on large commercial farms in Natal.

A mathematical programming model of rural KwaZulu, excluding three northern districts, is used to simulate the effects of various economic scenarios on resource allocation. The (regional) model aggregates enterprise levels predicted for four representative household types, two located in areas of low cropping potential and two in areas of high cropping potential.

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The regional model includes off-farm wage earning activities and accounts for differences in the wage earning potentials of individual household members. As demonstrated by Low (1986), these features clearly influence resource allocation and agricultural production on small farms in Southern Africa. To some extent, the effects of risk, leasure and food consumption requirements on (profit maximizing) household resource allocation are also captured by the model.

In the latter sections of this paper, solution levels are compared with base data and the model is used to predict responses to changes in farm output and input prices, changes in off-farm employment and a rental market for crop land. The paper concludes with comment on policy implications stemming from the results.

The Model

The regional model (Table 1) comprises 503 rows and 616 columns of which 37 are integer activities (Lyne & Ortmann 1989b). Region 1 represents areas of high cropping potential in the area modelled, and Region 2 the areas of low cropping potential.

/Table 1/

Most of the household data were gathered in a sample survey of Gcumisa ward conducted during 1985 (Stewart and Lyne 1988). Within each agronomic region, the sample households were classified into two groups, using cluster analysis, according to the proportion of their members and workforce capable of earning "high" off-farm wages. To facilitate this classification, wage rates were predicted for all members of the workforce (healthy adults aged 15-59) who were not wage employed using "offer wage" functions estimated from observations on wage employed household members (Lyne 1988). The offer wage rate separating "high" and "low" off-farm wage rates was set at the sample median. It was anticipated that households within each group would have roughly proportional resource levels because the clustering variables were measured as ratios. Consequently, arithmetic group means (Table 2) were used to synthesize the representative households modelled in each agronomic region (Day 1963).

/Table 2/

Leisure time sacrificed for work is costed in the objective function with the cost per unit time increasing as more leisure is sacrificed. Each household's seasonal stock of "de facto" on-farm labour (and leisure) time varies inversely with the number of members allocated to off-farm employment. Integer activities ensure a unique choice between commuter and farm related occupations. Activities selling off-farm labour at "high" and "low" wages are included with the latter activity competing for both categories of household workers. Household food consumption requirements are treated as seasonal constraints with minimum requirements varying inversely with the number of off-farm workers. Wage remittances were measured nett of food and travel expenses incurred by off-farm workers at their rural homes.

Aggregation is achieved by weighting and summing the solutions to the representative household models using the estimated number of households in each population group as weights. The demand for off-farm wage labour is assumed to be perfectly elastic in both the "high" and "low" wage markets but the supply of wage labour from individual household types is not permitted to exceed the mean levels presented in Table 2. Market demand for food crops is treated as a stepped function because farm gate prices are usually higher for local sales than for urban sales owing to transport costs. Quantities sold on the rural market are therefore restricted to a level less than or equal to quantities purchased. Likewise, on-farm labour transactions between households are subject to a constraint preventing sales from exceeding purchases. Other markets are assumed to be perfectly price elastic or inelastic. All crops, excluding sugar-cane, are introduced at two levels of technology, traditional and potential. Livestock activities were excluded as they are not expected to have a significant influence on the allocation of arable land or labour. Average hard size is less than 3,5 cattle, households have access to communal grazing and herding duties are generally performed by children.

Evidence suggests that farmers behave in a risk-averse manner (Binswanger 1980; Moscardi and De Janvry 1977; Young 1979:1065). Neglect of risk in planning models can lead to considerable overstatements of the size of risky enterprises. Other consequences may be specialized cropping patterns, biased estimates of the supply elasticities of individual commodities, overestimation of the value of certain resources, such as land and irrigation water, and the incorrect prediction of technology choices (Hazell 1982:384).

Income risk associated with a particular mix of enterprises is usually measured in terms of the variance in, and covariance between, detrended enterprise gross incomes (or gross margins). In this study, variance-covariance matrices were approximated for each region using the mean absolute deviation approach described by Hazell (1971); and Hazell and Scandizzo (1974). Estimated crop yields, producer prices, revenue deviations from mean revenue and raw data sources are given in Lyne and Ortmann (1989a).

Risk is accounted for in the objective function by maximising Baumol's (1963) $L = E-\theta\sigma$ criterion, where E is expected nett income, θ a risk aversion parameter and σ the standard deviation of income. A value of θ was estimated independently for each representative household by simulating its observed enterprise mix. The optimum θ values, i.e. those that resulted in the best simulation, were substituted into the regional model.

The objective function of the regional programming model can be written as:

$$\text{Max } L = \sum_{i=1}^{N} a_i \left(([P'YX]_i - [R'E]_i - [C'X]_i \; [W'H]_i - [F'N]_i - \theta_i [X'\Omega X]_i^{0'5}) \right)$$

a_i = weight to neutralize differences between total household numbers in each homogeneous group i.

[P'YX] = gross farm income, P being a vector of unit product prices, Y a diagonal matrix of per hectare yields and X a vector of hectares.

[R'E] = nett off-farm income, R being a vector of nett remittances and welfare payments per recipient and E a vector of off-farm workers and welfare recipients.

[C'X] = total market production costs, where C is a vector of per hectare production costs excluding family labour.

[W'H] = family labour costs, H being a vector of hours worked and W a vector of on-farm wage rates.

[F'N] = Purchased food costs, F being a vector of unit food prices and N a vector of food purchases.

θ_i = an aggregate "risk aversion" coefficient for all households in homogenous group i.

Ω = a variance-covariance matrix of per hectare crop incomes, so that $[X'\Omega X]$ represents variance in income.

N = the number of homogeneous groups (four in this model) each with its own Ω.

In the case of linear programming, the objective function must be linearized by replacing the term $[X'\Omega X]^{0,5}$ with its linear estimate:

$$Est(X'\Omega X)^{0,5} = \frac{\sqrt{\cap}}{T} \left(\Sigma_t \left| \Sigma_j (r_{jt} - \bar{r}_j) X_j \right| \right)$$

where $\cap = T\pi/2(T-1)$. This is a correction factor that converts the square of the mean absolute deviation to an estimate of the population variance assuming the population is normally distributed (Simmons and Pomareda 1975:473). The term T represents the number of periods considers. $(r_{jt} - \bar{r}_j)$ the deviations from mean revenue for crop j and time period t, and π the mathematical constant.

Validation of the Model

To validate a model it is necessary to have a set of base data against which the predicted results can be compared. Unfortunately, KwaZulu has neither a complete nor a reliable set of agricultural base data. Nevertheless, comparisons have been drawn where possible. Production comparisons are presented in Table 3. It should be noted that crop rotation constraints included in the model were not binding in the solution.

/Table 3/

For both production measures (hectarage and yield) the PAD's are acceptable, a value of 10 percent being considered good (Hazell and Norton 1986:271).

Fallow land (59 110 ha) comprises some 19,3 percent of the total area cultivated. This prediction compares favourably with other estimates which range from 15,6 to 27,0 percent (Knight and Lenta 1980:191; Lyne 1981:121; Lyster 1987:137; Stewart and Lyne 1988). High proportions of fallow land have also been documented in the Transkei, Malawi (50 percent fallow) and Lesotho (Low 1986:122). Extensive (traditional) rather than intensive (potential) crop production and the presence of fallow land lend support to Low's household-economics theory which forms the basis of this empirical model.

Independent household income estimates are available but direct comparisons cannot be drawn owing to differences in the way income is measured. In this study, disposable income includes total pension and disability payments, nett wage remittances and nett crop value. Annual income estimates generated for the (weighted) average rural household are listed in Table 4.

/Table 4/

Annual cash income predicted by the model (R2 624) compares favourably with Stewart and Lyne's (1988) estimates of R2 400 and R2 682 (nett of income from livestock and handicrafts) for the Gcumisa households sampled in regions of high and low cropping potential during 1985. Nattrass and May (1986) report a mean annual cash income of approximately R3 000 (nett of inflation and income sources omitted from the model). This may be an over-estimate as income from daily commuters was measured as wage earnings rather than remittances.

A summary of base solution levels for key activities is presented in Table 5.

/Table 5/

Simulated responses to changes in relative price and employment levels

Several economic scenarios were simulated and in the following sections the results are compared with the base solutions (Table 5). All results reflect static equilibrium solutions and therefore imply complete adjustment to changes in prices and employment. A land market is excluded in all but the last scenario. In the traditional system of land tenure, landholders are unwilling to let others use their (fallow) land, even on a temporary basis, for fear that they might lose permanent usufruct (Lenta 1982).

Scenario 1: **Cereal price increased by 10 percent**

An important consideration in rural development is the impact of a relative change in cereal prices on household income and utility, food purchases and sales, labour employment and land use pattern. In KwaZulu maize is the predominant subsistence crop and relative changes in its price are expected to influence some or all of these factors. The simulated effects of a 10 percent relative increase in producer and retail maize prices are summarized in Table 5.

Household disposable income per annum would increase by 6,7 percent to R2 757 compared with the base solution. This increase is primarily due to the substitution of farm produced cereals for purchased cereals, reflected in the reduction of cereal imports by R87,9 million to R23,9 million and a 3,5 fold increase in the value of farm produced cereals consumed. Area planted to cereals increases 1,6 fold to 209 465 hectares of which 80 139 hectares are grown at higher yield levels. There is also a switch from extensive (traditional) to intensive (potential) root production but total root production declines relative to the base solution. Sugar-cane production increases with increases in cereal production because sugar-cane is a good risk diversifier. Higher sugar-cane sales also contribute to higher household income. All available land is utilized, with the shadow price of land being R26,37 per hectare in

Region 1 and R6,24 per hectare in the region of low cropping potential. The nett value of crop production increases by 58,4 percent to R90,9 million.

According to the solution, the number of off-farm wage workers would not be reduced. This implies that the increased amount of labour-time required to produce the greater tonnage of cereals and sugar-cane would be drawn from family labour, increasing its cost as leisure time declines. Since this labour cost is not a cash flow item, it does not dampen the observed increase in household disposable income. However, the decreased value of L per household (R1 561) compared with the base model implies that higher household income is more than offset by increasing (production) risk and leisure time lost. It can be expected therefore that with a relative cereal price increase of 10 percent household utility would fall as the greater majority of rural households in KwaZulu are deficit cereal producers (Nieuwoudt and Vink 1988).

Scenario 2: Sugar-cane price increased by 10 percent

Sugar-cane plays an important role in the economy of rural KwaZulu, particularly in the high potential areas. It was considered appropriate to simulate the impact of a 10 percent relative increase in sugar-cane price as the crop is produced for commercial rather than subsistence purposes.

Results of this simulation are summarized in Table 5. It is estimated that a (relative) 10 percent increase in the sugar-cane price would, in the absence of any artificial restraints such as quotas, result in full utilization of potential sugar-cane land in the area modelled. This amounts 128 000 hectares (Ortmann 1985:69).

Although the area under cereals is estimated to fall by one-third, 10 062 hectares of the remaining area are cultivated at "potential" levels of technology with the higher yields partially offsetting the effects of a reduced area. Cereal imports increase and the value of cereals produced and consumed at home declines.

The area under roots is estimated to fall by 52 percent to 11 909 hectares. However, there is a switch from traditional technology (five tons/hectare) to potential technology (13 tons/hectare). The nett effect is an increase in root production (24 percent) and sales (27 percent). The change from traditional to potential technology in both cereals and roots which accompanies the increase in sugar cane production is the result of risk aversion and the fact that arable allotments are fully utilized in Region 1 (i.e. the high-potential area). All of the fallow land (33 602 hectares) lies in the low-potential area (Region 2) and implies that crop land in Region 1 has attained a shadow price (R15,92/hectare). Consequently, households in Region 1 attempt to maximize returns per hectare, after taking into account risk and other factors, rather than returns per unit of time spent farming.

Disposable income per household is estimated to increase by 6,2 percent, with a considerable income range. $L(=E-\theta\sigma)$ increases by two percent to R1 606 reflecting an increase in its upper limit. A relative increase in sugar cane price implies that households in regions of high crop potential benefit relative to households in areas where sugar-cane cannot be grown (Region 2). The overall impact of this particular policy on KwaZulu has been an estimated doubling of the nett value of crop production to R114,8 million.

Scenario 3: Input subsidies

The susidization of farm inputs has often been proposed as a tool to stimulate agricultural production in less-developed areas (see, for example, Feder et al 1981; Nieuwoudt and Vink 1988). In this scenario, production costs of all crops were decreased by five percent in order to simulate the effects of input subsidies (Table 5).

A major impact of input subsidies is that production of all crops considered would increase: the area of cereals by 32 percent, legumes and roots by approximately 13 percent and sugar-cane by 18 percent. Cereal imports decline and more roots, sugar-cane and, for the first time, legumes are sold. The nett value of crop production increases by 29 percent to R74 million. There is no fallow land, implying that cropland attains a shadow price in both regions. In the high potential area (Region 1) the shadow price is estimated as R17,28 per hectare and in the low potential area (Region 2) as R3,53 per hectare.

Disposable income per household is estimated to increase by 1,8 percent and the value of L by 0,8 percent relative to the base values. It is interesting that the income and L ranges are smaller than those in the previous scenario. The reason for this is simply that input subsidies benefit farmers in all regions whereas a sugar-cane price increase only benefits farmers in the high potential region.

Scenario 4: Increased unemployment

To simulate the impacts of increased unemployment, the number of on-farm workers at home was increased by one-half person to 1,5 in household Type 2 and to 2,0 in household Type 4 because an increase in unemployment is expected to impact largely on workers with a comparative disadvantage in wage employment. The results are shown in Table 5. Wage workers in total are estimated to decrease by 12 percent.

Production of all the crops considered is estimated to increase and the fallow area to decrease. This is consistent with Low's household economics theory (Low 1986). Consumption of home-produced crops is expected to increase as is the amount of food imported by non-commuters owing to the greater number of people at home.

The nett value of crop production is estimated to increase to R60,4 million but total wage remittances are estimated to fall by 6,5 percent to R461,9 million, causing disposable income per household to decrease by 3,7 percent to R2 488 per annum and the value of L per household by 9,4 percent to R1 427 per annum.

Scenario 5: Input subsidies and increased unemployment

In this scenario the simultaneous impact of both input subsidies, equivalent to a five percent reduction in production costs, and increased unemployment, as defined in Scenario 4, are considered. The results are summarized in Table 5.

The greatest impact appears to be on crop production. All available land is used to produce crops and crop land attains a shadow price, namely R17,28 per hectare for "household Type 1" land, R26,22 per hectare for "household Type 2" land and R3,53 per hectare for households in the low potential area (Region 2). The difference in shadow price between "Type 1" and "Type 2" land is primarily due to the fact that there are relatively more on-farm workers in the Type 2 households (due to the way unemployment was defined), and because no land market was considered.

The overall effect of this scenario is that disposable income per household remains virtually unchanged but the value of L per household falls by 8,6 percent. The nett value of crop production increases from R57,4 million to R74,2 million, or by 29,3 percent.

Scenario 6: Input subsidies, increased unemployment and a market for crop land

This scenario duplicates Scenario 5 but considers a land rental market for arable allotments. Individual households would only enter the rental market if it were to their benefit, i.e. no household would be worse off as a result of renting.

The mean disposable income per household for the two scenarios is the same (R2 526/annum) since the cost of renting land by the lessee (Household Type 2) is an income to the lessor (Household Type 1), but the upper range in annual disposable income decreases from R2 859 to R2 817 (Table 5). Although the income component of the wealthiest household is lower, its total utility is higher because the decline in costs associated with risk and family labour more than offsets the reduction in cash income.

It is predicted that Type 2 households would rent 15 722 hectares of crop land from Type 1 households. The shadow price of land stabilizes at R21,85 per hectare in the high potential region and remains at R3,53 per hectare in Region 2.

Discussion and conclusions

The prgramming model described in this study does not capture the "profit effect", i.e. the effect of an increase in household income on the consumption of goods and leisure. However, omission of the profit effect may not have influenced the model results significantly, since very few farmers in KwaZulu are surplus producers.

Policies advocated to improve African food security often assume that most farmers are nett sellers of food and that emphasis on commercial crops endangers food security (Weber et al 1988). During 1971-1973 KwaZulu produced only 30 percent of its cereal requirement (Lenta 1981). Less than 17 percent of KwaZulu farmers sampled by Gibbs (1988) were self sufficient in grains and less than five percent of the Gcumisa sample households sold surplus maize. An increase in the price of a staple such as maize is therefore expected to harm large numbers of households in urban and rural areas. The rural situation is demonstrated in Scenario 1 where a 10 percent relative increase in retail and producer cereal prices reduced the welfare (L) of all households modelled, even though cash incomes increase.

A similar increase in the price of sugar-cane (Scenario 2), on the other hand, improves the welfare of households in areas where the crop can be grown. In contrast with the results obtained by Barnum and Squire (1979) for rice growers in Malaysia, rents accrue primarily to the fixed resource, crop land, rather than to farm labour. If a land rental market existed (Scenario 5), land rents would be visible and the welfare of all market participants would increase. Lessees would be able to spread fixed costs (eg. of management and information) thereby improving the relative profitability of farming. Policy-makers should concern themselves with identifying and removing constraints to an efficient land rental market.

It should be noted that emphasis on a commercial crop does not necessarily undermine food security as risk aversion may result in complementarity of cash and food crops. In Scenario 2, nett food imports increased by only 1,2 percent (R2,5 million) relative to the base solution, whilst sugar-cane exports increase by R103,3 million. Weber et al (1988) suggest that complementarity is likely for a number of other reasons including access to inputs and infrastructure which tend to accompany cash crops. Since KwaZulu has access to reliable food sources in Natal, affordability is more important than accessibility. Relative increases in cash crop prices are therefore more likely to improve than worsen nutritional status.

Subsidization of inputs (Scenario 3) would improve the welfare and output of rural households. Production credit is subsidized in KwaZulu and its availability and use have been associated with efficiency and surplus production (Nieuwoudt and Vink 1988; Wheeler and Ortmann 1989). Decreasing off-farm wage employment (Scenario 4) stimulates agricultural production for market and non-market purposes but leaves households worse off. Negative (positive) relationships between off-farm employment and food production (food imports) have been observed throughout Southern Africa (Low 1986) and are consistent with Low's household economics model. Increased production resulting from rising off-farm unemployment is not a success story for agriculture and policy-makers should not overlook the opportunity cost of labour in implementing agricultural projects or in determining approproriate technology.

Agricultural statistics for KwaZulu are scarce and this proved to be a limitation in developing the model. The predictive power of the model could be improved if household data were available for more (homogeneous) districts in rural KwaZulu. Nevertheless, the solutions accord with expectations and study draws attention to the role that a regional model can play in determining the direction of macro-responses to changing economic circumstances.

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Table 1: A mini-tableau for the regional model.

	Region 1 - - - - - - - - - - - - - - Region 2												
	Household 1					Household 4							
	Production	Marketing				Production	Marketing				Regional		
		own	buy	sales			own	buy	sales		purchases	rural sales	
	X_1			local	urban	X_4			local	urban			RHS
Restraints 1	a_1	-1	-1										$\leq b_1$
Commodity balances 1	$-y_1$	1		1	1								≤ 0
⋮													
Restraints 4						a_4	-1	-1					$\leq b_4$
Commodity balances 4						$-y_4$	1		1	1			≤ 0
Purchases			1					1			-1		=0
Rural sales				1					1			-1	=0
Local marketings											1	-1	≥ 0
Objective function	$-C_{11}$		$-C_{21}$	P_{11}	P_{21}	$-C_{14}$		$-C_{24}$	P_{14}	P_{24}			Max!

Table 2. Mean characteristics of household types in each region.

Particulars	Region 1 Type 1 (n=60)	Region 1 Type 2 (n=72)	Region 2 Type 3 (n=31)	Region 2 Type 4 (n=30)
Children (<16 yrs)	4,0	5,0	5,0	5,0
Pensioners (>59 yrs) and disabled persons	1,0	1,0	1,5	1,5
Workers (healthy persons aged 16-59) with high wage earning potential	2,0	0,5	2,0	0,5
Workers with low wage earning potential	1,0	3,0	2,0	3,0
Observed wage workers	2,0	2,5	2,0	2,0
Arable land allotment (ha)	0,954	0,882	0,809	0,770

Notes: 1. Household members rounded to nearest 0,5.

Table 3. Base (adjusted for mixed cropping) and predicted production in the districts of KwaZulu modelled (1985=100).

Land use	Base production (adjusted) Base (ha)	Predicted (ha)	Base (t)	Predicted (t)
Cereals (traditional)	154 250	131 704	119 851	93 542
Legumes (traditional)	44 578	45 714	15 013	13 113
Roots (traditional)	15 558	24 886	79 202	124 431
Sugar-cane	43 596	45 552	1 270 167	1 321 011
Other	10 463			
Fallow	unknown	59 110		
Area cultivated	unknown	306 966		

Notes: 1. The percentage absolute deviation (PAD) for all crop areas is 13,6.
2. The PAD for all crop yields is 8,4 per cent.
Source: Lyne and Ortmann, 1989a, pp. 23-24.

Table 4 Annual income estimates predicted by the model (1985=100).[1]

Particulars	Household (R)[2]	
Net wage remittances and welfare payments	2 423	
Crop sales	201	
Cash income		2 624
Value of crops consumed	177	
Market input costs	(218)	
<u>Disposable income</u>		2 584
Essential food purchases[1] and maize milling costs	(634)	
Disposable income net of essentail food costs	1 773	

Note: 1. For rural residents excluding all wage commuters.
2. The exchange rate of the South African rand (R) was approximately £0,34 in 1985 and £0,23 in June 1989.

Table 5. Solution levels for key activities in the regional model (1985=100).

Particulars	Unit	Base solution	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
1 Household disposable income : mean	R/annum	2 594	2 757	2 745	2 630	2 488	2 526
: range	R/annum	2 312 - 2 797	2 452 - 2 865	2 312 - 3 069	2 353 - 2 859	2 127 - 2 797	2 162 - 2 859
L = E - θe : mean	R/annum	1 575	1 561	1 606	1 587	1 427	1 439
: range	R/annum	1 295 - 1 887	1 283 - 1 877	1 295 - 1 948	1 299 - 1 906	1 021 - 1 887	1 026 - 1 906
Wage workers		768 655	768 655	768 655	768 655	674 842	674 842
Net wage remittances	$R10^6$	499,2	499,2	499,2	499,2	461,9	461,9
2 Food imports into rural areas	$R10^6$						
- Cereals		111,8	23,9	120,4	99,5	118,6	109,4
- Legumes		100,7	117,4	100,7	100,7	104,7	104,7
- Roots		7,6	7,6	7,6	7,6	8,1	8,1
Total		220,1	148,9	228,7	207,8	231,4	222,2
3 Area under crops	Ha						
- Cereals: traditional		131 704	129 326	77 679	173 757	138 366	172 444
: potential		0	80 139	10 062	0	0	0
- Legumes: traditional		45 714	27 413	45 714	51 481	47 461	52 714
- Roots: traditional		24 886	0	0	28 075	26 351	28 316
potential		0	6 659	11 909	0	0	0
- Sugar-cane		45 552	63 431	128 000	53 654	48 459	53 453
Fallow land		59 110	0	33 602	0	46 330	0
4 Sales out of rural areas	$R10^6$						
- Legumes		0,0	0,0	0,0	7,5	0,0	6,0
- Roots		19,4	11,8	25,5	22,6	20,5	22,6
- Sugar-cane		49,4	68,8	152,7	58,2	52,5	58,0
Total		68,8	80,6	178,2	88,3	73,0	87,3
5 Sales between rural households	$R10^6$						
- Roots		3,1	3,1	3,1	3,1	3,2	3,2
6 Value of farm crops consumed (at local retail prices)	$R10^6$						
- Cereals		28,3	100,3	22,9	36,0	29,9	35,6
- Legumes		32,4	16,3	32,4	32,4	33,7	33,7
- Roots		5,6	5,6	5,6	5,6	6,0	6,0
Total		66,3	122,2	60,9	74,0	69,6	75,3
7 Total crop production costs	$R10^6$	77,7	111,9	124,3	88,3	82,2	88,4
8 Net value of crop production (4+6-7)	$R10^6$	57,4	90,9	114,8	74,0	60,4	74,2

Notes: 1. Number of households = 357 100.
2. Utility (U) is positively related to L.
3. Total area cultivated = 306 567 hectares.
4. High income wage workers = 432 764 in all scenarios.
5. Scenario 1 = Cereal price increased by 10 per cent.
6. Scenario 2 = Sugar-cane price increased by 10 per cent.
7. Scenario 3 = Input subsidies, equal to a 5 per cent reduction in market production costs.
8. Scenario 4 = Increased unemployment, equal to a 12 per cent decrease in wage workers.
9. Scenario 5 = Input subsidies (scenario 3) and increased unemployment (scenario 4).

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