DO HIGH FOOD MARKETING COSTS CONSTRAIN CASH CROP PRODUCTION? EVIDENCE FROM ZIMBABWE

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Do High Food Marketing Costs Constrain Cash Crop Production? Evidence from Zimbabwe*

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I. Introduction

A growing body of evidence throughout sub-Saharan Africa argues for the pursuit of a food security strategy based on diversification of smallholder agriculture into high-valued cash crops.[1] The empirical record suggests that in many semiarid areas cash crops such as cotton, sunflower, and groundnut provide higher returns to land and labor than food grains and thus present major opportunities to promote smallholder income growth, food security, and national foreign exchange generation. Empirical findings have also shown that, to the extent that food and cash crops require labor or draft inputs at different periods, crop diversification may generate a significantly higher value of output for a given bundle of inputs.[2]

In spite of these findings, smallholders in most semiarid areas of Africa continue to devote up to 90% of their cropped land to food grains. This is especially ironic in the semiarid areas, considering the drought tolerance of oilseeds compared with maize and sorghum. While several constraints to the expansion of cash cropping are well-known—poor seed delivery systems, lumpy investment requirements, and risks associated with acquiring food from unreliable markets where prices and availability fluctuate considerably[3]—the expected profitability of these crops relative to grain crops normally has not been questioned.

This article suggests that cash crop production may be economically unviable—despite providing higher returns to land and labor than grain crops—in an environment of high food-marketing costs to rural areas. A simple conceptual model is presented to show that the seemingly higher financial returns to cash crops over grain production are based on the implicit assumption that farmers are self-sufficient in grain. Evidence suggests, however, that most farm households in the

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semiarid areas of sub-Saharan Africa are net grain purchasers despite devoting the bulk of their resources to grain production. For these households, the opportunity cost of cash crop production is not the net returns to growing and selling food grains but, rather, the cost of acquiring the grain forgone by cultivating cash crops, which is related to acquisition costs of grain rather than selling prices. Typical assessments of crop profitability (e.g., returns to land and labor) may be based on the wrong prices, and thus provide misleading information to national extension services and policymakers about desired crop composition to raise farm incomes and national agricultural growth. Large wedges often observed between rural producer and consumer grain prices may make cash crop production unprofitable until enough grain is planted for household consumption requirements.[4]

These theoretical implications are supported by econometric evidence from Zimbabwe indicating that cultivation of various oilseed crops for the market, which often provide substantially higher rates of return than grain under semiarid smallholder conditions, is closely associated with the degree of grain self-sufficiency of the household. Controlling for differences in household assets and location, grain-surplus households in five semiarid regions of Zimbabwe were found to cultivate 48% more oilseed crops for the market than their grain-deficit neighbors. The results indicate that in situations where productivity gains through new technology are not on the immediate horizon policy efforts to raise rural incomes through crop diversification are critically dependent on the development of food markets that reduce the consumer price of staple grain in rural areas. Moreover, the micro-level effects of artificially high food-marketing costs on cropping patterns and household incomes may have important macro-level reverberations by skewing cropping patterns away from those of comparative advantage and agricultural growth. Finally, the results suggest that the direction of causality between cash crop production and household income may run both ways: households that engage in substantial cash cropping may have higher incomes, yet in an environment of high food-marketing costs, the ability to engage in cash cropping appears dependent on adequate household productive assets over and above those needed for subsistence grain production needs.

II. Conceptual Framework

Typically, when commodities such as food are bought and sold by smallholders, the farm gate price is some fraction of the purchase price. The width of the wedge between these prices is a function of transportation, storage and processing technology, infrastructure, policy-related factors, and institutions that coordinate exchange across space, time, and form.

The evidence is now overwhelming that throughout much of semi-arid sub-Saharan Africa, a large proportion of rural farm households cannot or do not produce enough grain to feed themselves and are purchasers of grain.[5] Therefore, returns to crop production for sale may not accurately represent the relative profitability of alternative crops. For grain-deficit households, the decision to grow a hectare of cash crops must be at the expense of a hectare of food grain for home consumption. In this case, the decision facing the smallholder is whether to (1) grow oilseed or other crops for cash to buy back grain for home use or (2) grow grain until expected food self-sufficiency is reached before diversifying into cash crops.

The relevant grain price in strategy 1 is the cost of acquiring staple grain, not the farm gate price. Strategy 1 is a food security strategy based on the argument that income from cash crop cultivation can buy back more grain than could have been produced if those same resources were devoted to food crop production. Strategy 2 appears on the surface to be a risk-averse food self-sufficiency strategy but would also generate a higher expected return on available household resources if the income generated from cash crop cultivation were insufficient to buy back the grain that could have been produced with those resources for home consumption. Abstracting from nonmarket purposes for growing cash crops,[6] the decision rule for choice of crop on each additional hectare put under cultivation is: grow cash crops if

$$Y_i > D[PP_{gr}Q_{gr} - C_{gr}] + (1 - D)[Q_{gr}sxPC_{gr} - C_{gr}], \qquad (1)$$

where

Y_i = expected gross margin of cash crop i (Z$/hectare);
D = one if, given the outcome of the decision rule of the previous marginal hectare, the household expects to be food self-sufficient;[7] and zero if, given the outcome of the decision rule of the previous marginal hectare, the household expects to be food deficient;
PP_{gr} = grain producer price (Z$/kilogram);
Q_{gr} = expected grain production per hectare (kilograms/hectare);
C_{gr} = variable costs of grain production (Z$/hectare);
s = proportion of grain production that is consumable over 1 year, accounting for storage losses (percent of kilograms produced);
x = extraction rate from grain to meal (percent); and
PC_{gr} = acquisition price of grain meal in rural area (Z$/kilogram).

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If, given the allocation decisions on the previous land units, the household expects to have a grain surplus ($D = 1$), the decision rule reduces to a simple comparison of gross margins from grain and cash crop i. If, however, the household expects to be grain deficient, cultivation of cash crop i means that 1 hectare of grain for home consumption is forgone. The second bracketed term, $[Q_{gr}sxPC_{gr} - C_{gr}]$, accounts for the net cost of purchasing the amount of grain meal that could have been produced on that hectare, accounting for storage losses, grain-to-meal milling losses, milling costs, and production costs incurred if the household produced and processed the grain itself.

This model suggests that, ceteris paribus, the viability of producing cash crops by net grain-purchasing households is negatively related to the acquisition price of grain meal, not to the producer price of grain. The greater the wedge between these producer and consumer prices, the greater is the divergence in the value of grain by grain-surplus and grain-deficit households. The higher the acquisition cost of staple food relative to producer prices for cash crops, the lower the incentive is for grain-deficit households to diversify, ceteris paribus.

In many sub-Saharan African countries, marketing margins between producer and consumer food prices are large compared with those in other developing areas.[8] The organization of official grain-marketing systems in many East and Southern African countries features a predominantly one-way flow of grain from rural to urban areas and is characterized by centralized urban milling and storage facilities.[9] This structure implicitly assumes rural self-sufficiency in grain. Moreover, national food policies often restrict private movement of grain directly from surplus to deficit rural areas and thus inflate marketing costs and consumer prices in the latter areas. In some countries such as Zimbabwe, a circuitous flow of grain has evolved in which marketed grain surpluses flow out of rural areas through the official marketing channel to be milled in urban areas and are then returned to rural areas in the form of commercial maize meal.[10] Because of redundant transportation costs and relatively high milling margins of centralized urban millers, the price of commercial maize meal is typically 10%–50% higher than the cost of maize procured and milled through local private channels.[11]

How does the large wedge between producer and consumer maize prices affect smallholder incentives to produce groundnuts and sunflower, the major nonfood cash crops in semiarid Zimbabwe? By restating inequality (1), the net revenue remaining to the household (Z_i) from planting oilseed crop i rather than grain is

$$Z_i = Y_i - D[PP_{gr}Q_{gr} - C_{gr}] - (1 - D)[Q_{gr}sxPC_{gr} - C_{gr}]. \qquad (2)$$

In order to assess whether the wedge between producer and consumer maize prices is large enough to alter the sign of Z_i for grain-surplus and grain-deficit households, equation (2) is calculated using survey data on crop production costs and returns in five semiarid smallholder areas collected by the Zimbabwean Ministry of Lands, Agriculture, and Rural Resettlement (MLARR).[12]

Results are presented in table 1. For households that have a grain surplus ($D = 1$), sunflowers provided higher gross margins than maize in all five areas, while groundnuts gave higher gross margins in four of five areas. These results are consistent with those of the World Bank, which also indicate that sunflower and groundnut provide con-

TABLE 1

NET REVENUE AFTER PLANTING 1 HECTARE OF OILSEED CROP AND USING THE REVENUE TO PURCHASE MAIZE MEAL FORGONE, CALCULATED FROM EQUATION (2)

SMALLHOLDER AREA AND CROP	NET REVENUE IN Z$ (Z_i in Eq. [2]) FOR HOUSEHOLDS THAT ARE		% REDUCTION IN CONSUMER PRICE OF MAIZE MEAL REQUIRED FOR OILSEED PRODUCTION/MAIZE MEAL PURCHASE STRATEGY TO BREAK EVEN
	Net Grain Sellers ($D = 1$)	Net Grain Buyers ($D = 0$)	
Buhera:			
Groundnut	133	−11	4
Sunflower	80	−64	19
Chiruma:			
Groundnut	−92	−351	59
Sunflower	26	−229	36
Mutoko:			
Groundnut	550	337	*
Sunflower	133	−80	14
Nyajena:			
Groundnut	221	138	*
Sunflower	79	−4	1
Zvishivane:			
Groundnut	19	−209	31
Sunflower	68	−160	21

SOURCES.—Calculated from eq. (2). Crop budget data were drawn from a sample of 276 households in semiarid smallholder areas selected by the Zimbabwean Ministry of Lands, Agriculture, and Rural Resettlement (*The First Annual Report of Farm Management Data for Communal Area Farm Units* [Harare: Economics and Markets Branch, 1990]). Maize milling cost and outturn data are drawn from T. S. Jayne and M. Chisvo, "Unravelling Zimbabwe's Food Insecurity Paradox: Implications for Food Security in Southern Africa," *Food Policy* 16 (August 1991): 319–29, and storage loss data from D. P. Giga and J. Biscoe, "Treating Maize Grain for Storage with Registered Protectants in Zimbabwe: Technical, Practical and Economic Considerations," *Zimbabwe Science News* 23 (October/December 1989): 101–3.

* No decrease in maize meal consumer price is necessary because the strategy of oilseed production/maize meal purchase is already profitable, according to the survey data.

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sistently higher returns to land, labor, and capital than the grain crops in the semiarid areas.[13] This type of analysis implicitly assumes self-sufficiency in grain, that is, that the opportunity cost of using farm resources for oilseed production is the returns from alternative crops for sale.

When the assumption of grain self-sufficiency is relaxed, oilseed production becomes distinctly less viable. In seven of the nine cases where oilseeds gave higher gross margins than maize, this result was reversed when the opportunity cost of land was conceived in terms of grain forgone for consumption (valued at the consumer price of grain meal, i.e., $D = 0$) rather than grain forgone for selling (valued at the producer price, i.e., $D = 1$). These contrasting results are due to the large difference between maize producer prices and consumer maize meal costs.[14]

How much lower must the consumer price of staple meal be to make oilseed production viable for grain-deficit smallholders? The answer to this question can be found by setting net revenue in equation (2) to zero and solving for the consumer grain price (PC_{gr}). These threshold consumer prices for grain meal are presented in the right-hand column of table 1. The results suggest that for food-deficit farmers grain meal prices would have to decline by about 5%–30% in most cases before sunflower or groundnut production would be a profitable substitute for food crops. The cost of marketing food to rural areas may thus affect the growth of cash crop production.

III. The Model

The foregoing suggests that, in the areas of Zimbabwe analyzed by MLARR, smallholders will have little incentive to produce oilseeds for the market until enough land and resources have been devoted to grain for self-sufficiency. Beyond this point, however, one may expect that extra productive resources would be used increasingly for cash crop production if these crops provide higher returns for sale. It does not follow that all remaining land and resources in excess of that required for grain self-sufficiency should be devoted to oilseeds in consideration of various nonmarket purposes of surplus grain production such as gifts, beer brewing for ceremonial functions, livestock feed, and insurance stocks. In addition, recent research from elsewhere in Africa indicates that there are important complementarities between grain and cash crop production. In Senegal, S. Goetz found that crop diversification allowed farmers more fully to utilize farm inputs, to the extent that food and cash crops require labor or draft inputs at different periods, thus generating a higher value of output for a given bundle of inputs.[15] In southern Mali, Josue Dione found that households producing cotton were more likely to have animal traction equipment, access

to credit, and technical inputs and, as a result, to produce more grain crops.[16]

The discussion leads to two specific empirical questions: (Q1), Is oilseed cultivation higher, ceteris paribus, among grain-surplus households than grain-deficit households? and (Q2), If there are complementarities between grain and oilseed production, is there any difference in the ability to exploit them between grain-deficit and grain-surplus households? Note that these questions do not stem from behavioral assumptions about smallholders' responses to market and production risks, although these factors are undoubtedly important in many areas.[17] While it is often noted that smallholders appear to strive for grain self-sufficiency along with any new ventures into cash cropping, it is unlikely that risks associated with the availability or price of staple grain are important causes of this behavior in Zimbabwe. Unlike many developing areas, Zimbabwe's Grain Marketing Board throughout its history has defended its producer and selling prices with little exception. Staple maize meal is also consistently available throughout the year at fixed prices (or slightly above), even in the most remote areas. Moreover, the Grain Marketing Board, which buys the bulk of smallholder grain and sunflower seed sold nationally, offers fixed prices with no variation within years and very little variation in real prices between years. Rather, Q1 and Q2 are based on the theoretical implications from Section II that oilseed cultivation for sale may provide lower expected net revenue than food crops for grain-deficit households—despite providing higher returns to land and labor than grain—depending on the level of food marketing costs and consumer prices in rural areas.

Using cross-sectional survey data from Zimbabwe, Q1 and Q2 are examined econometrically. It is widely considered that, due to yield variations, area planted is a more accurate reflection of resource allocation than ex post production outcomes, hence the use of oilseed area as the dependent variable.[18] Area planted to oilseeds was regressed on predetermined variables entering a standard production function such as number of draft animals, labor input, and capital equipment, as well as the expected degree of household grain self-sufficiency. Since decisions affecting grain self-sufficiency are made simultaneously with area planted to oilseeds, estimated values from two auxiliary equations are used in the estimation of oilseed area. With the symbol * denoting an estimated value, the set of equations is

$$y_1 = f_1(x) + e_1, \tag{3a}$$

$$\mathrm{SSL}^* = y_1^* + \mathrm{ST} - \mathrm{REQ}, \text{ and} \tag{3b}$$

$$y_2 = f_2(x, \mathrm{SSL}^*) + e_2, \tag{3c}$$

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where

y_1^* = predicted value of grain production used to estimate the level of grain self-sufficiency (SSL*);
x = vector of predetermined household asset variables described below;
ST = household grain stocks at the beginning of the harvest period;
REQ = grain consumption requirements (based on the number of resident adults and children); and
y_2 = area planted to oilseed crops with the intention of sale.[19]

Both grain stocks and consumption requirements are considered known with reasonble accuracy at planting time. Prices of oilseeds and grain crops were excluded because the Grain Marketing Board's policy of pan-territorial and pan-seasonal pricing creates a lack of observed price variation among households.

We may empirically test Q1 and Q2 in equation (3c) by allowing the slope and intercept linking cash crop area to the degree of household grain self-sufficiency to change at the point at which self-sufficiency is reached. The specification of (3c) used here is

$$y_2 = a_0 + a_1(L) + a_2(\text{DRAFT}) + a_3(\text{EQUIP}) + \sum_{j=1}^{4} b_j(\text{LOC}_j) + a_4(\text{SSL*}) + a_5(D) + a_6(\text{SSL*})D, \tag{4}$$

where

L = household labor expressed in adult equivalents;
DRAFT = number of draft animals;
EQUIP = value of animal traction equipment owned;
LOC_j = area-specific dummy variables to account for variations in rainfall and infrastructure conditions between households in different regions; and
D = dummy variable that takes on a value of one for households in which SSL* > 0, and zero otherwise.

Under the assumption that oilseed cultivation is not influenced by the achievement or the degree of grain self-sufficiency, a_5 and a_6 equal zero, and equation (4) reduces to

$$y_2 = a_0 + a_1(L) + a_2(\text{DRAFT}) + a_3(\text{EQUIP}) + a_4(\text{SSL*}) + \sum_{j=1}^{4} b_j(\text{LOC}_j). \tag{5}$$

Using regression results from equations (4) and (5), Q1 may be empirically examined using an F-test of the joint hypothesis that $a_5 = a_6 = 0$ and Q2 may be examined by comparing the magnitude and significance of a_4 and a_6.

IV. Data and Characteristics of the Sample

The cross-sectional household data were drawn from field surveys of 495 families selected randomly from 20 wards in five smallholder areas between April 1990 and March 1991. Average annual rainfall within each region ranges from 400 to 700 millimeters. Rainfall during the production period was slightly below average.

To facilitate visual comparison, the total sample of households was stratified into quintiles according to their net grain sales during the year.[20] Characteristics of the sample are summarized in table 2. Across all quintiles, grain and oilseeds constitute 76% and 19%, respectively, of total cropped area. The proportion of farmers growing oilseeds with the intention of selling varied from 33% among households in the bottom grain sale quintile to 63% among the top quintile. The most common response among households in the grain-deficit quintiles as to why they did not grow more grain to feed themselves was lack of sufficient land and draft power. This is in spite of the fact that an average of 79% of their cropped land was already devoted to grain.[21] On the other hand, smallholders in the grain-surplus quintiles increasingly mentioned the profitability of other crops as the main reason why they did not plant more grain.

The distribution of land, value of equipment, and number of draft animals among households varied widely among households in different quintiles. Other researchers have also noted a very skewed distribution of land, draft animals, and other productive resources among smallholders households.[22] This skewed distribution of resources is consistent with findings that 10% of the households typically account for over 50% of the grain crop income generated in these areas. The grain-surplus quintiles also had, on average, substantially higher per capita incomes from farm and nonfarm sources.

V. Results

Coefficient estimates for equations (4) and (5) are presented in table 3. All household asset variables had the expected sign and were significant at the 5% level or lower, with the exception of household labor. The hypothesis that oilseed cultivation did not differ between grain-surplus and grain-deficit households, that is, that $a_5 = a_6 = 0$ in equation (4), was rejected at the .05 level of significance. Controlling for differences in household assets and location, grain-surplus households were estimated to cultivate, on average, 0.70 hectares of oilseed crops for the market compared with 0.47 hectares by their grain-deficit neighbors. In the driest and most grain-deficit location, oilseed area

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TABLE 2

CHARACTERISTICS OF FARM HOUSEHOLDS IN STUDY SAMPLE, DISAGGREGATED BY NET GRAIN SALES QUINTILES

	NET GRAIN SALES QUINTILES (Kg/Household)					TOTAL SAMPLE
	−2,503–−378	−377–−95	−94–278	279–1,289	1,290–13,286	
Number of households	97	100	99	100	99	495
Family labor (adult equivalents)	8.34	6.45	6.12	6.92	7.90	7.16
Draft animals	4.87	5.46	4.66	6.34	11.11	6.57
Value of draft equipment (Z$)	981	911	1,035	1,347	1,597	1,177
Fertilizer applied to grain crops (kg/ha)	6.31	3.94	12.12	6.07	23.93	11.93
% households growing oilseeds with intention of selling	33	44	50	49	63	48
Oilseed area (ha)	.30	.40	.56	.61	.95	.55
Grain area (ha)	1.77	1.94	1.85	2.03	3.07	2.13
Total area planted (ha)	2.28	2.44	2.46	2.77	4.14	2.82
Total area possessed (ha)	2.64	2.67	3.28	3.02	4.80	3.31
Average grain yield (kg/ha)	460	520	796	1,251	1,960	990
Main constraint to increasing area cultivated to grain (% of households identifying the following):						
Not enough land	37.4	24.3	16.8	22.7	14.3	23.1
Draft power shortage	27.0	29.5	25.7	16.8	12.5	22.3
Labor shortage	6.2	11.4	14.8	10.9	12.5	10.2
Other crops more profitable	4.2	5.4	14.4	17.2	24.2	12.5
Total income per resident	176	164	230	303	317	237

SOURCE.—University of Zimbabwe/Michican State University/ICRISAT Grain Marketing Surveys data base, 1990–91 (Department of Agricultural Economics and Extension, University of Zimbabwe).

NOTE.—*Net grain sales* is defined as the quantity of grain sold via barter and cash minus the quantity of grain purchased via barter and cash.

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TABLE 3

COEFFICIENT ESTIMATES FOR FACTORS AFFECTING HECTARES PLANTED TO OILSEED CROPS

INDEPENDENT VARIABLES	COEFFICIENTS (t-statistics) FOR EQUATION (3)	(4)
Constant	−.089	.007
	(−.420)	(.042)
Adult equivalent labor (L)	−.076	−.071
	(−1.64)	(−1.54)
Draft animals (DRAFT)	.052*	.057*
	(2.48)	(2.72)
Value of draft equipment (EQUIP)	3.80×10^{-4}**	3.66×10^{-4}**
	(3.72)	(3.58)
Location 1 dummy (LOC_1)	.186	.150
	(1.31)	(1.06)
Location 2 dummy (LOC_2)	.462	.421
	(1.69)	(1.53)
Location 3 dummy (LOC_3)	1.24*	1.32*
	(2.17)	(2.34)
Location 4 dummy (LOC_4)	1.49**	1.45**
	(5.62)	(5.45)
Expected self-sufficiency level (SSL*)[a]	-1.28×10^{-4}	1.34×10^{-4}
	(−.59)	(1.08)
Expected self-sufficiency dummy (D)	.012	. . .
	(.115)	
Interaction term (SSL* · D)	2.09×10^{-4}*	. . .
	(2.27)	
Adjusted R^2	.258	.249
Sum of squared errors	241.02	244.80
Degrees of freedom	483	485

[a] Predicted values of the variable. The instruments in eq. (3a) include all of the household asset and location variables shown here. The adjusted R^2 and F-value of this regression were .27 and 23.05, respectively.

* Significant at the 5% level or lower.

** Significant at the 1% level or lower.

was estimated at 0.04 hectares and 0.27 hectares for grain-deficit and grain-surplus households, respectively. The sign of a_4 indicates no complementarities between grain and oilseed production among grain-deficit households. However, once the point of self-sufficiency is reached, household oilseed cultivation is estimated to increase by 0.21 hectares for every additional ton of grain produced.

Note that these empirical results pertain to a market environment in which staple grain meal is consistently available throughout the year at stable prices. Price-monitoring surveys conducted biweekly in a broad range of rural areas in Zimbabwe indicate that the controlled selling prices of commercial maize meal, set by the government, are normally respected and appear to be exceeded by at most 10% even in the most remote rural areas.[23] Moreover, historical reviews of grain marketing policy since 1980 indicate that commercial maize meal was

in short supply in rural areas only once (1983) due to government pricing policy in which subsidies on commercial maize meal (removed entirely since 1986) were so large that the milling capacity of urban processors was temporarily exceeded. While smallholders' observed self-sufficiency behavior is commonly attributed to market risks associated with fluctuations in food price and availability, and is undoubtedly important in many developing areas, this explanation does not appear compelling in other areas such as Zimbabwe.

VI. Conclusions and Policy Implications

Assessments of relative profitability between food and cash crops typically are made with reference to producer prices of alternative crops and thus implicitly assume that farmers are food self-sufficient. Such calculations do not accurately reflect the most economical use of farm resources in food-deficient areas, since these calculations underestimate the true opportunity cost of devoting scarce productive resources to nonfood crops. This methodological critique also applies to indicators of comparative advantage, which carry normative judgments about cropping patterns. For countries where a significant portion of the rural farming population is net food deficient, the determination of comparative advantage on the basis of relative output prices disregards important opportunity costs of cash crop production. Such analyses may provide misleading information to national extension services and policymakers about desired crop mix to raise smallholder incomes and food security.

Smallholders' overriding concern with food self-sufficiency, commonly explained in terms of risk aversion, may also be explained on the basis of expected net returns in an environment of high food-marketing margins and acquisition costs in rural areas. Despite providing higher returns for sale, the strategy of producing and selling oilseeds and purchasing food appeared to be unprofitable relative to food production for grain-deficit households in most areas analyzed in Zimbabwe. Econometric results from five survey areas also indicate that, in general, grain-deficit households are purchasers not because they are growing higher-valued crops with which to buy food but because they do not have the productive resources to grow enough staple food to feed themselves.

While mounting evidence from a wide range of developing areas indicates that smallholders who engage in substantial cash cropping have higher incomes than those who do not, the direction of causality has not been examined adequately.[24] The correlation between cash cropping and household income, while often interpreted as evidence to promote cash cropping, would also result from a situation in which diversification is undertaken generally by households that possessed sufficient purchased inputs and farm assets to assure food self-

sufficiency and used residual resources to expand into cash cropping. It is not surprising that numerous studies throughout Africa have found that household food production, cash crop production, and per capita incomes are all highly correlated.[25]

In the long run, improved food crop productivity will enhance cash cropping incentives for grain-surplus and grain-deficit households, to the extent that they could satisfy expected self-sufficiency requirements with a smaller fraction of their productive resources. However, given the dearth of new on-shelf technology appropriate for semiarid smallholder conditions, this appears to provide only long-run potential.

In the medium run, more efficient rural food markets, to the extent that they reduce the opportunity cost of cash crop production, may be an important precondition for stimulating dynamic changes in crop mix more consistent with national agricultural growth and foreign exchange generation. The analysis indicates that consumer prices for staple food must fall by 5%–30% to stimulate cash cropping incentives in most grain-deficit areas of Zimbabwe, ceteris paribus. This is noteworthy because previous research in Zimbabwe has estimated that the current controls on grain movement, which restrict grain from moving directly from surplus to deficit areas, inflate consumer grain prices by as much as 50%.[26] Removal of such restrictions and active support for the development of intrarural trade could contribute simultaneously to governments' food security and agricultural growth objectives, both by reducing the cost of food purchased and by raising the value of farm output sold. Such policies apparently are neglected because of the conventional perception that farm households are predominantly food self-sufficient. This misconception underscores the negative effects of unidirectional single-channel state marketing systems commonly found in East and Southern Africa, which are primarily geared to extract grain out of rural areas and into urban milling, storage, and consumption centers.

Several caveats to this analysis are highlighted to suggest extensions for future research. First, the analysis examines the effect of a household's grain deficiency on its incentives to grow oilseeds for sale. The analysis does not examine a household's incentives to grow oilseeds for its own consumption, gifts, or other nonmarket purposes. Second, the analysis does not examine the effect of production risk on the relative incentives to grow oilseeds, which may be especially relevant in semiarid areas prone to frequent drought. In such cases, the yield stability of grains versus oilseeds becomes important. The risk of drought may induce households to put more of their land in grain to assure adequate supplies even under poor yield conditions. Third, the analysis has not addressed potential economies of scope in input use, which might provide incentives for crop diversification

regardless of farmers' position in the grain market. Finally, the analysis does not examine how off-farm employment opportunities affect grain and cash crop production. The introduction of a competing source of labor income may alter somewhat the trade-offs between grain and oilseed production. However, the wedge between producer and consumer food prices creates the same dual calculation for off-farm employment as for cash crops; that is, returns to labor may be higher in off-farm employment than in production of food valued at the selling price, but not necessarily at the purchase price. Further analysis of the relationship between rural food markets and cash crop production in other countries would help gauge the robustness of these results.

Notes

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1. See, e.g., Joachim von Braun, Eileen Kennedy, and Howarth Bouis, "Commercialization of Smallholder Agriculture: Policy Requirements for the Malnourished Poor," *Food Policy* 15 (February 1990): 82–85; Eileen Kennedy, "The Effects of Sugarcane Production on Food Security, Health, and Nutrition in Kenya: A Longitudinal Analysis," Research Report 78 (International Food Policy Research Institute Washington, D.C., 1989); and David Sahn, "The Impact of Export Crop Production on Nutritional Status in Côte d'Ivoire," *World Development* 18 (December 1990): 1635–53.

2. Stephan Goetz, "Interlinked Markets and the Cash Crop–Food Crop Debate in Land-Abundant Tropical Agriculture," *Economic Development and Cultural Change* 41 (January 1993): 343–61; Josue Dione, "Informing Food Security Policy in Mali: Interactions between Technology, Institutions and Market Reform" (Ph.D. diss., Michigan State University, 1989).

3. See, e.g., J. Shaffer, M. Weber, H. Riley, and J. Staatz, "Designing Marketing Systems to Promote Development in Third World Countries," in *Agricultural Markets in the Semi-Arid Tropics: Proceedings of the International Workshop, 24–28 October 1983*, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), 1985 (Pantacheru, India: ICRISAT Center, 1985), pp. 305–18; H. P. Binswanger and John McIntire, "Behavioral and Material Determinants of Production Relations in Land-abundant Tropical Agriculture," *Economic Development and Cultural Change* 36, no. 1 (October 1987): 73–99; M. Fafchamps, "Cash Crop Production, Food Price Volatility, and Rural Market Integration in the Third World," *American Journal of Agricultural Economics* 74, no. 1 (February 1992): 90–99.

4. This hypothesis differs fundamentally from those that assert that food price volatility and share of food in total consumption rather than expected returns are what induce risk-averse farmers to strive for food self-sufficiency. See Fafchamps. Yet if food crops provide higher net returns than cash crops, then one need not appeal to risk-related factors in favor of food crop production to explain why households grow primarily food. The Fafchamps results are also dependent on the assumption that all farmers are food self-sufficient. When this assumption is relaxed, the Fafchamps model indicates, counterfac-

tually, that small farmers devote a larger share of their land to cash crops than do large farmers.

5. See surveys across regions and countries by Michael Weber, John Staatz, John Holtzman, Eric Crawford, and Richard Bernsten, "Informing Food Security Decisions in Africa: Empirical Analysis and Policy Dialogue," *American Journal of Agricultural Economics* 70 (December 1988): 1044–52; and Per Pinstrup-Andersen, "Government Policy, Food Security and Nutrition in Sub-Saharan Africa" (PEW/Cornell Lecture Series on Food and Nutrition Policy, Cornell University, Ithaca, N.Y., 1989).

6. For example, for one's own consumption, gifts, or ceremonial functions.

7. The level of food self-sufficiency must be an ex ante evaluation because the relationship between land, labor, and capital inputs and actual production is uncertain due to stochastic yields.

8. R. Ahmed and N. Rustagi, "Marketing and Price Incentives in African and Asian Countries: A Comparison," in *Agricultural Marketing Strategies and Pricing Policy*, ed. Dieter Elz (Washington, D.C.: World Bank, 1987).

9. For further evidence of the extractive aspects of official marketing systems in Tanzania, Malawi, Zimbabwe, and Zambia, see H. K. R. Amani and W. E. Maro, "Household Food Security in Tanzania: Preliminary Findings from Four Regions," in *Market Reforms, Research Policies and SADCC Food Security*, ed. M. Rukuni and J. B. Wyckoff, University of Zimbabwe/Michican State University Food Security Research in Southern Africa Project (Harare: University of Zimbabwe, Department of Agricultural Economics, 1990); B. Kaluwa and W. Chilowa, "Malawi: Food Marketing Liberalization and Household Food Security," in Rukuni and Wyckoff, eds.; T. S. Jayne and M. Chisvo, "Unravelling Zimbabwe's Food Insecurity Paradox: Implications for Food Security in Southern Africa," *Food Policy* 16 (August 1991): 319–29; and Republic of Zambia, *Evaluation of the Performance of Zambia's Maize Subsector*, Zambia Agricultural Training, Planning, and Institutional Development Project II (Lusaka: USAID/Zambia, 1990).

10. Jayne and Chisvo.

11. Despite this large difference between official and informal prices, the state Grain Marketing Board is still the dominant buyer in most areas of the country, and commercial maize meal constitutes the most important form of grain purchases in many of the semiarid rural areas. The dearth of private trade that might otherwise buy and sell within these official price margins is largely due to tight controls on private grain movement and resale, which cause shortages of grain before the next harvest in the deficient rural areas. These regulations entrench many rural areas' dependence on high-cost industrial maize meal transported from urban centers.

12. Government of Zimbabwe/Ministry of Lands, Agriculture, and Rural Resettlement, *The First Annual Report of Farm Management Data for Communal Area Farm Units* (Harare: Economics and Markets Branch, 1990). Milling costs (Z$0.052 per kilogram) and grain-to-meal conversion rates facing the household (0.97) are drawn from Jayne and Chisvo. Storage loss factors under smallholder conditions are drawn from D. P. Giga and J. Biscoe, "Treating Maize Grain for Storage with Registered Protectants in Zimbabwe: Technical, Practical and Economic Considerations," *Zimbabwe Science News* 23 (October/December 1989): 101–3.

13. World Bank, *Zimbabwe Agricultural Sector Memorandum*, vol. 2, *Main Report* (Washington, D.C.: World Bank, Agricultural Operations Division, 1991).

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14. Although this discussion is based on gross margin analysis, the conclusions are essentially the same if eq. (2) is modified to measure returns to labor. The focus here is on returns to land because land is considered the binding resource constraint in most smallholder areas of Zimbabwe. This is supported by responses (presented in table 2) by grain-deficit households that insufficient land was the most important constraint on increased grain production.

15. Stephan Goetz, "Economies of Scope and the Cash Crop–Food Crop Debate in Senegal" (University of Kentucky, Department of Agricultural Economics, 1991, typescript).

16. Dione (n. 2 above).

17. See Fafchamps (n. 3 above).

18. H. Askari and J. Cummings, "Estimating Agricultural Supply Response with the Nerlove Model: A Survey," *International Economic Review* 18, no. 2 (1977): 257–92.

19. Adult grain consumption requirements in Zimbabwe were drawn from Southern African Development Coordinating Committee (SADCC), *Food Security Bulletin* (Harare: SADCC Regional Early Warning Unit for Food Security, 1991).

20. "Net grain sales" is defined as total monetary and barter sales minus total monetary and barter purchases.

21. Results of other household surveys in semiarid regions of Zimbabwe also indicate that most grain-deficit farmers are unable to expand grain production, not because they are devoting substantial land to other crops but because of resource constraints: limited land, draft animals, and nonfarm income to finance investments in improved technology, poor soil, and erratic rainfall; Jones Govereh, "Constraints to Increased Crop Productivity in Two Low Rainfall Areas of Zimbabwe" (M.Phil. thesis, University of Zimbabwe, 1992).

22. Jayne Stack and Charles Chopak, "Household Income Patterns in Zimbabwe's Communal Areas: Empirical Evidence from Five Survey Areas," in *Integrating Food and Nutrition Policy in Zimbabwe*, ed. T. S. Jayne, J. B. Wyckoff, and M. Rukuni, University of Zimbabwe/Michigan State University Food Security Project (University of Zimbabwe, Department of Agricultural Economics and Extension, Harare, 1990).

23. University of Zimbabwe/Michigan State University/ICRISAT Grain Marketing Surveys data base, 1990–91 (Department of Agricultural Economics and Extension, University of Zimbabwe).

24. For a summary of recent surveys in Kenya, the Gambia, Guatemala, the Philippines, and Rwanda, see von Braun, Kennedy, and Bouis (n. 1 above).

25. See, e.g., Dione (n. 2 above); Goetz, "Economies of Scope and the Cash Crop–Food Crop Debate in Senegal" (n. 15 above); J. Stanning, "Smallholder Maize Production and Sales in Zimbabwe," *Food Policy* 4 (August 1989): 260–67; and J. Jackson and P. Collier, "Incomes, Poverty and Food Security in the Communal Lands of Zimbabwe," Rural and Urban Planning Occasional Paper 11 (University of Zimbabwe, Department of Rural and Urban Planning, 1988).

26. Jayne and Chisvo (n. 9 above).