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EFFECT OF DEBT POSITION ON THE CHOICE OF MARKETING STRATEGIES FOR FLORIDA ORANGE GROWERS

by

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Abstract

This study reexamines previous research by Moss and van Blokland into the relationship between debt position and choice of marketing instruments. Specifically, this study uses an efficiency criteria to determine whether the optimal marketing instrument changes as the solvency position changes.

Keywords: debt position, marketing instrument, stochastic dominance.

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The linkage between debt position and choice of marketing strategy has recently received attention in agricultural economics literature. Moss and van Blokland examined the effect of debt choice on the choice of marketing strategy for orange producers. Turvey and Baker have presented a more complex model of debt choice and choice of marketing strategy for corn and soybean farmers.

These studies attempt to demonstrate how the choice of an optimal marketing strategy can vary with changes in the firm's solvency ratio. For example, net returns from marketing oranges using futures markets may be more highly correlated with interest rates than the net returns using cash markets. If hedging returns are positively correlated with interest rates, the returns to equity will be more variable under a futures strategy. Therefore, the choice of marketing strategy may depend not only on the producer's attitude toward risk and the variability of returns, but also on the producer's debt position. Thus, the debt position and the degree of correlation between the rate of returns under each marketing strategy with interest rates must both be considered in determining the appropriate marketing strategy. If the choice of marketing strategy is affected by the producer's debt position, then past attempts to recommend marketing strategies based solely on the distribution of revenue may have yielded poor results.

This study examines the effect of debt position on the choice of marketing strategy for Florida orange producers given different debt positions and stochastic interest rates. Specifically, this study uses stochastic dominance to determine which marketing strategies are efficient at different debt levels. If the same marketing instruments are dominant across debt levels, then debt has little effect on the choice of marketing strategy.

Theory

The theoretical basis for decision-making in a risky or uncertain world is the expected utility hypothesis. The expected utility hypothesis basically states that given complete and transitive preferences, economic agents choose the action that maximizes their expected economic well-being. This theoretical result is based on an axiomatic proof and has generally been accepted except for a few detractors who primarily object to the strict transitivity of preferences (Fishburn).

Direct application of the expected utility hypothesis (Moss and van Blokland and Kaylen, et al.), however, can be numerically complex and costly, and has only recently become practical from a computing standpoint. Further, the results are typically questioned because of the imposition of a particular functional form for utility. Mean-variance models tend to be mathematically more tractable, but also suffer the restrictive assumption of a particular utility function. However, recent work by Meyer indicates that a large number of utility functions may be consistant with the mean-variance technique.

Compared to direct utility maxmization or mean-variance models, stochastic dominance techniques require very mild assumptions about agent preferences. First degree stochastic dominance (FSD) requires only that agents prefer more to less. Second degree stochastic dominance (SSD) additionally requires that agents be risk averse. These assumptions allow the comparison of distributions of net returns over many sets of utility and preference characteristics. Unfortunately, because of the general nature of the analysis, often no single dominant strategy can be identified. Instead, a set of dominant strategies is identified as being dominant to inferior strategies[1].

The determination of a FSD efficient strategy results from a comparison of the cumulative probability distributions (CDF) of returns for different strategies. If two CDFs, F_1 and G_1, reflect the risky outcomes of strategies F and G, then F dominates G in

FSD if $F_1(R) \leq G_1(R)$ for all possible R in the range of the CDFs[2]. There must also be at least one strong inequality in the comparison for F to dominate G. The CDF of the dominant strategy, then, will lie to the right of the CDF of the other strategy.

A distribution dominates another in a SSD sense if its integral, evaluated at each R, is less than that of the other distribution. If F_2 and G_2 are the integrals of the CDFs, where

(1) $F_2(R) = \int_a^R F_1(x)dx$

and similarly for G_2 (x is an observed return, and $F_1(x)$ is the CDF), then F dominates G in SSD if $F_2(R) \leq G_2(R)$ for all R and there is at least one strong inequality. Courses of action can then be ranked for risk averse agents by simply comparing the distributions of returns from those actions.

The inclusion of stochastic interest rates is important to this analysis because, in theory, the futures price at any point in time is directly related to the carrying cost between the date of contract and the date of sale (Tomek and Robinson). One portion of this storage cost is the cost of capital. Specifically, if the expected price of Frozen Concentrated Orange Juice (FCOJ) in nine months is $1.25 per pound solid and the interest rate is 12 percent, then $.15 per pound solid of the basis can be attributed to the cost of capital. If the interest rate declines from 12 percent to 10 percent, the basis narrows by $.025 per pound solid or $375 per standard contract.

Methodology and Data

Three marketing strategies are analyzed for a representative farm. The farm is assumed to consist of 150 acres of mature orange grove valued at $8,750 per acre. Variable costs of production are assumed to be $748.10 per acre. The marketing strategies considered are the cash market, the cash market with a FCOJ futures market hedge, and a season average marketing pool with other citrus producers.

Annual net returns to the citrus grove are calculated for each marketing strategy for three marketing periods within each crop year, the data used to calculate these returns are from the 1970-71 to 1987-88 marketing years. The marketing periods evaluated within each crop year are December, February and April. Fruit marketed in each period changes due to variety. In addition, weather may affect the crop differently depending on its maturity. Thus, this analysis really looks at three representative farms, each marketing a different variety of orange in a different month. The returns for each of these representative farms under the alternative marketing instruments are then adjusted to 1988 dollars using the personel consumption expenditure component of the implicit gross national product deflator (PCE). The distributions for the three marketing instruments for each representative farm are then compared using stochastic dominance to determine if a dominant strategy exists.

The three marketing strategies are also compared at five different debt-to-asset ratios (0, .30, .40, .50, and .60) in order to evaluate the importance of interest correlation with marketing strategy. These debt levels are typical for orange groves in Florida as suggested by the Federal Land Bank regional office in Lakeland, Florida. A zero debt case is included to represent the no interest effect situation.

The cash market prices used are those of the last week of each marketing period. The futures contract is assumed to be for the month following the marketing month and is opened ten months earlier. For example, the January 1988 contract would be sold in March, 1987 and offset in December, 1987. The futures contract used is for 15,000 pound solids of FCOJ and the broker's fee is $75 per turn with a five percent margin requirement. The interest rate charged to the producer on the margin requirement is the real rate from the Federal Intermediate Credit Bank (U. S. Department of Commerce). The participation pool price used is a season average pool price based on pound solids of juice received throughout the marketing year.

The yield in boxes per acre for the grove is based on state averages (Florida Agricultural Statistics). The average early and mid-season yields are assumed to come from the December and February marketing periods, while Valencia orange yields are the basis for the April marketing period. Yields of juice in pound solids are calculated for the specified varieties based on the number of boxes and the squeeze percentage for each year (Florida Citrus Processors Association).

Net returns in each period, t, are calculated using

$$R_t^i = P_t^i Y_t - V - Dr_t$$

where R_t^i is the net returns to marketing strategy i (1988 dollars), P_t^i is the price realized from marketing strategy i (1988 dollars), Y_t is the yield for the farm, V is the variable cost of production for the entire farm (1988 dollars), D is the debt load in 1988 dollars, and r_t is the real interest rate (FICB interest rate deflated by the log change in PCE). Net returns to each marketing strategy are presented in Table 1 at the zero debt level. Note that there are no negative returns to the participation strategy.

First and second degree stochastic dominance analysis was performed on the set of three marketing strategies in each marketing period for each assumed debt level. The analysis used computer software developed by Raskin and Cochran.

Results

The correlation between returns and interest rates appears to be significant, especially for cash and futures marketing strategies (Table 2). The correlation also tends to be higher for the earlier marketing periods. This suggests that optimal marketing strategies may change as debt load increases. However, the stochastic dominance analysis does not support that hypothesis.

No ranking of marketing strategies was possible using FSD. This can be seen visually from the CDFs plotted in Figures 1-3. Consequently, it is necessary to assume risk

aversion among orange producers to determine dominate marketing strategies. The dominant marketing strategies, in the SSD sense, for each marketing period and for each debt position are presented in Table 3. There is no change in marketing strategy as debt is increased. Participation in the marketing pool dominates for December marketings, participation and cash market strategies are both efficient and dominate the hedging strategy in February, and the cash market dominates in April. These rankings hold for all debt levels.

The effects of interest rate movements, seem to be negligible when considering risk and the appropriate marketing instrument. This contradicts Moss and van Blokland who find some switching in the optimal marketing instrument between debt positions. Specifically, they find that hedging is the preferred strategy in the December marketing period for agents with risk aversion coefficeints smaller than 0.75 while participation is preferred for agents with risk aversion coefficeints greater than 0.75. Similarly, Moss and van Blokland show that the utility maximizing marketing instrument in the February marketing period is cash with the exception of a small band of risk aversion coefficeints between 2.50 and 0.50 for which participation is the preferred instrument.

Possible explanations for the deviations of the results of this study and those of Moss and van Blokland involve the choice of firm size, specific assumptions about risk preferences, and the exact distribution of returns. Moss and van Blokland allowed the firm to change the scale of the farm. The amount of equity was fixed at $200,000 and the firm was allowed to expand to achieve the optimal solvency ratio. As a result, the firm with a solvency ratio of .60 is much larger than a firm with a solvency ratio of .30. This compounds the effect of the randomness of the interest rate.

Second, Moss and van Blokland assume a power utility function. Assuming any utility function would allow the researcher to choose a single optimum. The results of this study indicate that both cash and participation strategies are SSD efficient in the February

marketing period. Implicit in this statement is the idea that choosing between these strategies would require additional information about producer preferences. The Moss and van Blokland construction develops this additional information through the explicit utility function. Stochastic dominance, however, applies no information beyond simple risk aversion.

Lastly, Moss and van Blokland assume a particular distribution of random variables. Specifically, they assume that the rate of return to equity is normally distributed. This assumption represents outside information. The technique used in the current study uses only sample revealed information about the distribution of returns.

Conclusions

The basic results of this study indicate that growers who market in December should use a participation strategy, those who market in April should sell on the cash market, and during the February marketing period both cash and participation are efficient marketing strategies. The results also indicate that the choice of marketing strategy is robust to the initial solvency position if the producer cannot instantaneously vary the scale of the firm.

The results of this study do not invalidate the argument that the choice of marketing instruments is affected by debt considerations for two reasons. First, as previously mentioned, the choice of debt position is intimately related to the choice of scale, and the choice of scale may have a compounding affect on risk. Second, orange production tends to be a relatively lucrative crop. Therefore, minor variability in the interest rate may not create the same cashflow difficulties as in a low margin crop such as corn or wheat. The results of this typeof analysis may show an increased affect of interest rate variability on marketing strategiesfor less profitable crops.

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1. While both the direct utility maximization and mean-variance models allow for a particular "optimal" action, the typical application of these techniques results in an efficient set of actions which depends on the producer's risk aversion coefficient. Thus, the loss in stochastic dominance may not be as damning.

2. This description of stochastic dominence follows Anderson et al..

Table 1. Calculated Real Net Returns to Each Marketing Strategy.

Marketing Year	Net Return to Assets Cash Marketing			Net Return to Assets Hedge Marketing			Net Return to Assets Participation		
	December	February	April	December	February	April	December	Ferbuary	April
	1988 Dollars								
1970-71	(42,028)	22,067	41,463	(37,844)	(1,310)	(6,118)	22,654	42,711	13,876
1971-72	51,314	84,157	74,521	15,485	91,258	87,330	36,891	70,035	76,402
1972-73	37,974	69,777	57,937	39,792	67,604	66,377	51,459	81,705	74,151
1973-74	49,137	78,482	39,809	22,325	62,612	55,131	32,732	66,540	40,270
1974-75	30,416	37,691	39,832	40,000	59,480	57,953	37,547	60,487	47,723
1975-76	66,121	105,367	96,197	57,536	98,192	105,889	38,055	65,317	43,377
1976-77	(9,981)	(18,793)	37,146	70,127	(34,311)	(17,506)	190,472	140,558	74,445
1977-78	184,283	232,461	202,225	85,615	102,062	126,322	206,872	226,929	214,080
1978-79	198,364	280,830	202,217	144,017	223,274	163,164	210,661	261,653	202,967
1979-80	210,971	243,206	170,896	205,985	274,912	200,972	204,550	248,902	176,012
1980-81	120,672	167,917	130,071	175,824	82,376	39,733	196,263	172,415	70,831
1981-82	119,355	120,379	64,296	155,233	163,091	110,899	90,020	76,223	18,863
1982-83	126,105	129,259	172,717	151,999	163,337	203,991	102,368	120,551	151,192
1983-84	79,886	160,641	105,636	25,571	59,788	(13,906)	212,582	205,300	133,871
1984-85	267,867	220,283	176,292	266,504	246,148	191,684	170,451	141,543	108,247
1985-86	113,328	132,432	105,461	192,117	239,728	170,836	115,436	122,853	89,345
1986-87	110,238	171,315	139,472	57,696	137,747	97,765	94,981	118,663	89,842
1987-88	203,892	313,329	353,415	150,586	254,629	288,469	184,669	257,499	203,091

Table 2. Correlation Between Gross Returns and Interest Rates.*

Month	Marketing Strategy		
	Cash	Hedge	Participation
December	.30672	.40927	.15524
	(.2157)	(.0917)	(.5385)
February	.17772	.36204	.02054
	(.4805)	(.1398)	(.9355)
April	.20566	.29113	.08529
	(.4130)	(.2412)	(.7365)

* Numbers in parentheses are the probabilities the correlation coefficiencts are equal to zero.

Table 3. Dominant Marketing Strategies at Each Solvency Position.

Debt/Asset Ratio	Participation	Cash	Hedging
December			
0	X		
30	X		
40	X		
50	X		
60	X		
February			
0	X	X	
30	X	X	
40	X	X	
50	X	X	
60	X	X	
April			
0		X	
30		X	
40		X	
50		X	
60		X	

Figure 1. Probability Density Function
for Marketing Strategies in December.

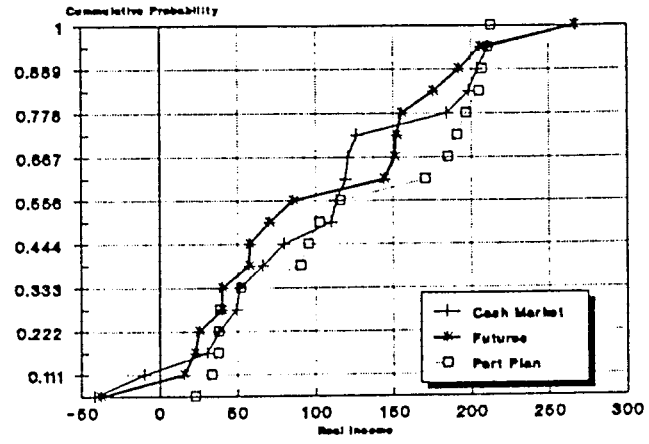

Figure 2. Probability Density Function
for Marketing Strategies in February.

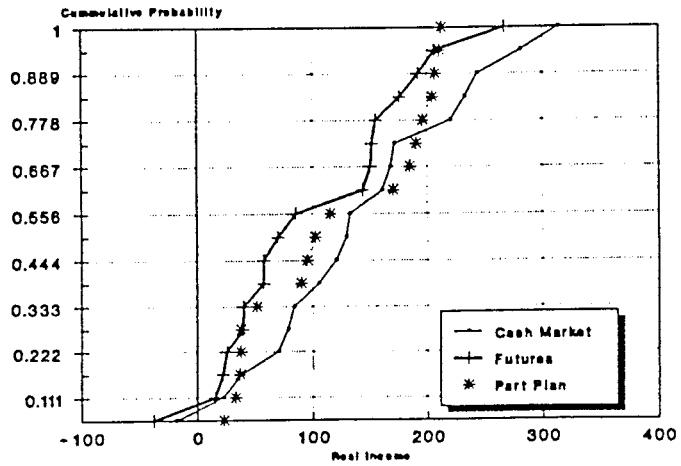

Figure 3. Probability Density Function
for Marketing Strategies in April.