# FORWARD CONTRACTING VERSUS HEDGING UNDER PRICE AND YIELD UNCERTAINTY

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## Abstract

Although apparently preferred by farmers to direct hedging as a forward pricing mechanism, forward contracting has received little attention in the literature dealing with optimal forward pricing levels. An often-cited reason for producer preference for forward contracting is the absence of basis risks under that forward pricing alternative. This paper presents models of optimal forward contracting and hedging under price and yield uncertainty within a mean-variance framework. The results indicate that basis certainty does not explain preferences for forward contracting.

*Key words:* forward contracting, hedging, yield uncertainty, price uncertainty.

Survey results indicate that producers of agronomic crops make more use of forward contracting than hedging as a forward pricing tool. While only 7.5 percent of surveyed grain farmers had traded futures in 1977, nearly 20 percent had sold grain under forward cash contracts (Commodity Futures Trading Commission). A survey of marketing agencies in 1974 indicated that 55 percent of the corn, 49 percent of the soybeans, and 33 percent of the wheat purchased from farmers by those agencies involved forward cash contracts (Heifner et al.). Forward cash contracting of upland cotton reached as high as 75 and 50 percent in 1973 and 1975, respectively (U. S. Department of Agriculture). Despite its widespread use, forward contracting has been largely ignored in the research literature dealing with optimal forward pricing levels in the face of both price and yield uncertainty, a situation faced by producers of agronomic crops prior to harvest.

While forward contracting differs from direct hedging on several counts, the distinguishing feature of interest here is the absence of basis uncertainty with forward cash contracting. Forward contracting establishes either a certain price for contracted output in the case of "fixed" price contracts or a fixed basis with respect to a particular futures contract in the case of "basis" contracts. Producers can establish a fixed price for their contracted output anytime during the life of a "basis" contract. At the time price is established, the "basis" contract becomes indistinguishable from a "fixed" price contract. Handlers typically cover their contract commitments to producers by hedging unless they have forward contracted their own sales. Since handlers assume costs and risks by offering forward contracts, the basis offered on forward contracts calling for harvest time delivery is usually less than the historic harvest time basis. However, the basis offered on forward contracts occasionally may equal or exceed the historic norm as handlers make procurements to meet their own forward commitments (Harris and Miller).

This paper presents a model for determining optimal "fixed" price forward cash contracting levels when prices and yields are uncertain and provides comparisons to optimal direct hedging levels under the same circumstances. The hypothesis to be tested is whether the absence of basis risk with forward contracting explains apparent producer preference for forward contracting vis-a-vis direct hedging as a forward pricing tool.

## THEORETICAL MODELS

Previous studies have focused attention on the optimal level of direct hedging relative

to cash sales in the face of uncertain prices and yields. Minimum risk hedging levels (hedging levels which minimize the variance of returns) when prices and yields are uncertain have been derived by both McKinnon and Heifner. Heifner's model is the more general since it also allows for basis risks— the uncertainty concerning the relationship between cash and futures prices when hedges are lifted. Using Midwestern soybean data, Heifner's estimated minimum risk hedges ranged from 57 percent of the expected crop in Iowa to only 22 percent of the expected Indiana crop. Rolfo derived optimal hedging levels assuming that producers maximize expected utility of income within a mean-variance framework, or alternatively, that producers' utility functions are logarithmic. Using cocoa data, Rolfo found that yield and basis uncertainty reduce the ratio of the optimal hedge to expected output to well below unity and may result in establishment of long futures positions. These studies treated the production decision as exogenous in that the choice of input levels was made prior to the hedging decision.

Anderson and Danthine have considered the case in which input and hedging decisions are made simultaneously. Their optimal hedging level can be decomposed into an expected output component, a hedging adjustment term, and a speculative component. In none of these studies is forward contracting considered as a forward pricing mechanism. Nelson has discussed use of both futures and forward contracts in forward pricing, but the effects of yield uncertainty on forward pricing levels are ignored in the analysis.

In the following, Rolfo's mean-variance model is modified to allow for "fixed" price forward cash contracting in the face of price, basis, and yield uncertainty. An individual risk-averse producer maximizes utility of income from predetermined input levels by the optimal choice of forward contracting level within a mean-variance framework.[1] In the way of notation, the upper case is used to denote variables always known with certainty. These are G = forward cash contract price; F = price of harvest futures prior to harvest; and D = basis offered on forward cash contracts; i.e., D = G − F. Lower case variables are uncertain by assumption. These

are: f = price of futures at harvest; p = harvest spot price; d = harvest basis, d = p − f; and y = yield. Finally, $\chi/2$ represents the producer's risk parameter ($\chi/2 > 0$); E( ); V( ); and C( ) are the expected value, the variance, and the covariance of parenthetical terms, respectively.

With forward contracting, the producer's objective function is:

$$(1) \quad Z = BG + E(p(y-B)) - \chi/2[V(py) + B^2V(p) - 2BC(py,p)],$$

where B = quantity forward contracted. With B as the choice variable, the optimal level of forward contracting from the first order condition for maximization of equation (1) is:

$$(2) \quad B^* = \frac{C(py,p)}{V(p)} + \frac{G-E(p)}{\chi V(p)}.$$

For comparative purposes, the optimal level of futures holdings with direct hedging in the face of price, yield, and basis uncertainty is given by:

$$(3) \quad N^* = \frac{C(py,f)}{V(f)} + \frac{F-E(f)}{\chi V(f)},$$

where $N^*$ = the optimal amount of futures holdings (Rolfo).

Equations (2) and (3) are each comprised of hedging and speculative components. The first term of each equation is the hedging component and indicates the level of forward pricing activity which minimizes the variance of returns. The speculative component, the second component of each equation, reflects the effects of forward pricing on the level of returns. This component is inversely related to the producer's risk parameter and disappears if the producer is infinitely risk averse; i.e., the producer seeks only to minimize the variance of returns.

In equation (3), the numerator of the speculative term is the difference between futures price prior to harvest and the expected level of futures price at harvest time or the expected return from holding futures. This term disappears if futures are unbiased; otherwise, it may be positive or negative according to the level of perceived futures bias. For forward contracting (equation (2) ), the numerator of the speculative component

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represents the difference between the forward contract price and the spot price expected at harvest. This numerator may be positive, zero, or negative according to both the level of perceived futures bias and the level of D relative to E(d). The denominators of the speculative components of equations (2) and (3) include the variances of spot prices and futures, respectively. Note that basis uncertainty affects the speculative component for forward contracting, but not for direct hedging. The relative magnitude of V(f) versus V(p) depends upon the extent of basis variability and the covariance between harvest time futures and basis. Yield variability does not affect the speculative components of these equations.

The hedging components of these equations are directly related to the covariances between returns from spot marketings and harvest time prices, which, in turn, depend on the extent to which the producer's output is correlated with aggregate output and the elasticity of demand. Although the denominators of these components contain harvest time price variances, there is not necessarily an inverse relationship between these variances and minimum risk forward pricing levels as the numerators are not independent of these variances. The hedging components are independent of forward price as neither the preharvest futures nor the forward contract price appears therein.

The relative magnitudes of optimal direct hedging and forward contracting cannot be determined *a priori* except under restrictive assumptions as to the distributions of yields and prices. If yields, futures, and the basis at harvest are stochastically independent (Bohrnstedt and Goldberger), the hedging components of both equations reduce to E(y) and the denominator of the speculative component for equation (2) exceeds that of equation (3) by the amount V(d) for a given finite level of risk aversion.[2] Then, if D < E(d), the optimal level of direct hedging exceeds that of forward contracting regardless of perceived futures bias.

## EMPIRICAL MODELS

In this section, optimal forward contracting levels for soybeans subject to price, basis, and yield uncertainty are estimated for ten Coastal Plain counties in South Carolina for each year from 1975 to 1984.[3] For comparative purposes, concurrent optimal direct hedging levels are also estimated. The preharvest decision dates for each forward pricing alternative are those nearest April 15 for which forward contract basis data for Charleston, South Carolina, are available. Forward contracting and spot deliveries are assumed made at Charleston on dates nearest November 1 for which Charleston cash prices are reported.

Following Rolfo's approach, expectational rather than historic data are used to measure price and yield uncertainty under both forward pricing alternatives. Futures price forecast error, $\tilde{f}$, is given by $(f - F)/F$ where f is the price of November futures at the harvest time delivery and F is the price of November futures at the decision date. Cash price forecast error, $\tilde{p}$, is given by $(p - \hat{p})/\hat{p}$ where p is the Charleston cash price at harvest time delivery and $\hat{p}$ is the expected Charleston harvest time cash price measured by November futures at the decision date plus the expected harvest time basis.[4] Yield forecast error, $\tilde{y}$, is given by $(y - \hat{y})/\hat{y}$ where y is realized yield and $\hat{y}$ is forecasted yield as of the decision date.[5] Revenue forecast error from cash marketings is thus $\tilde{p} + \tilde{y} + \tilde{p}\tilde{y}$. Also, $f = F(1 + \tilde{f})$, $y = \hat{y}(1 + \tilde{y})$, and $P = \hat{p}(1 + \tilde{p})$.

Optimal forward contracting and direct hedging levels expressed as proportions of forecasted yield are:

$$(4) \quad \frac{B^{*}}{\hat{y}} = \frac{C[(1+\tilde{p})(1+\tilde{y}),\tilde{p}]}{V(\tilde{p})}$$

$$- \frac{E(d) - D + \hat{p}E(\tilde{p})}{X\hat{y}\hat{p}^2 V(\tilde{p})}$$

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[2]An intuitive explanation for the result that E(y) is the risk minimizing forward pricing level under stochastic independence is offered by McKinnon (p. 849). Under stochastic independence, short crops are just as likely to be associated with low harvest prices as high harvest prices. Purchases in the cash market to meet forward commitments would not increase the variance of the producer's returns. Forward sales of E(y) allow the producer to protect himself against price variability without worsening the influence of yield uncertainty on the variance of his returns.

[3]The ten counties are Allendale, Bamburg, Barnwell, Calhoun, Clarendon, Florence, Hampton, Orangeburg, Sumter, and Williamsburg.

[4]The estimated harvest time basis is the average harvest time basis for the previous 3 years. The cash price forecast error used here differs from that used by Rolfo (p. 105). In the current notation, Rolfo's measure of that error is $(p - F)/F$; i.e., futures are not adjusted by a basis estimate when used to forecast cash prices.

[5]Forecasted yields are 1 year ahead forecasts from linear trend regressions estimated using yield data for the previous 10 years.

and

$$(5) \quad \frac{N^{*}}{\hat{y}} = \frac{\hat{p}C[(1+\tilde{p})(1+\tilde{y}),f]}{FV(\tilde{f})} - \frac{E(\tilde{f})}{\chi\hat{y}FV(\tilde{f})},$$

respectively.[6] Equations (4) and (5) are estimated for each of the ten South Carolina counties for each year between 1975 and 1984. For each of those years, the variances, covariances, and expected values involving $\tilde{f}$, $\tilde{p}$, and $\tilde{y}$ are calculated from the ten immediately preceding observations on those variables. Data sources are as follows: yields—South Carolina Crop Reporting Service; futures prices—*Wall Street Journal*; Charleston cash prices—Department of Agricultural Economics and Rural Sociology, Clemson University, and *The State*; and Charleston forward prices—Department of Agricultural Economics and Rural Sociology, Clemson University.

Displayed in Table 1 are the cash, futures, and basis determinants of the optimal forward pricing levels for 1975-84. With the exception of 1975-6, the variances of forecast errors for spot prices exceed those of futures prices. Variances of forecast errors for both prices trended upward over 1975-84. Means of both cash and futures forecast errors are uniformly positive; however, these means are not significantly different from zero at the 5 percent level. There are no trends apparent in either mean over the sampling interval, but mean cash price forecast errors exceed those for futures after 1977. With the exception of 1977-8, forward contract basis offers are less than or equal to the expected harvest time basis in Charleston.

Covariances between cash marketing revenue and price forecasting error and yield forecasts are calculated for each of the ten counties for 1975-84. Owing to space limitations, only the means across the ten counties and associated mean standard errors are shown in Table 1. As can be seen from comparison of these means to their corresponding standard errors, differences in these measures across counties are small. While there is a close correspondence between the covariance terms from equations (4) and (5) for any year, the covariance term from equation (4) is never greater than the corresponding term from equation (5). Also shown in Table 1 are the mean covariances (and associated mean standard errors) between price and yield forecast errors across the ten counties. Note that these covariances are positive prior to 1978. From 1978 onward, the covariances between cash price and yield forecast errors have larger absolute values than the corresponding covariances between futures price and yield forecast errors.

Equations (4) and (5) are estimated for each of the ten counties from 1975-84 for $\chi$ = 0.01, 0.10, 1.0, 10, 100, and $\infty$, with averages across the counties reported in Table 2.[7] Optimal forward contracting levels labeled CONTRACTA are derived using estimated levels of $E(\tilde{p})$. Contracting levels labeled CONTRACTB are derived under the assumption that $E(\tilde{p}) = 0$ (preharvest futures and basis estimates are unbiased). Optimal hedging levels, labeled HEDGE, are derived using sample estimates of $E(\tilde{f})$. Note, however, that optimal hedging levels with unbiased futures (i.e., $E(\tilde{f}) = 0$) are identical to HEDGE levels for $\chi = \infty$ since the numerator of the speculative component of equation (5) equals zero in this circumstance.

From Table 2, note that optimal contracting and hedging levels are relatively insensitive to changes in $\chi$ between one and $\infty$; i.e., the speculative components of optimal forward pricing levels are inconsequential for these values of $\chi$. Also for values of $\chi \geq 1$, there are downward trends over time in all of the forward pricing alternative levels due to increases in the variances of forecast errors for cash and futures prices and the absence of corresponding trends in the covariances of cash marketing revenue and price forecast errors. After 1976, optimal hedging levels generally exceed optimal contracting levels for these $\chi$ values. This follows from the larger values of $V(\tilde{p})$ relative to $V(\tilde{f})$ after that year. Optimal forward contracting and hedging levels greater than unity indicate that risk averse producers would have incentives to forward price quantities in excess of expected production. For $\chi \geq 1$, optimal forward pricing levels greater than unity are encountered from 1975-7. On these occasions, the sample covariances between price and yield forecast errors are positive.

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[6] The hedging component of equation (5) differs by the factor $\hat{p}/F$ from that derived by Rolfo (p. 110) due to differences in measurement of $\tilde{p}$. See Footnote 4.

[7] To avoid the cluttering of Table 2, mean standard errors are not reported. However, as in Table 1, differences across counties are small. Optimal forward contracting and direct hedging levels for each of the counties are available from the author upon request.

TABLE 1. DETERMINANTS OF OPTIMAL FORWARD CONTRACTING AND HEDGING LEVELS FOR SOUTH CAROLINA SOYBEANS, 1975-1984

| Determinant[a] | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
| $V(\tilde{p})$ | 0.028 | 0.032 | 0.038 | 0.046 | 0.044 | 0.048 | 0.054 | 0.067 | 0.073 | 0.077 |
| $V(\tilde{f})$ | 0.029 | 0.032 | 0.035 | 0.045 | 0.043 | 0.047 | 0.053 | 0.065 | 0.072 | 0.073 |
| $E(\tilde{p})$ | 0.101 | 0.091 | 0.123 | 0.109 | 0.127 | 0.114 | 0.130 | 0.101 | 0.075 | 0.083 |
| $E(\tilde{f})$ | 0.104 | 0.097 | 0.124 | 0.107 | 0.123 | 0.110 | 0.128 | 0.099 | 0.072 | 0.074 |
| F | 5.63 | 5.08 | 7.29 | 6.24 | 6.99 | 6.54 | 8.36 | 6.69 | 6.70 | 7.10 |
| E(d) | −0.17 | −0.24 | −0.23 | −0.17 | −0.07 | −0.07 | −0.07 | −0.10 | −0.07 | −0.05 |
| D | −0.30 | −0.25 | −0.10 | −0.10 | −0.10 | −0.10 | −0.10 | −0.10 | −0.10 | −0.05 |
| $C[(1+\tilde{p})(1+\tilde{y}),\tilde{p}]$ | 0.036 | 0.036 | 0.039 | 0.044 | 0.035 | 0.038 | 0.028 | 0.039 | 0.043 | 0.043 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) | (0.003) |
| $C[(1+\tilde{p})(1+\tilde{y}),\tilde{f}]$ | 0.037 | 0.037 | 0.039 | 0.045 | 0.036 | 0.038 | 0.029 | 0.039 | 0.043 | 0.043 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) |
| $C(\tilde{p},\tilde{y})$ | 0.008 | 0.003 | 0.000 | −0.003 | −0.010 | −0.012 | −0.023 | −0.025 | −0.028 | −0.031 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) |
| $C(\tilde{f},\tilde{y})$ | 0.008 | 0.004 | 0.002 | −0.001 | −0.009 | −0.010 | −0.022 | −0.024 | −0.026 | −0.029 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.003) |
| $\hat{y}$ | 19.5 | 20.6 | 20.4 | 21.6 | 20.8 | 22.9 | 19.7 | 20.2 | 20.7 | 19.2 |
| | (0.62) | (0.54) | (0.60) | (0.56) | (0.46) | (0.45) | (0.49) | (0.51) | (0.55) | (0.61) |

[a]Units of measurement for F, E(d), and D are dollars per bushel, $\hat{y}$ is measured in bushels per acre. Remaining terms are proportions. The $C[(1+\tilde{p})(1+\tilde{y}),\tilde{p}]$, $C[(1+\tilde{p})(1+\tilde{y}),\tilde{f}]$, $C(\tilde{p},\tilde{y})$, $C(\tilde{f},\tilde{y})$, and $\hat{y}$ terms are means for ten South Carolina counties. Mean standard errors are shown in parentheses.

TABLE 2. OPTIMAL FORWARD CONTRACTING AND DIRECT HEDGING LEVELS FOR ALTERNATIVE RISK AVERSION LEVELS, AVERAGES FOR TEN SOUTH CAROLINA COUNTIES, 1975-1984

| Risk aversion parameter[a] | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
| ................................................. Ratio of optimal forward pricing level to expected yield ................................................. | | | | | | | | | | |
| $\chi = 0.01$ | | | | | | | | | | |
| CONTRACTA | −3.0 | −1.8 | −0.89 | 0.68 | −1.3 | −0.89 | −1.0 | −0.56 | −0.21 | −0.37 |
| CONTRACTB | 0.52 | 1.07 | 1.37 | 1.15 | 0.73 | 0.71 | 0.48 | 0.59 | 0.54 | 0.43 |
| HEDGE | −2.1 | −1.8 | −1.3 | −0.79 | −1.2 | −0.77 | −0.94 | −0.54 | −0.13 | −0.16 |
| $\chi = 0.10$ | | | | | | | | | | |
| CONTRACTA | 0.89 | 0.84 | 0.83 | 0.80 | 0.60 | 0.62 | 0.38 | 0.47 | 0.51 | 0.47 |
| CONTRACTB | 1.23 | 1.13 | 1.06 | 0.98 | 0.80 | 0.78 | 0.52 | 0.59 | 0.58 | 0.55 |
| HEDGE | 0.93 | 0.82 | 0.83 | 0.80 | 0.63 | 0.65 | 0.39 | 0.48 | 0.52 | 0.51 |
| $\chi = 1.00$ | | | | | | | | | | |
| CONTRACTA | 1.27 | 1.11 | 1.00 | 0.95 | 0.79 | 0.77 | 0.51 | 0.57 | 0.58 | 0.55 |
| CONTRACTB | 1.31 | 1.14 | 1.03 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| HEDGE | 1.23 | 1.08 | 1.04 | 0.96 | 0.81 | 0.79 | 0.53 | 0.58 | 0.59 | 0.58 |
| $\chi = 10.0$ | | | | | | | | | | |
| CONTRACTA | 1.31 | 1.14 | 1.02 | 0.96 | 0.81 | 0.78 | 0.53 | 0.58 | 0.59 | 0.56 |
| CONTRACTB | 1.32 | 1.14 | 1.02 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| HEDGE | 1.26 | 1.10 | 1.06 | 0.97 | 0.83 | 0.81 | 0.54 | 0.59 | 0.59 | 0.59 |
| $\chi = 100.0$ | | | | | | | | | | |
| CONTRACTA | 1.32 | 1.14 | 1.02 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| CONTRACTB | 1.32 | 1.14 | 1.02 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| HEDGE | 1.27 | 1.11 | 1.07 | 0.97 | 0.83 | 0.81 | 0.54 | 0.59 | 0.59 | 0.59 |
| $\chi = \infty$ | | | | | | | | | | |
| CONTRACTA | 1.32 | 1.14 | 1.02 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| CONTRACTB | 1.32 | 1.14 | 1.02 | 0.96 | 0.81 | 0.79 | 0.53 | 0.59 | 0.59 | 0.56 |
| HEDGE | 1.26 | 1.11 | 1.07 | 0.97 | 0.83 | 0.81 | 0.54 | 0.59 | 0.59 | 0.59 |

[a]CONTRACTA = optimal forward contracting level using estimated $E(\tilde{p})$. CONTRACTB = optimal forward contracting level assuming $E(\tilde{p}) = 0$. HEDGE = optimal hedging level using estimated $E(\tilde{f})$.

Changes in $\chi$ below unity result in dramatic reductions in optimal forward pricing levels for CONTRACTA and HEDGE. When $\chi = 0.01$, the speculative components of these forward pricing alternatives overshadow their corresponding hedging components, resulting in negative optimal values. That is, producers would have incentive to be long in futures under HEDGE or to offer forward contracts under the CONTRACTA alternative. For 1978-9, when $D > E(d)$, reductions in $\chi$ below unity increase optimal levels of CONTRACTB. In all other years, levels of CONTRACTB are reduced by reductions in $\chi$, although not to the extent to which CONTRACTA and HEDGE are reduced.

## SUMMARY AND CONCLUSIONS

Rolfo's mean-variance model is extended to accommodate forward contracting (which is not subject to basis risk) as an alternative to direct hedging (which is subject to that risk) with applications to soybean data. Counter to intuition, both theoretical and empirical analyses indicate that the absence of basis risks with forward contracting does not necessarily lead to higher levels of forward contracting relative to direct hedging for producers who are infinitely risk averse. Infinitely risk averse producers would have incentive to forward contract or hedge quantities smaller (larger) than their expected output if yields and harvest time prices are negatively (positively) correlated. Another surprising result is that although the variances of harvest time price forecast errors have steadily increased from 1957 to 1984, risk minimizing forward contracting and hedging levels have decreased over the same interval. Although optimal forward contracting and hedging ratios are relatively insensitive to changes in the risk aversion coefficient above unity, these ratios are sensitive to changes in that coefficient below unity. Thus, optimal forward pricing ratios are variable with respect both to time and

producers' risk preferences. These results suggest that rule of thumb recommendations such as forward price one-half to two-thirds of expected yields may be inappropriate for some producers. Extension efforts should focus on educating producers as to how individual circumstances affect optimal forward pricing ratios.

The results presented here indicate that the absence of basis risk with forward contracting does not explain producer preference for forward contracting over direct hedging as a forward pricing tool. An obvious explanation follows from the naivete of the mean-variance model employed. Whether these results hold for alternative utility functions deserves further research; however, recent evidence indicates that the mean-variance model performs well when compared to direct utility maximization (Kroll et al.).

The present analysis has ignored differences in margin requirements between direct hedging and forward contracting. Nelson has argued that the costs associated with margin accounts required with direct hedging are likely to be trivial in most cases. However, access to credit may differ according to whether crops are hedged directly or forward contracted (Barry and Willmann; Harris and Baker).

The research presented here could be extended in several ways. South Carolina is not a major soybean producer, thus the current empirical results may not be applicable to major producing regions such as the Midwest and the Delta. There is a need to extend the analysis to other producing regions. The analysis could be expanded to accommodate alternative forward pricing tools; e.g., options. Kenyon has argued that yield uncertainty is less of a problem with options than with hedging. Finally, the analysis could be expanded to incorporate the effects of government price-support programs on harvest time price variability.

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