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by

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Price-Quality Relationships for Grain:
An Evaluation of Buyers' Discount Behavior*

The provision of information on quality attributes has long been recognized as important to the efficient pricing and marketing of agricultural products. (See, for example, Farris, Mehren, Zusman.) Product quality information is expected to contribute to pricing efficiency by making it possible for market prices to more fully reflect quality differences. It is important to be able to determine the success with which quality information schemes, like that for grain grades and standards, promote the prevalence of more accurate price-quality relationships in the market. Not only are there an increasing number of such schemes (e.g. those concerned with nutritional information), but also these schemes are costly to establish and maintain. Quality pricing accuracy would not be improved by establishing a quality information scheme if the quality information provided is irrelevant to market decision-makers.

In the United States, the economic suitability of the quality information upon which the 65-year-old system of grain grading is based is at issue, and is emphasized by the major role of grains in United States foreign trade. To maintain a competitive position in world grain markets, grain shipments to major importers must continue to be of a quality sufficient to assure acceptability. The information provided within the grain grades and standards should help pull the required quality of grain through the marketing channel by making it possible for the proper price-quality signals to be transmitted to handlers and producers.

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In United States' grain markets, price-quality relationships are expressed in terms of price discounts on standardized quality factors (e.g. percent moisture, bushel testweight in pounds, percent damage and percent foreign matter). Buyers monetize their perception of the value of a decrement in quality by setting an offer price below the price they are willing to pay for the standard quality (in most cases, "No. 2") bushel of grain. Final offer prices are based upon "discount schedules" set by buyers for each of the government-mandated quality factors. For example, a bushel of wheat might be discounted below the No. 2 price on the basis of a schedule that calls for a 12 cent reduction for the first 1/2 percent moisture above standard quality (e.g. 13.5 percent H_2O) and 3 cents for each 1/2 percent moisture increment thereafter.

The question is whether the standardized quality factors sufficiently encompass those raw material characteristics that significantly affect grain buyers' handling costs and end product values. If the standardized grain quality factors do not include input characteristics of economic value to end users of grain and/or include some quality characteristics of no economic importance to buyers and processors, then the market price signals based upon those inappropriate grain quality factors will be inefficient and lead to suboptimal resource allocation. In practice this kind of pricing inefficiency can occur when quality characteristics of economic importance are not discounted, or when the quality factors that are subject to discounting do not reflect the raw material characteristics that are economically relevant to grain buyers. A methodology to assess this latter type of pricing inefficiency is developed here and applied to the New York and Pennsylvania markets for wheat and corn. Only after determining if the current quality factors already subject to discount are economically relevant should work on developing additional quality factors to discount be attempted.

In this paper, a model is formulated which expresses the prices of quality characteristics as a function of economic elements, such as grain end-use value, that are considered important in the efficient pricing (discounting) of quality characteristics. By determining the extent to which the buyer discount schedules reflect or are explained by these economic elements, the economic relevance of the existing standardized quality factors can be assessed.

An empirical model, suitable for statistically testing hypotheses regarding the relationship between the prices of quality characteristics and input quality is constructed from the theoretical model. In subsequent sections, data sources and variable selection for the empirical model are discussed, hypothesized net relationships among variables are presented and appropriate features of the statistical testing procedure, canonical correlation, are outlined. Finally the results of the statistical analysis are interpreted in terms of the economic relevance of the existing grain quality standards and their contribution to market pricing efficiency.

Theoretical Model of Quality Discounts

A simple single product--single raw material (input) model is developed to illustrate how the amount of an input characteristic (e.g. moisture, bushel testweight) influences a buyer's valuation of the input. Output is a function of the amount of input characteristics provided to the production process. If q = output quantity and X_j = the total quantity of the j^{th}

characteristic of the input used in production, then the general production function can be written as $q = F(X_1, X_2, \ldots, X_m)$ or simply $q = F(X_j)$. That is, output of the end product is a function of the quantities of input quality characteristics supplied to the production process. Further, let R_j = the value to the input purchaser of a unit of input characteristic j. The profit function can be written as:

$$(1) \quad \pi = pF(X_j) - \sum_{j=1}^{m} R_j X_j,$$

where the latter term is equivalent to the price per unit of input times the quantity of input used.

In grain marketing, equation (1) is the profit function for a buyer of standard "No. 2" quality grain. Buyers recognize that the addition of units of characteristic j away from the No. 2 level results in reduced revenue and extra handling expenses (e.g. drying costs) If X_j^1 = the number of units of characteristic j that is acceptable as No. 2 quality and X_j^2 = the number of units of characteristic j that are not within the No. 2 range, then the production function can be rewritten as $q = F(X_j^1, X_j^2)$. Total revenue, $pF(X_j^1, X_j^2)$ is less than $pF(X_j^1)$. To compensate for the revenue reduction (due to loss of end product output or quality) caused by each additional unit of characteristic j away from the No. 2 level, a buyer will discount the j^{th} characteristic by an amount equal to r_j. Also the buyer will be compensated, via the discount schedule, for handling costs incurred for each additional unit away from the No. 2 level by an amount equal to h_j.

Let $D_j = r_j + h_j$. D_j is the change in buyer valuation of the j^{th} characteristic, or the total compensation the buyer receives for units of the j^{th} characteristic away from No. 2 quality. The profit function can be rewritten as:

$$(2) \quad \pi = pF(X_j^1, X_j^2) - [\sum_{j=1}^{m} R_j X_j^1 - \sum_{j=1}^{m} D_j X_j^2 + \sum_{j=1}^{m} h_j X_j^2]$$

Say a buyer discounts only for excess moisture and high foreign matter. If he dries the grain to No. 2 levels, removing the excess moisture so that it does not affect the end production process, but does nothing to remove foreign matter, which does cause a reduction in output, a $r_j X_j^2$ term in the profit function will appear relating to foreign matter, but not to moisture. On the other hand, the excess moisture removal does result in drying costs, $(+h_j X_j^2)$, to the buyer which must be compensated for with the moisture discount $(-h_j X_j^2)$.

Since the total quantity of each characteristic used is equivalent to the amount, in bushels, of the grain input used (V) times the amount of the j^{th} characteristic provided by each unit of input (X_{jv}), equation (2) can be rewritten as:

$$(3) \quad \pi = p\,F(X_j^1, X_j^2) - [\sum_{j=1}^{m} R_j X_{jv}^1 V - \sum_{j=1}^{m} D_j X_{jv}^2 V + \sum_{j=1}^{m} h_j X_{jv}^2 V]$$

To find the effect of a change in the per bushel number of units of the j^{th} characteristic outside the No. 2 range on a profit maximizing buyer's valuation of the grain input, the first order conditions for equation (3) are solved by differentiating with respect to X^2_{jv} and setting equal to zero.

$$(4)\quad \frac{\partial \pi}{\partial X^2_{jv}} = p \left(\frac{\partial F}{\partial X^2_j}\right) \left(\frac{\partial X^2_j}{\partial X^2_{jv}}\right) + D_j V - h_j V = 0, \quad (j = 1,\ldots\ldots,m)$$

since

$$\frac{\partial F}{\partial X^2_{jv}} = \left(\frac{\partial F}{\partial X^2_j}\right) \left(\frac{\partial X^2_j}{\partial X^2_{jv}}\right)$$

Solving for D_j yields

$$(5)\quad D_j = -\frac{P\left(\frac{\partial F}{\partial X^2_j}\right) \left(\frac{\partial X^2_j}{\partial X^2_{jv}}\right)}{V} + h_j$$

Since $X^2_j = VX^2_{jv}$ and $\frac{\partial X^2_j}{\partial X^2_{jv}} = V$, equation can be simplified to:

$$(6)\quad D_j = -p\left(\frac{\partial F}{\partial X^2_j}\right) + h_j, \text{ with } \frac{\partial F}{\partial X^2_j} \lessgtr 0$$

In words, equation (6) represents the change in the buyer's valuation of the j^{th} characteristic, or the total compensation the buyer receives for units of the j^{th} characteristic that deviate from No. 2 quality (i.e, the discount). It is a function of the price of the end product times the marginal contribution of that j^{th} characteristic to production plus the handling cost incurred per unit of the j^{th} characteristic away from the No. 2 quality. In terms of a moisture discount schedule, the change in buyer's valuation, attributed to an additional unit of moisture above the No. 2 range (D_j in equation(6)), is expressed, for example, as a 2¢ deduction from the No. 2 price for each of these additional units of moisture. These deductions then, for excess moisture content, excess foreign matter, excess damaged kernels and deficient bushel testweight, form the data base for the empirical model which follows.

Empirical Model

According to equation(6), observed variation in discount schedules across firms (both within and across different end-product industries) can be explained by across-firm variation in: 1) end-product prices; 2) handling costs; and 3) marginal products of input quality characteristics. In a perfectly competitive market, if the quality factors upon which the discounts are based are economically relevant for profit maximizing by grain purchasing firms, then across-firm variation in their set of discount schedules for percent moisture, bushel testweight, percent foreign matter and percent damaged kernels should be explained by variation in the price (market value) of the grain's end-product (EUV), the marginal physical contribution of the quality characteristic to end-product output (MPC) and firm operating costs incurred as a result of sub-standard grain quality (OC).

In the case of a non-perfectly competitive market, market power on the buying side would be expected to provide buyers with the ability to raise discount schedules beyond the perfectly competitive level. A variable representing local market share (MS) then, was added to further explain across-firm variation in discount schedules.

Data Sources

New York and Pennsylvania grain buyers were surveyed regarding their 1979 discount schedules for corn and wheat, designated end-products of their production operations, the size of the facilities and their annual share of total grain purchased in their respective local markets. The survey provided 50 discount schedules from 41 firms, 33 for soft wheat (red and white) and 17 for corn. These firms included flour millers, feed manufacturers, wet corn millers, and cereal manufacturers. Simple statistics for the full sample, reported in Table 1 demonstrate the extent of across-firm (within and across different end-product industries) variation in discount schedules.

Data entries for each discounted factor are cumulative discounts. In other words, if corn is discounted 10 cents per bushel for the first 1/2 percent of moisture above 15 1/2 percent (upper limit for No. 2 standard quality) and 2 cents per bushel for each 1/2 percent thereafter through, say to 18 1/2 percent, a data entry of 20 cents would appear for the discounting firm. Since the charge by the discounting firm is for the total amount of the j^{th} characteristic (away from No. 2 standards) present per bushel of grain (X_{jv}^2 in the theoretical model) this cumulative approach best represents actual market pricing. This total change is equivalent to summing D in equation (6) for each j.

Table1: Summary Statistics for Data Set consisting of Wheat and Corn Discounts.

Discounted Attribute	Mean Cumulative Discount in cents/bushel	Standard Deviation of Cumulative Discounts
For Corn and Wheat:		
Moisture*	32.84	22.30
Testweight	5.59	5.83
Foreign Matter	2.38	1.70
Damage	1.18	1.31
For Corn Only:		
Moisture	21.14	16.81
Testweight	2.61	3.14
Foreign Matter	0.59	0.87
Damage	0.86	1.16
For Wheat Only:		
Moisture	38.87	22.58
Testweight	7.12	6.32
Foreign Matter	3.29	1.21
Damage	1.34	1.37

*Moisture discount data incorporate shrinkage adjustments.

Eight different end-product industries were observed--four for each grain. They included various types of flours, feeds, cereals and corn syrups and sugars. Average third quarter prices received for those end-products in 1979 were used to represent grain buyer end-use values (EUV). Relative firm cost structures with respect to handling grain of sub-standard quality (the OC variable) were obtained by matching survey data on operation size (annual quantity of grain handled) with published handling cost per bushel data for appropriate grain industries (Hill, Hill and Stice, National Commission on Food Marketing). Local market share--80 percent of respondents limited purchases to within a 20 to 30 mile radius of their plant--serves as a proxy for non-competitive impacts of unequal buyer market power that may account for divergence between actual discounting practices and behavior predicted by the theoretical model. Finally, a dummy variable is used to represent MPC, the marginal contribution of each input quality factor to end-product output. Because the marginal physical product of grain quality characteristics for firms within the same end-product industry should be relatively similar, all pastry flour millers for example, are given the same dummy variable data entries. On the other hand, because of expected differences in the marginal contribution of input characteristics between firms with different end-products, breakfast cereal producers, for example, are given different dummy variable entries than flour millers.

An appropriate multivariate technique for determining the degree to which the above set of explanatory variables accounts for the variation in discounts across firms is canonical correlation. (See Schrader and Zdanky's use of canonical correlation in testing for discount variation across Midwestern corn buyers.) Unlike multiple regression, which regresses a single "dependent" variable on a set of explanatory variables, canonical correlation allows for analysis of the associated variation in two sets of variables. In the present study, buyer discount schedules for percent moisture, bushel testweight, percent damaged kernels and percent foreign matter comprise a "set" of "dependent" variables because these quality factors are not independent of one another (e.g. moisture and testweight) and because the factors have been designated as a set by government grades and standards to represent grain quality.[1]

Canonical Correlations

The canonical correlation procedure forms weighted sums or linear combinations of the sets of dependent ("criterion") y variables and explanatory ("predictor") x variables such that the two linear combinations (called "canonical variates or variables") are maximally correlated. In other words, if Y and X are two new variables created by forming linear combinations of the original two sets of variables (i.e. $Y = \sum_{i=1}^{m} a_i y_i$; $X = \sum_{j=1}^{k} b_j x_j$), then the canonical correlation routine will find two unique vectors of standardized weights, α_i and β_j, that give a maximum simple correlation coefficient (P_{cc}) for the new variables Y and X. In the present study, the y variables are the discounts for the quality factors, i.e., moisture, testweight, foreign matter and damage, and the x variables are EUV, MPC, OC and MS.

More than one pair of canonical variates can be derived. Subsequent pairs of variates are found that maximally correlate Y and X subject to being statistically independent (orthogonal) to the preceding, more highly correlated pairs of linear combinations. The Wilks' Lambda F ratio is used to establish the statistical significance of the canonical correlations (CCs) by testing the null hypothesis that there is no linear relationship between a pair of canonical variates. (See Anderson, Chapter 9 for a detailed explanation of the use of this F ratio.)

Results and Interpretations

Output of the canonical correlation procedure for the data set consisting of discount schedules for both corn and wheat is reported in Table 2.

Although the squared multiple correlation coefficient (R^2) indicates, in a multiple regression context, the percentage of variation in the dependent variable "explained" by the fitted linear combination of independent variables, the canonical correlation coefficient squared (P^2_{cc}) represents the variance shared by linear composites of two sets of variables and not the shared variance of the two sets themselves. A relatively high P^2_{cc}, does not necessarily indicate a strong "explanatory" relationship between the original sets of variables.

An alternative index of explained variation, proposed by Stewart and Love, called a "redundancy index," (RED) is widely accepted. The redundancy index gives the amount of variation in the set of "y" variables accounted for ("explained") by the set of "x" variables and is equivalent to the mean of the squared multiple correlation coefficients obtained from

Table 2: Canonical Correlations (CC) for Data Set Consisting of Discount Schedules for Both Corn and Wheat.

	CC_1	CC_2
P_{cc}	.828	.733
P^2_{cc}	.686	.537
F Statistic	7.27	4.56
Sample Size	50	50
Structure Matrices and Coefficients (S)- (Correlations between Original Variables and Their Canonical Variates)		
Dependent Variable Set:		
Moisture	.474	.450
Testweight	.446	-.088
Foreign Matter	.907	-.403
Damage	.225	.952
Explanatory Variable Set:		
End Use Value (EUV)	.375	.659
Market Share (MS)	-.157	.511
Operating Costs (OC)	.166	-.753
Marginal Physical Contribution (MPC)	.861	.316
Redundancy Indices (RED)		
Proportion of Variation Explained	.223	.172
Cumulative Proportion	.223	.395

multiple regressions of the "x" set upon each variable of the "y" set (Stewart and Love, p. 162). The relationship between the two sets of original variables is captured by multiplying the proportion of the total variation of the original "x" variables that is extracted by the X set times the squared correlation between X and Y (P^2_{cc}). The magnitude of the redundancy index, given a high canonical correlation coefficient, will,,therefore, depend upon the extent to which all of the variables in the "x" set are correlated with the X canonical variate. The sum of the redundancy indices for all of the significant canonical correlations gives the total or cumulative variation in the "y" set accounted for the by "x" set.

The redundancy indices of .223 and .172 for the first two canonical correlations, CC_1 and CC_2, which have a cumulative sum of .395, are also reported in Table 2. The magnitudes of these redundancy indices indicate that for a cross-section analysis, a reasonable degree of explanatory power is provided by the empirical model. A review of the literature using canonical correlation analysis disclosed redundancy indices ranging from .15 to .59, comparable to the magnitudes obtained here. The fact that no additional redundancy was contributed by subsequent canonical correlations confirms the significance of the first two canonical correlations based on the F tests.

To interpret and evaluate the relationship between an individual explanatory variable and the set of dependent variables, the structure coefficients (S) (or "loadings", in the language of factor analysis) are used. (See Alpert and Peterson, Laessig and Dickett, Levine and Lambert and Derrand for an explanation of the development and use of the structure coefficient.) The structure coefficients are the simple correlation coefficients between each canonical variate and the original variable from which the variate is constructed, and are used more reliably than canonical weights for determining the degree to which an individual variable serves as a proxy for the entire canonical variate.

As seen in the matrix of structure coefficients reported in Table 2, in the first canonical correlation, CC_1, MPC acts as a proxy for the explanatory canonical variate, indicated by a structure coefficient of .861. The 22.3 percent explained variation (redundancy) of the first canonical correlation, then, is based primarily upon MPC's contribution.[2] However, because MPC and EUV are found to be highly collinear, which casts strong doubt upon the reliability of the signs in the structure vectors of CC_1, removal of the influence of one of the collinear variables is crucial before checking for the conformity of signs given by the statistical output with the directional relationships predicted by the economic model. Therefore, the second canonical correlation, CC_2, in which the influence of MPC is drastically reduced, is used as the basis for further analysis of directional relationships between the quality factors and the explanatory variables. The vector of explanatory variable structure coefficients for CC_2 illustrates that most of the "explanatory power" of the MPC has been exhausted by the formation of CC_1 (i.e. the structure coefficient for MPC in CC_2 is low = .316). Moreover, variation in the explanatory canonical variate is seen to most closely parallel variation in OC and EUV.[3]

The EUV and MS variables have positive signs. Higher end-use values mean higher impacts of substandard quality grain upon buyer profitability which is reflected in higher quality discounts. The larger the local market share, the greater is the ability to charge higher than average competitive discounts. The OC variable was constructed so as to represent the declining costs associated with larger operations. A lower OC represents a larger scale of operation that makes for a lower operating cost structure, particularly with respect to drying and milling processes. In a competitive market, these lower costs are expected to be passed along to sellers in the form of lower discount schedules. A negative sign on the structure coefficient for OC, however, implies that larger, lower cost firms, ceteris paribus, discount more heavily.

Traditional institutional arrangements may make large firms more likely to discount up to what they believe the market will bear. Farmer relationships with smaller operations tend to be more personalized and operate less strictly on an economic basis, and smaller firms depend for the most part upon local farmers for grain supplies. Many of the larger firms, however, extend their buying reach across a number of producing and buying areas. If, as is often the case, farmers face limited local buying capacities as well as the inability to economically truck their grain outside of the local buying area, a small firm-large firm dual discounting system can likely flourish. This interpretation is strengthened by the positive sign of the market share variable (MS), indicating that the greater the market share of a single firm, the higher the grain quality discounts offered by that firm.

Relevance of Standardized Quality Factors

The preceding redundancy analysis indicates the degree to which variation in the set of discount schedules is accounted for by the set of explanatory variables. The more important question, the extent to which each of the standardized quality factors being discounted is based upon economically important elements and is contributing to pricing efficiency, can be approached only by examination of the structure matrix for the dependent variable set. Again, from Table 2, the high structure coefficients for foreign matter (for CC_1, S = .907) and damaged kernels (for CC_2, S = .952) suggest that discounts for these quality factors most closely conform to behavior predicted by the model of input characteristic pricing efficiency. In other words, discount schedules for foreign matter and damaged kernels most closely represent what is being explained (to the extent of 39.5 percent cumulative redundancy) by the explanatory variable set. Thus, those standardized factors do promote more efficient quality pricing in the market.

On the other hand, relatively low structure coefficients in both canonical correlations for moisture and testweight apparently indicate that variation in moisture, and to a greater extent, in testweight discounts are not readily explained by elements important for pricing efficiency given by the theoretical model.[4] In order to account for any structural difference in the discounting of corn and wheat, a separate canonical analysis was performed upon individual grain samples. With the single grain samples, a greater proportion of moisture discount variation was explained; for example, the structure coefficient for moisture in the wheat-only sample increased from .450 to .645. Testweight, however, remained virtually unexplained by economically relevant factors, indicating that the testweight quality factor is not valued, or discounted, according to pricing efficiency or market structure considerations.

The finding that testweight is not an economically relevant grading factor is supported by the research of Hill (1973), Hill and Roush, and Hill and Jensen, in which no significant relationship between testweight and nutritional feed value of corn was found. Thus their findings also indicate that, at least for feed use, bushel testweight is not a relevant factor for quality discounting of corn.

Conclusions

Empirical market evaluations of the accuracy with which prices reflect quality valuations are rare, partly because of the difficulty in determining exactly what "quality" is. The system of grain grades and standards provides an opportunity for such empirical testing because the quality factors upon which valuations, or prices, are to be based, have been defined. However, there is a question as to how economically meaningful these factors are to present-day grain purchasers.

A methodology for evaluating the economic relevancy of the quality factors has been developed here and applied to the price discounts made for grain quality in the Northeast market of the United States, using the technique of canonical correlation. Several conclusions may be drawn and some market prescriptions made based on the findings from this study.

The model's results indicate that damage and foreign matter are, in fact, economically important quality factors that warrant discount pricing. The finding of this study that testweight is not, however, an economically significant factor for quality discounts, in conjunction with similar findings by other researchers, suggest that testweight should be considered for elimination from the United States government's set of grain grades and standards.

The model did not explain moisture discounts very well. The lack of variation in moisture discounts within local markets may be related to the year-to-year variability in the degree of dryer utilization in the Northeast market. Annual fluctuations in harvest weather conditions lead to uncertain grain buyer expectations regarding the quantity of grain that the operation will actually discount and dry in a given marketing year. Because grain dryers use moisture discounts to pay for the long-run cost of dryer operation and ownership, a single year's discount schedule, usually set well in advance of the harvesting season, must account for both the level of the previous year's dryer utilization as well as the expected level for the coming year. If the net present value of the dryer investment is to be positive, compensation for two years of dry weather and low volumes of discounted grain, for example, would have to be accomplished bya significant increase in moisture discounts for the following year. Since weather patterns tend to vary across the local markets surveyed, relative similarity within and variability across local markets in moisture discounts would not be unlikely. Ideally then, for further analysis of the economic relevance of moisture discounts, dryer utilization over time should be taken into account.

This study's findings that larger, supposedly lower-cost firms discount more heavily than do smaller firms, and that the greater the market share of the grain buyer, the larger the discounts made, indicate that discount behavior is being affected by some non-competitive elements. This suggests the need for some countervailing power on the part of farmers, as for example with the formation of cooperatives to create a more equal bargaining position in the determination of discounts applied to grain deliveries.

A more indirect corrective measure may be the provision of better market information to farmers by publicizing buyers' discount schedules and providing assessment of the impacts of those schedules on farmer profitability, since farmers do not, at present, seem to be well informed as to buyers' discounts before bringing in their grain. With this information, a farmer may be better able to decide among alternative buyers for his grain and/or consider investment in on-farm drying and storage facilities himself or in cooperation with his neighbors. While an accurate assessment of the extent to which these corrective measures are needed does depend on the particular local market under surveillance, at least in the Northeast market for corn and wheat, some improvements in the pricing efficiency of grain quality appear to be needed.

Footnotes

1 The theoretical model was developed on the basis of the simplifying assumption that the j quality characteristics present in a unit of input are independent of one another in terms of their respective effects upon output and quality characteristic pricing. To allow for the fact that the quality attributes are actually purchased as "bundles," the marginal productivity effects of quality characteristic interaction must be included. This is done with canonical correlation, which represents the dependent variables of the theoretical model as an interdependent set of discounts.

2 This is so because canonical analysis is the equivalent of performing independent principal component analyses on each of two sets of variables. Then the resulting component structures are rotated to develop weights for each variable that produce maximal correlations between components on each side. In the process, the correlations between certain members of the two sets are maximized, while the correlations between the other members are reduced nearly to zero. (Bharadwaj and Wilkening, p. 162).

3 The depletion of MPC's explanatory power for CC_2 is confirmed by a canonical analysis of a model lacking only the MPC variable. In that model only one significant canonical correlation was found and it was virtually identical to CC_2 for the full model in terms of structure and redundancy output.

4 To eliminate any possible distortions arising from the mixing of drying and non-drying firms in the sample (since moisture discounts should reflect the cost of drying as well as shrinkage), canonical correlation was performed upon the sample of only those 39 buyers with drying facilities. Results were very similar to those reported in Table 2.

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