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Success and Failure of Agricultural Futures Contracts

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Most new futures contracts fail. This study estimates the effects of several factors on the success or failure of agricultural futures contracts. Commodities with futures markets and without futures markets are included. Characteristics for which no data exist, such as homogeneity, vertical integration, buyer concentration, and activeness of the cash market, are measured by the Delphi approach. An active cash market is found to be necessary for futures contract success since this variable alone perfectly predicts whether or not a commodity has a futures market.

Key Words: active cash market, buyer concentration, Delphi approach, futures markets, homogeneity, open interest, volume

Futures exchanges apparently have difficulty predicting the success or failure of futures contracts. Most new futures contracts fail within 10 years of their introduction (Carlton, 1984). Silber (1981) estimates that between two-thirds and three-quarters of new contracts fail to attract and sustain a profitable level of trading volume. Similarly, Kolb (1991) estimates that only three of ten new futures contracts become profitable. The only research study directly addressing the success and failure of futures contracts is an analysis by Black (1986). Black showed cash market size, risk-reduction ability of the contract, cash price variability, and liquidity costs influence volume of trade and open interest of financial futures contracts.

The collapse of the former Soviet Union has led many countries (Eastern European countries as well as other countries around the world) to move toward a market economy. As markets are freed, price volatility will increase and a need for new agricultural futures contracts may emerge. Thus, creation of futures markets is being considered in many of these countries. Additionally, recent market structure changes (such as vertical integration in the pork sector) which cause cash markets to disappear are prompting questions about the viability of some existing futures markets. Reductions in price supports in the United States could also create the need for new futures markets. When developing new futures contracts, commodity exchanges need

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to know why futures markets succeed or fail. Countries considering the development of a futures market must be aware of the conditions required for the success of a futures market.

The present research seeks to identify factors that contribute significantly to the success or failure of agricultural commodities futures contracts. Following Black (1986), we define a successful contract as one that maintains a consistently high volume of trade and open interest. Hence, determining those factors contributing to the success of agricultural commodities futures contracts is equivalent to determining factors affecting volume and open interest.

Black's (1986) research addressing success and failure of futures contracts focused on nonagricultural commodities. We extend Black's model to include (*a*) homogeneity, vertical integration, buyer concentration, and activeness of the cash market, and (*b*) commodities without futures markets. Because data for the added variables are not available from any published source, the data are obtained by surveying experts using the Delphi approach. The commodities without futures markets are considered within a selectivity model using both open interest and volume as dependent variables.

Hypotheses Suggested by Past Literature

Previous authors have suggested numerous explanations for the success or failure of various futures markets. From the list of criteria earlier investigators considered necessary for selecting commodities for futures trading (Kolb, 1991; Carlton, 1984; Tomek and Gray, 1970; Sandor, 1973; Pierog and Stein, 1989; Gray, 1966), the following characteristics were consistently mentioned as important to the success or failure of agricultural commodities futures contracts:

(*a*) The own-hedge contract should be more effective in reducing risk than the existing cross-hedge contract.
(*b*) Cash prices must be variable to create hedging needs and speculative interests.
(*c*) The liquidity cost of using the own futures market should not be too much higher than the liquidity cost of using the existing cross-hedge futures market.
(*d*) The cash market must be large enough to attract a large number of potential participants into the futures markets as either hedgers or speculators.
(*e*) The marketing channel must not be vertically integrated or highly concentrated.
(*f*) The cash market must be active with frequent transactions.
(*g*) The commodities traded must be homogeneous and/or have a well-defined grading system.

These characteristics are all primarily related to the demand for futures trading. A poorly designed contract can also fail, but the factors contributing to poor design tend to be unique to each contract and thus are not considered here.

Procedure

The procedure employed for our analysis consists of estimating the effects of (*a*)–(*g*) above on futures market volume and open interest. Most of the factors expected to influence futures market success, however, are not easily measured. The measurements of variables (*a*) through (*g*) are explained below.

Relative Residual Risk (*RR*)

Following Black (1986), the relative residual risk is obtained by estimating the following equation:

$$(1) \qquad \Delta \textit{Cash Price}_{it} = \alpha_i + \beta_i(\Delta \textit{Futures Price}_{it}) + \varepsilon_{it},$$

where Δ represents weekly changes,[1] and α_i and β_i are parameters to be estimated. The coefficient of determination (R^2) of the *i*th equation is used as a measure of risk reduction for commodity *i* (Black, 1986). That is, $(1 - R^2)$ is a measure of the risk that remains in a futures contract (residual risk).

The relative residual risk is calculated as the ratio of the residual risk of the cross-hedge market (alternative market) and that of the own-hedge market (cross-hedge markets for the commodities selected are presented in table 2). The cross-hedge markets were selected based on the similarity of those markets to the own-hedge markets. The coefficient of this variable is expected to be positive; i.e., a high relative residual risk (greater than one) implies cross-hedging bears more risk than own-hedging. Thus, the own-hedge market is preferred to the cross-hedge market, so contract volume and open interest in the own-hedge market increase with an increase in relative residual risk.

Cash Price Variability (*PVAR*)

The cash price variability is obtained by taking the standard deviation of the weekly cash price changes and dividing it by the mean of weekly prices. For commodities where daily or weekly cash prices were not available, monthly cash price changes were calculated. The variance of the monthly cash price change was then transformed to obtain a weekly variance. The transformation assumes weekly prices are not autocorrelated, and is written as follows:

[1] Cash market for feeder cattle and live cattle operated only on Mondays and Tuesdays; hence, weekly cash price changes are computed as the difference between prices of two consecutive Tuesdays.

(2) $$\text{Var}(\Delta WP) = \frac{\text{Var}(\Delta MP)}{T},$$

where T is the number of weeks in a month, assumed to be four; ΔWP and ΔMP are weekly and monthly price changes, respectively; and Var denotes variance.[2] This transformation was not performed on commodities with futures markets since they all had daily prices. Literature on futures markets shows a strong positive correlation between price volatility and trading volume.

Liquidity Cost (*CLIQ*)

Liquidity cost is measured as the average weekly trading volume of all active months in the cross-hedge futures market. A cross-hedge can be preferred to an own-hedge market if the cross-hedge market is sufficiently more liquid. Black (1986) argued that the more liquid the cross-hedge market, the more costly (in terms of foregone liquidity) is own-hedging. Thus, the success of new contracts should be inversely related to liquidity cost.

In a recent article, however, Tashjian and Weissman (1995) reported that highly correlated, and even redundant, sets of contracts could be successful. The idea is that a set of contracts containing correlated contracts (the soybean complex, for example) can, at the optimal level of transaction fees, generate more revenue than a set of uncorrelated contracts. Thus, highly correlated contracts may be successful.

The arguments set forth by Black (1986) and by Tashjian and Weissman (1995) are not as exclusive as they may appear. Both are based on the activeness of the underlying market. In Tashjian and Weissman's argument, the markets considered are assumed liquid and very active, whereas in Black's argument, newly developed contracts are less active and less liquid.

Cash Market Size (*SIZE*)

The annual U.S. production[3] of each commodity was used as a measure of the size of the cash market. For live hogs, commercial hog slaughter was used as a measure of production. For live cattle, slaughter steers and heifers of 500 pounds and over were used as an indication of live cattle production.

For feeder cattle, the formula to calculate annual production was specified as follows:

(3) $$PRODUCTION_t = COW\text{-}CALF_t + FS_{bt} - FS_{et},$$

where $PRODUCTION_t$ is annual production, $COW\text{-}CALF_t$ is annual cow-calf supply, FS_{bt} denotes the beginning feeder supplies as of January 1 of the current year, and

[2] Let P_i be the price at week i. Then $P_5 - P_1$ is a monthly price change. Also, $P_5 - P_1 = (P_5 - P_4) + (P_4 - P_3) + (P_3 - P_2) + (P_2 - P_1)$; thus $\text{Var}(P_5 - P_1) = 4\text{Var}(P_2 - P_1)$.

[3] Production data were obtained from various issues of the USDA's *Agricultural Situation and Outlook Report.*

Table 1. Production and Price Unit of Selected Commodities with Associated Futures Contract Size

Commodity	Production Unit	Price Unit	Contract Size
Kansas City wheat	million bushels	$/bushel	5,000 bushels
Chicago wheat	million bushels	$/bushel	5,000 bushels
Corn	1,000 bushels	$/bushel	5,000 bushels
Soybeans	million bushels	$/bushel	5,000 bushels
Soybean meal	1,000 tons	$/ton	100 tons
Soybean oil	million pounds	$/100 pounds	60,000 pounds
Feeder cattle	1,000 head	$/pound	50,000 pounds
Live cattle	1,000 head	$/pound	40,000 pounds
Live hogs	1,000 head	$/pound	40,000 pounds
Pork bellies	million pounds	$/pound	40,000 pounds
Minneapolis wheat	million bushels	$/bushel	5,000 bushels
Cotton	1,000 tons	$/100 pounds	500 pounds
Rice	million cwt	$/cwt	2,000 cwt
Sunflower seed	1,000 cwt	$/cwt	1,000 cwt
Milk	billion pounds	$/100 pounds	150 pounds
Nonfat dry milk	million pounds	$/pound	15,000 pounds
Cheese	million pounds	$/pound	15,000 pounds
Apples	million pounds	$/pound	80,000 pounds
Pears	1,000 tons	$/2,000 pounds	400 pounds
Tomatoes	million pounds	$/100 pounds	800 pounds
Broilers	million pounds	$/100 pounds	300 pounds
Eggs	million dozen	$/100 dozen	225 dozen
Potatoes	1,000 cwt	$/cwt	800 cwt
Onions	million pounds	$/100 pounds	80,000 pounds

Notes on weight equivalents: 1 hundredweight (cwt) = 100 pounds, 1 ton = 20 cwt, 1 ton = 2,000 pounds, 24 million head = 21.4 billion pounds [Chicago Board of Trade (CBOT), *Commodity Trading Manual*, 1982, p. 195], 1,000 head = 891,750 pounds; consequently, 1 head = 891.75 pounds. Potatoes contract size was used as the contract size for the following commodities: onions, tomatoes, apples, and pears. Orange juice contract size was used as the contract size of milk, nonfat dry milk, and cheese.

FS_{et} denotes the ending feeder supplies as of January 1 of the following year. The annual production of each commodity was then divided by the contract size of the futures contract for that commodity. Production units and contract size of the selected commodities are given in table 1. For commodities without futures, contract size was subjectively determined to be similar in value to commodities with futures markets.

Homogeneity (*Grading Effectiveness*)

Futures contracts are defined as a legal agreement to buy or to sell a given quantity and quality of a commodity at a specified price at the time the contract is executed (CBOT, 1982). A commodity whose quality is subjective or depends on individual taste will not be easy to grade, and hence it will not be suitable for futures trading.

Black (1986) gives the example of tobacco as a commodity whose quality variation is so high that a successful tobacco futures market is unlikely. Moreover, Hieronymus (1972) argued that units of commodities traded on futures markets must be interchangeable; that is, the commodity must be describable.

For the present research, homogeneity is defined as the effectiveness of the grading system, and we expect it will be positively related to trading volume and open interest. A grading system is effective if the grades adequately explain differences in value. Grading effectiveness measures products in terms of their quality. Alternatively, products could have been measured in terms of time, space, and form. If a commodity is not homogeneous, meaning it has not been effectively graded, basis risk will be high and standards of delivery will be hard to establish. Grading effectiveness is measured by the Delphi approach.

Market Structure

The structure of the marketing channel of commodities across all levels can influence the likelihood of success or failure of commodity futures contracts. Preventing the exercise of market power through contract design increases the possibilities of success of futures contracts. Two measures of market structure were considered here: vertical integration and buyer concentration.

Vertical Integration

In the present research, vertical integration includes both ownership and contract integration. The degree of vertical integration depends on the number of pricing points and the percentage of the commodity which is priced at each point. Only pricing points where the form of the commodity is not changed are considered. Some commodities (e.g., live cattle) have only one pricing point where form is not changed (from feedlot to packer); others (wheat, corn, etc.) have multiple pricing points where their form is not changed. The more pricing points without form being changed, the less vertical integration. Vertical integration is measured by the Delphi approach, and it is expected to be negatively correlated with volume of trade and open interest.

Buyer Concentration

Concentration is defined as the percentage of the commodity handled by the largest firms. For commodities with multiple pricing points (wheat, corn, etc.), concentration indicates an average concentration across pricing points. For commodities with a single pricing point, such as live cattle, only buyer concentration is considered. Buyer concentration is measured with the Delphi approach, and is expected to be negatively correlated with volume of trade and open interest.

Activeness of Cash Market

An active cash market will be one in which a large number of market participants quote bids and offers daily. We hypothesize that commodities without an active cash market will be unlikely to have a successful futures contract. The more active a market, the higher its ability to attract hedgers and speculators. Moreover, there is a positive correlation between activeness of a commodity's cash market and its volume of trade and open interest. This argument is supported by Black (1986, p. 46), who states, "A heavily traded market enables a market maker to absorb larger orders without much risk. It is probable, then, that the quoted spread will be good for larger volume than in a less active market." Peterson (1995); Lehman (1995); and Thompson (1995) all assert that an active cash market is required for a futures contract to be successful. The activeness of the cash market is measured with the Delphi approach.

The Delphi Approach

The Delphi approach is a group process that allows experts, located in different geographical areas, to contribute meaningfully in solving a given problem (Render and Stair, 1988; Stevenson, 1986). The problem in our case is to measure homogeneity, vertical integration, buyer concentration, and the activeness of the cash market. A scale of 1–10 was used to classify each commodity with respect to the four characteristics in question. For example, in the case of homogeneity, a value of 1 means the commodity considered is not homogeneous, whereas a value of 10 indicates it is.

A panel of 10 experts was selected. Each expert was called in advance and agreed to participate; however, only seven of the ten returned all the surveys. Anonymity of responses was preserved throughout the process to minimize the influence of dominant individuals on the outcome. The names of the seven experts are listed in N'Zue (1995).

The respondents were asked to classify a total of 26 commodities considering only the time period between January 1, 1987 and December 1, 1992. The mean and standard deviation of the estimates obtained from the first round were computed and provided to each participant. In the second round, the respondents were asked to reevaluate their estimates and to either change or justify their previous estimate if their estimate fell outside the mean +/− standard deviation interval.

This procedure was repeated three times, and the mean of the estimates of the third round was taken as the final measure for each characteristic. The responses given were short and often referred to respondents' knowledge of local markets. Responses changed little between the second and third rounds. Apparently the panelists were confident in their answers, or the reasons provided by others were unconvincing. The repeated procedure added some precision, but because answers remained relatively unchanged, it might have been just as effective to use a single survey and sample more experts. Surveying experts was the only practical way of gathering data that otherwise would have been unattainable. Such an approach does have some inherent weaknesses. Opinions of experts can diverge from reality. Most experts would know whether a given commodity had a futures market, and this could have influenced their responses. Because of these weaknesses, the research presented here should be considered indicative rather than definitive. (A shortened version of the survey is provided in the appendix.)

Data

Daily closing prices, cash prices, total volume, total open interest, and futures price changes for January 15, 1987 through December 31, 1992 were obtained for commodities with futures markets and used in computing estimates. Some commodities (e.g., lumber and orange juice) were surveyed but not included in the study since information on their trading volume, open interest, and daily closing prices was not available.

The data for traded commodities were created using *Continuous Contractor* from Technical Tools. Contracts were rolled over on the 15th of the month prior to delivery. Differences were taken before splicing so that no outliers were created on the rollover day. Cash price changes were also computed. The changes in futures and cash prices were used to compute weekly futures and cash price changes.

For nontraded commodities, monthly prices were collected from various issues of the U.S. Department of Agriculture's (USDA's) *Agricultural Situation and Outlook Report.* The data set includes agricultural commodities and livestock as described in table 1. Minneapolis wheat, cotton, and rice have futures markets, but are used only for out-of-sample prediction. For nontraded commodities, potatoes and orange juice contract sizes were used as proxies for contract sizes.

The Model

Our objective is to measure the importance of market and commodity characteristics in the success or failure of a futures market. Thus, an intuitive approach would consist of incorporating the set of characteristics (*a*)–(*g*), presented earlier, as explanatory variables for volume traded and open interest—our two measures of success. Our group of interest, however, consists of commodities with futures markets as well as commodities without futures markets. For the latter, neither trading volume nor open interest values can be observed. The available data are said to be incidentally truncated, so a selectivity model is the appropriate alternative.

The general specifications of the models for volume of commodity *i* in year *t* (VOL_{it}) and open interest of commodity *i* in year *t* (OI_{it}) are given, respectively, as:

$$(4) \qquad VOL_{it} = f\big(RR_{it},\ \ln(CLIQ_{it}),\ PVAR_{it},\ \ln(SIZE_{it}),\ VI_i,\ BCR_i,\ ACM_i,\ HOM_i\big)$$

and

(5) $$OI_{it} = f\big(RR_{it}, \ln(CLIQ_{it}), PVAR_{it}, \ln(SIZE_{it}), VI_i, BCR_i, ACM_i, HOM_i\big),$$

where the subscripts i and t refer to commodity and time, respectively. Note that this specification includes commodities with and without futures markets. RR_{it} is a measure of the risk reduction of the existing contract versus risk reduction available in the cross-hedge market, $CLIQ_{it}$ is a measure of the liquidity of the cross-hedge market, $PVAR_{it}$ is a measure of cash price variability, and $SIZE_{it}$ measures cash market size. VI_i measures vertical integration, BCR_i measures buyer concentration, ACM_i measures activeness of the cash market, and HOM_i measures commodity homogeneity.

Heckman (1976) suggested a two-step method for obtaining estimates of selection models. The first step in Heckman's procedure consists of using a probit model to explain the probability of a commodity having a futures market. This is the dependent variable. Independent variables for this model are the same as in (4) or (5) except for residual risk, which could not be calculated for commodities without futures markets. Parameters estimated in the probit regression are used to calculate the inverse Mill's ratio, which is employed in the second step (see Greene, 1997, p. 952, for a definition of the inverse Mill's ratio). The second step in Heckman's procedure consists of estimating equations for volume and open interest using data only on commodities with futures markets. Unlike (4) and (5), equations in step two are now conditional on the commodity being observable, and they include a new right-hand-side variable, a function of the inverse Mill's ratio calculated in the first step [see Davidson and MacKinnon (1993) or Greene (1997) for more details on selectivity models]. Parameter estimates obtained in this two-step procedure are used to estimate equations (4) and (5).

When estimating the probit equation in the first step, the variable for activeness of the cash market (*ACM*) provided a perfect fit. This is due to the fact that the ACM values assigned to commodities with a futures market were all higher than those ACM values assigned to any commodity without a futures market. The lowest value of ACM for a commodity with a futures market was 6, and the highest for one without a futures market was 4.17.[4] In other words, the model states that having an ACM value of at least 6 perfectly predicts this commodity has a futures market. Similarly, the model predicts any commodity with an ACM value of 4.17 or lower does not have a futures market. Consequently, there is no need to correct for selectivity bias since every commodity with a futures market would have the same inverse Mill's ratio. The selectivity model would generally have been estimated by adding a function of the inverse Mill's ratio as an explanatory variable in (4) and (5).

In this model, however, step two consists of estimating the volume and open interest equations with right-hand-side variables as in (4) or (5), using only observations

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[4] Orange juice and lumber were included in the survey, but were not included in the study because of a lack of adequate cash price data. Orange juice and lumber received ratings of 5.33 and 5.50, consistent with both having a futures market.

Table 2. Mean Across Years of Futures Trading Volume for Selected Commodities in Contracts per Week, and the Cross-Hedge Market for the Selected Commodities (January 1987 through December 1992)

Commodity	Weekly Average Volume	Weekly Average Open Interest	Cross-Hedge Market
Corn	198,910	990,050	Chicago wheat
Chicago wheat	59,516	264,410	Kansas City wheat
Kansas City wheat	25,003	131,330	Chicago wheat
Soybeans	191,010	542,900	Soybean meal
Soybean meal	17,928	65,599	Soybeans
Soybean oil	17,188	76,954	Soybeans
Live cattle	17,007	79,805	Feeder cattle
Feeder cattle	2,036	13,757	Live cattle
Live hogs	7,421	28,801	Live cattle
Pork bellies	4,393	12,888	Live hogs

for commodities with a futures market. Maximum-likelihood estimation accounting for multiplicative heteroskedasticity was used to obtain parameter estimates of equations (4) and (5). *PROC MIXED* of SAS (SAS Institute, Inc.) was used to estimate the models with the variance equation including RR_{it} and $PVAR_{it}$.

Empirical Results

Table 2 presents the mean across years of futures contracts trading volume, open interest of selected commodities in contracts per week, and the cross-hedge market for each selected commodity. Corn and soybeans have the highest weekly average volume and open interest. Feeder cattle and pork bellies have the lowest weekly average volume and open interest. The cross-hedge markets were selected based on the similarity of those markets to the own-hedge markets.

Table 3 presents the means of the survey variables for the selected commodities. None of the nontraded commodities have an active cash market. All commodities without futures were given a rank below 5 by the panel of experts used in the survey. Most of these commodities also have a very concentrated market.

Table 4 summarizes the correlation matrix of the surveyed variables. The correlation coefficients suggest that homogeneity is not highly correlated with the other variables surveyed. The correlation coefficients also suggest that vertical integration is highly correlated with both buyer concentration and cash market activeness. The negative correlation between buyer concentration and active cash market indicates the more buyers concentrated in a market, the less active that market will be.

As reported in the primary estimation results, activeness of the cash market is a necessary condition for the existence of futures contracts. When justifying the broiler contract, Aldinger (1991) considered mainly price variability, size of the cash market,

Table 3. Means of the Survey Data Obtained from the Delphi Approach for Homogeneity, Vertical Integration, Active Cash Market, and Buyer Concentration

Commodity	Homogeneity	Vertical Integration	Active Cash Market	Buyer Concentration
Kansas City wheat	8.17	2.83	8.67	3.50
Chicago wheat	8.17	2.83	8.67	3.50
Corn	7.83	2.67	8.67	3.00
Soybeans	7.33	3.00	8.83	3.43
Soybean meal	8.67	3.83	7.33	5.00
Soybean oil	8.50	4.83	6.50	5.00
Feeder cattle	4.17	3.17	6.17	4.57
Live cattle	4.83	5.17	6.33	6.57
Live hogs	5.67	5.33	6.67	6.43
Pork bellies	7.00	5.00	7.33	4.86
Minneapolis wheat	8.17	2.83	8.67	3.50
Cotton	7.33	3.17	7.50	6.33
Rice	7.83	4.83	6.00	5.86
Sunflower seed	6.83	4.00	3.17	6.00
Milk	8.00	6.17	3.00	4.29
Nonfat dry milk	9.33	4.00	3.00	6.00
Cheese	6.83	4.17	3.17	6.00
Apples	4.00	5.17	4.17	5.67
Pears	3.83	4.83	3.83	6.00
Tomatoes	4.00	5.00	3.83	5.33
Broilers	7.83	9.83	1.33	8.14
Eggs	7.50	9.00	2.00	8.33
Potatoes	4.67	4.67	3.50	6.17
Onions	4.33	4.17	3.50	5.17

Note: For each of the four measures, the average standard deviation of means across commodities is as follows: homogeneity (grading effectiveness) = 1.0, vertical integration = 0.8, cash market activeness = 0.9, and buyer concentration = 1.3.

Table 4. Correlation Matrix of the Survey Variables

	Homogeneity	Vertical Integration	Active Cash Market	Buyer Concentration
Homogeneity	1.000			
Vertical Integration	−0.483	1.000		
Active Cash Market	0.274	−0.705	1.000	
Buyer Concentration	−0.206	0.777	−0.725	1.000

Table 5. Maximum-Likelihood Parameter Estimates of the Futures Contract Volume Model

Mean Equation	Parameter Estimate	Standard Error
Intercept	174.87**	53.63
Price Variability (*PVAR*)	7.66*	3.87
Residual Risk (*RR*)	2.19	7.59
Size (ln(*SIZE*))	34.88**	4.31
Liquidity (ln(*CLIQ*))	−29.06**	5.14
Homogeneity (*HOM*)	19.64**	4.96
Vertical Integration (*VI*)	42.79**	15.90
Buyer Concentration (*BCR*)	−76.98**	14.56

Notes: Single and double asterisks (*) denote coefficients significant at the 10% and 5% probability levels, respectively. Total volume is in thousand units. Multiplicative heteroskedasticity is assumed. The variance is assumed to be a function of price variation and residual risk.

and contract specifications. Considering the activeness of the cash market, as was done here, could have predicted the broiler contract was doomed to fail.

Since the *ACM* variable was high for all commodities with a futures market, the variable was very similar for all of the futures markets. Because of this lack of variability, its coefficient could not be estimated precisely, and thus it was excluded from the regression equation. The interpretation of the resulting model is: An active cash market is a necessary condition for the existence of a futures market; however, once the futures market exists, other market characteristics become more relevant to the success of the market. Table 5 presents the maximum-likelihood parameter estimates for the volume equation without the activeness of the cash market variable. These estimates suggest that cash price volatility, cash market size, liquidity cost, homogeneity, and buyer concentration contribute significantly to explaining futures contract volume.

The parameter estimates of the open interest models are provided in table 6. Based on the estimation results, cash market size, liquidity cost, homogeneity, and buyer concentration contribute significantly to futures contract open interest. The homogeneity variable has a consistently positive parameter estimate for both volume and open interest. That is, a commodity's grading effectiveness is important to the success of its underlying futures contract. This may explain why commodities such as tobacco and tea are not traded. In both the volume and open interest models, the parameter estimates of buyer concentration are consistently negative, indicating futures contracts may fail (or have problems) when markets become more concentrated.

Table 6. Maximum-Likelihood Parameter Estimates of the Futures Contract Open Interest Model

Mean Equation	Parameter Estimate	Standard Error
Intercept	811.61	253.11
Price Variability (*PVAR*)	32.70*	16.64
Residual Risk (*RR*)	−11.02	23.59
Size (ln(*SIZE*))	162.90**	19.06
Liquidity (ln(*CLIQ*))	−120.32**	24.26
Homogeneity (*HOM*)	72.44**	24.36
Vertical Integration (*VI*)	238.52**	72.87
Buyer Concentration (*BCR*)	−392.38**	68.06

Notes: Single and double asterisks (*) denote coefficients significant at the 10% and 5% probability levels, respectively. Total open interest is in thousand units. Multiplicative heteroskedasticity is assumed. The variance is assumed to be a function of price variation and residual risk.

Concluding Comments

Cash market activeness is the key to the existence of futures contracts. Indeed, the active cash market variable perfectly predicted whether a commodity had a futures market or not. Thus an active cash market is required for the success of a futures contract. The changing structure (i.e., buyer concentration, vertical integration) of the market for some commodities (livestock, for example) will create a decline in futures contract volume and open interest, and may eventually cause these contracts to fail.

An implication of this research for countries considering the development of their own futures markets is that unless an active cash market exists, resources invested in developing futures markets will be wasted. Moreover, those countries should first direct their efforts toward developing active cash markets and effective grading systems, and then consider the possibility of developing futures markets.

These implications also apply to commodity exchanges in identifying new futures contracts. The model used here would have predicted that the broiler futures contract was doomed to fail. None of the nontraded commodities considered are likely to have a successful contract, since none of them have an active cash market. For those commodities with a cash market active enough to support a futures market, other factors such as cash market size, liquidity cost, market structure, and grading system effectiveness help determine volume and open interest.

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Appendix: Shortened Version of Surveys Used to Measure the Four Commodity Characteristics by the Delphi Approach

Homogeneity (*Grading Effectiveness*)

The following survey uses the Delphi approach to obtain a cardinal measure of the effectiveness of the grading system. A grading system is effective if the commodity is homogeneous or if grades adequately explain differences in value. A scale of 1–10 is used to rate the degree of homogeneity. A ranking of 10 should indicate that the commodity considered is very homogeneous, and a ranking of 1 should indicate that the commodity considered is not homogeneous. Please circle the number (only one) you think best describes the degree of homogeneity of the commodities below. In your response please consider only the time period from January 1, 1987 through December 31, 1992.

	Scale (1–10)									
Commodity [a]	Lowest	-----	-----	-----	-----	-----	-----	-----	-->	Highest
Soft Red Winter Wheat	1	2	3	4	5	6	7	8	9	10
Hard Red Winter Wheat	1	2	3	4	5	6	7	8	9	10
Corn	1	2	3	4	5	6	7	8	9	10
Feeder Cattle	1	2	3	4	5	6	7	8	9	10
Live Cattle	1	2	3	4	5	6	7	8	9	10
Live Hogs	1	2	3	4	5	6	7	8	9	10
Pork Bellies	1	2	3	4	5	6	7	8	9	10

[a] More commodities were used in the survey than those shown here.

The remaining three surveys were similar in design. The definitions used in the other surveys are provided below.

Activeness of Cash Market

The following survey uses the Delphi approach to obtain a cardinal measure of the effectiveness of the activeness of the cash market for a given commodity. The activeness of a market is determined by the percentage of market participants quoting bids and offers, and the frequency with which they are quoted. An active cash market is one in which market participants quote bids and offers daily. A less active cash market is one in which fewer participants quote bids and offers, or bids and offers are quoted less frequently. A scale of 1–10 is used to rate the activeness of the cash market of a given commodity. A ranking of 10 should indicate that the commodity considered has a very active cash market, and a ranking of 1 should indicate that the commodity considered does not have an active cash market.

Vertical Integration

The following survey uses the Delphi approach to obtain a cardinal measure of the effectiveness of vertical integration across one or several pricing points. Vertical integration includes both ownership and contract integration. The degree of vertical integration depends on the number of pricing points and the percentage of commodity which is priced at each point. Consider only pricing points where the form of the commodity is not changed. Some commodities (live cattle, for example) have only one pricing point where form is not changed (from feedlot to packer), whereas others (wheat, corn, etc.)

have multiple pricing points where their form is not changed. The more pricing points without form being changed, then the lower should be the measure of vertical integration. For a commodity with one pricing point, all of the commodity freely priced at that pricing point should have the same measure of vertical integration as a commodity with two pricing points and half of the commodity at each pricing point being transferred through some form of vertical integration.

Buyer Concentration

The following survey uses the Delphi approach to obtain a cardinal measure of concentration of firms at the pricing points for a given commodity. Some commodities (live cattle, for example) have a single pricing point, whereas others (wheat, corn, etc.) have multiple pricing points. Concentration is defined as the percentage of the commodity handled by the largest firms. For commodities with a single pricing point, consider only buyer concentration. For commodities with multiple pricing points, concentration should indicate an average concentration across all buyers. A scale of 1–10 is used to rate the degree of concentration of the market of a given commodity. A ranking of 10 should indicate that the commodity considered has a very concentrated market (i.e., a large number of firms at all the pricing points).