Relationship of Rotterdam Peanut Prices to U. S. Peanut Production[1]

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ABSTRACT

In the 1980s exports of peanuts (*Arachis hypogaea* L.) from the United States ranged from 228,000 mt to 473,000 mt making up nearly 20% of the total U. S. production. The European Community was the largest importer of U. S. peanuts with Argentina and China the major U. S. competitors for peanut imports. Edible peanut prices quoted in Rotterdam are recognized as world reference prices in the peanut trade. From 1978 to 1990 monthly prices of U. S. 40/50 shelled peanuts in Rotterdam ranged from \$600/mt to \$2,100/mt. A change of \$100/mt in the Rotterdam price results in an estimated change in the value of U. S. farmers' stock peanuts of \$66/mt. Rotterdam prices are sensitive to monthly estimates of peanut production in the southeastern U. S. There is a critical southeast production threshold of about 1.0 mil mt, below which Rotterdam prices increase \$125/mt for a decrease of 50,000 mt in production. Above the level of production, the price changed \$51/mt for each 50,000 mt change in production. The Rotterdam price is an important barometer for domestic prices for additional peanuts produced by U. S. peanut farmers.

Key Words: Peanut prices, peanut production, world groundnut prices.

In the 1980s the United States was the largest exporter of peanuts (*Arachis hypogaea* L.) in the world. Nearly 20% of the peanuts produced in the United States are exported. However, export quantities in the 1980s have ranged widely from 228,000 mt to 473,000 mt. The European Community (EC), led by Netherlands and the U.K., is the largest importer of peanuts of any world area (3). It is also the world's largest importer of U. S. peanuts. Argentina and China are major competitors of the U.S. for peanut imports into the EC.

Edible peanut prices quoted in the Rotterdam market are recognized as the world reference price in the peanut trade. The Rotterdam price is the barometer for prices that the peanut marketers in the United States pay farmers for the additional peanuts that they produce and sell. Since 1978 monthly prices for U. S. 40/50 shelled runner peanuts have varied from \$600/mt in 1987 to more than \$2,100/mt in 1990 (5). However, the contract price offered to peanut farmers for additional peanuts is usually quite stable prior to the first official production estimates in early August, but prices may become highly variable as the crop production becomes a reality. As an example, the following remarks were made "In the United States, the groundnut market was affected by the disastrous crop, particularly in the south eastern region... News of the the bad American crop led to uncontrolled buying by many traders to cover their requirements... the expectation of a drop in price might lead to a fluctuating market with a weak undertone" (4).

Peanut farmers must make early crop-year decisions on the acreage of additional peanuts to plant, and if and when to contract them. If farmers don't contract additionals, they must place them with the Commodity Credit Corporation (CCC) at harvest for which the farmer receives the support price for additionals. Later the farmer receives profits, if any, that may be obtained by the marketing of the peanuts by the peanut growers association acting as the marketing agent for the sale of the CCC peanuts (2).

In order for peanut farmers and marketers of U.S. peanuts for exports to make improved decisions regarding contracting and market timing for additional peanuts, factors associated with and explaining price variation for additional peanuts may be helpful information. Prices in Rotterdam are sensitive to monthly estimates of peanut production in the United States, especially to production in the southeastern region. Also, prices for Argentina and China peanut imports into the EC follow rather closely U.S. prices. A determination of the critical production threshold from which peanut prices change substantially may prove beneficial to peanut farmers, buyer-shellers, and exporters.

The objectives of this paper were to 1) estimate the relationship of Rotterdam prices to estimated U.S. peanut production, 2) determine the peanut production level that is a critical threshold that substantially affects Rotterdam peanut price relationships in Rotterdam among major importing countries.

Data and Methods

Data Source

Price data were obtained from The Public Ledger's Commodity Week and the Foreign Agricultural Service, USDA. The data included weekly prices quoted in Rotterdam for shelled edible 40/50 runners for United States and Argentina and 40/50 shantung hsu-ji peanuts from China. Peanut production estimates for the southeastern U.S. (Alabama, Florida, and Georgia) were obtained from reports issued by the National Agricultural Statistics Service, USDA. The estimates of peanut production are announced the 10th of each month beginning in August with final production data issued in February. Therefore, production estimates were available for seven months of each marketing year beginning in August.

Data were obtained for the U.S. for the marketing years beginning in 1978 and continuing through 1991. Argentina and China price data were obtained for the 1984 through 1991 marketing years.

Conceptual Supply-Demand Relationship

The hectares of additional peanuts planted for the export market varies from year-to-year. Many peanut farmers plant some extra peanuts above those hectares needed to produce their quota to assure that they produce their quota. Some farmers plant additional peanuts based on potential contract prices offered and received, and some farmers plant additional peanuts based on the potential profits that they may receive by placing them with the CCC. Thus, the supply of additionals available for export is dependent on the hectares planted and the potential yield.

On the demand side of the equation, those in the peanut trade estimate that there is a potential export market for about 325,000 mt of U.S. farmers' stock peanuts. To supply that market, U.S. peanut buyer-shellers have offered contract prices to farmers in the range of \$300 to \$430/mt, or about \$700 to \$880/mt shelled in Rotterdam. Prior to the 1991 marketing year, contracting had to be completed by July 31. These contracted peanuts may be forward contracted into the export market or they may be held by peanut industry exporters.

The price forecasting equation is price dependent and includes the

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supply-demand relationships that result in equilibrium prices at a point in time. With a predetermined export demand and a domestic supply that may vary, a substantial change in the peanut supply at a certain point in time will result in a change in price on the opposite direction that is significantly more percentage wise than the change in supply. From a supply-demand conceptual relationship, there is a rather steep slope for some given supply levels, and then it becomes relatively flat, that is, beyond some point of supply there is little change in prices. It is the relationship that is examined in this analysis.

Statistical Analysis

Regression analysis was used to determine the relationship of the Rotterdam price to peanut production estimates in the southeast. A graphical examination of the data indicated that the price-production relationship changes substantially at distinct production levels (Fig. 1). Thus, a linear spline function was used to model the relationship. Statistically, a linear spline function captures the points where the slope of the regression line changes. However, the points of structural change (i.e., distinct production levels) are not known a priori but are required for the spline function estimation. The points were determined statistically using the cumulative sums of squares (CUMSUMSQ) test (1). In order to examine the adequacy of the spline function to model the price-quantity relationship, the linear and quadratic models were also estimated. The results from these three approaches were compared based on the price impacts and forecasting ability. The mean absolute percent error (MAPE) and Theil's inequality coefficient (U_2) were used to assess the forecasting ability. Regression analysis was used to estimate the relationship of other countries' prices to U. S. prices.

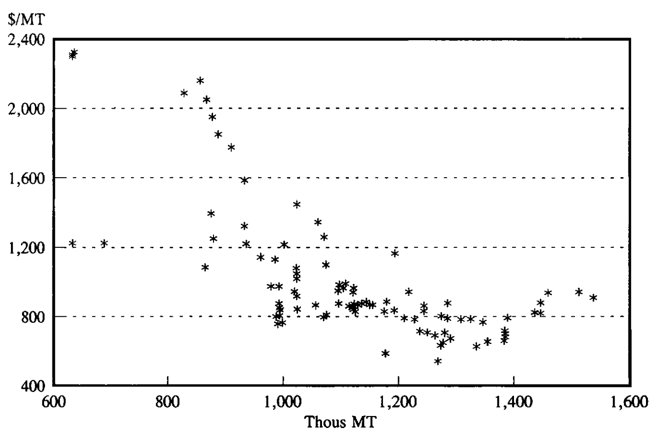

Fig. 1. Relationship of U.S. peanut prices in Rotterdam to production in the southeastern U.S., monthly, August to February 1978 to 1991.

Results and Discussion

In terms of farmers' stock peanut value in the U.S., a $100 mt change in the Rotterdam price for U.S. peanuts results in an estimated $66 mt change in the value of farmers' stock peanuts (FSP) (Table 1). Thus, the price of U.S. peanuts is a very important determining factor of price expectations for additional peanuts in the U.S.

Observations of price variation in conjunction with estimates of peanut production in the southeastern U.S. revealed that prices moved in the opposite direction of production estimates (Fig. 2). The lower than normal peanut production years, for example 1980, 1983, 1986, and 1990, resulted in substantial increases in shelled peanuts prices in Rotterdam.

The price and production relationship in Fig. 1 shows a curvilinear association over the range of the data. The data portray a steep increase in price at a production level of less than 1.0 mil mt, a lessor change in price between 1.0 mil mt and 1.134 mil mt production, and a small change in a price at production levels above 1.134 mil mt.

Table 1. Shelled peanut prices in Rotterdam and estimated farmers' stock peanut prices in the United States.

Rotterdam price U.S. shelled	Farmers' stock price U.S.[a]
$/mt	
2000	1130
1500	800
1000	471
900	405
800	338
700	272

Source: (6).
[a]FSP = (Rotterdam price mt - $287/mt for transportation and shelling) x (.66) culling and shell loss.

The price and production relationship estimated on a linear based equation showed that for each 100,000 mt change in the production estimate, the U.S. Rotterdam price changed about $156/mt in the opposite direction (Table 2). Since the data portrayed a curvilinear association, the relationship was also estimated using a quadratic equation. For each 100,000 mt change in production, the price changed in the opposite direction but in a decreasing amount of change as production increased. For example, at 900,000 mt of production the estimated price was $1,330/mt; at 1,000,000 mt the price was $1,135 mt or $195 less; and at 1,100,000 mt the price was $972/mt or $163 less. The quadratic equation was an improvement over the linear one in terms of goodness of fit. However, the equation indicated that prices would increase after production reached 1,546,000 mt which is not an expected direction.

A third type of equation (a spline function) was used to estimate the points where the price and quantity relationship changes substantially. The CUMSUMSQ test was used to determine statistically the point of structural change. The

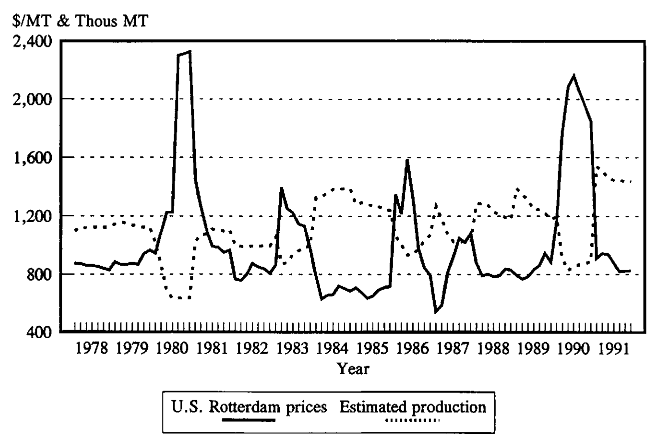

Fig. 2. Estimated peanut production in the southeastern United States and U.S. prices in Rotterdam, monthly, August to February, 1978 to 1991.

Table 2. Estimated regression coefficients explaining the relationship of the U.S. price for shelled 40/50 runner peanuts in Rotterdam and estimated production in the southeastern United States.

Equation type[a]	Constant	PROD[b]	PRODSQ[c]	PRODLI[d]	AR(1)[e]	R^2	MAPE	Theil U_2
Linear	2765.89 (10.58)[g]	-1.57 (-7.08)			-.86 (-18.51)	.87	8.46%	.111
Quadratic	4554.00 (5.98)	-5.05 (-3.57)	.0016 (2.51)		-.81 (-14.88)	.88	5.08%	.121
Spline[f]	3575.48 (8.88)	-2.49 (-5.92)		-1.01 (-3.55)	-.82 (-15.26)	.88	6.28%	.108

[a]The mean price for U.S. 40/50 runner peanuts in Rotterdam was $1015.61/mt and the mean production was 1,116,700 mt.

[b]PROD (production) is in thousand mt of monthly estimated production.

[c]Production squared.

[d]Production limits.

[e]AR(1) is the first order autoregressive estimated coefficient.

[f]Spline function limits on production: PROD ≤ 997,732 mt; PRODLI = PROD - 997,720 mt.

[g]Values in parenthesis are the t-values for the coefficients.

test indicated only one break point at 997,700 mt. At the production level below 997,700 mt, an estimated 50,000 mt production change would cause the estimated price to change in the opposite direction at about $125/mt (Table 2). For production above 997,700 mt, an estimated 50,000 mt production change would cause the estimated price to change in the opposite direction about $51/mt. This indicates that if the southeastern production estimates are about 1.0 mil mt or more, there are small changes in the Rotterdam price. This implies that there would be little price movement for domestic additionals.

To measure the forecasting ability, prices for the seven months for the 1991 marketing year were predicted. The two forecasting measures. MAPE and Theil U_2, gave conflicting results. However, both measures support the assumption that this modeling approach is superior to a "naive" model in forecasting the world peanut price. In terms of the MAPE measure, the quadratic model had the lowest forecast error while the spline model was second. In contrast, for the Theil U_2, the spline model was the best while the quadratic was the worst relatively for price prediction.

To peanut farmers and buyers, the Rotterdam price largely establishes the range of prices that will be paid for additional peanuts. Contracts offered to farmers by peanut buyers from January to August have ranged from $330 to $441/mt in the 1980s and early 1990s. This reflects a range of $800 to $950/mt in Rotterdam. With the new contract deadline of September 15, there is an opportunity to delay contracting until the first official crop estimates are available in August and September. However, if the expected peanut crop in the southeast is a large one (i.e., above about 1.0 mil mt), as in 1991, contracts may not be offered. But, if the first crop estimate indicates a short crop, prices would be expected to increase substantially providing the opportunity to farmers to benefit.

The sensitivity of price changes to production estimates was further shown by dividing the production years into those years when production was equal to or less than 1.0 mil mt and those years when production exceeded 1.0 mil mt. In the smaller production years, a 1.0% change in production resulted in a price change of 1.35% in the opposite direction. In the larger production years, a 1.0% change in production resulted in a price change of 0.78%.

In addition to the important relationship of the Rotterdam price for U.S. peanuts to southeastern peanut production, peanut buyers and exporters need information regarding the movement of prices for peanuts exported by other countries relative to U.S. prices. A linear regression of the price relationships indicated that a change of $100/mt in the Rotterdam price for U.S. peanuts resulted in a $60/mt change in the Chinese price and a $67/mt change in the Argentine price in the same direction as of the price for U.S. peanuts. Indirectly, the production of peanuts in the southeastern U.S. is quite important to the export market prices for peanuts from other countries.

Conclusions

Prices for U.S. peanuts in Rotterdam are highly related to peanut production estimates in the southeastern United States. There is a close relationship between U.S., Argentina, and Chinese peanut prices in Rotterdam with competing countries prices moving in the same direction as U.S. prices. Therefore, when peanut production in the southeastern U.S. is lower than normal, all prices move upward rather sharply in Rotterdam.

There is a strong indication that there is one critical peanut production threshold level that impacts on Rotterdam prices. When production estimates are lower than 1.0 mil mt, prices increase sharply, but when estimates are above 1.0 mil mt price changes are more moderate.

With the new contract deadline of September 15, the peanut industry should be in a position to estimate more closely the expected prices in the Rotterdam market. The production threshold values estimated in this analysis should provide some guidelines for farmer and buyer decision making in regard to contract offers for additional peanuts.

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