FACTORS AFFECTING THE FARM PRICE OF TART CHERRIES

by

Elisa A. Elberg, William G. Tomek

and B. A. Dominick, Jr.

April 1970 No. 6

FACTORS AFFECTING THE FARM PRICE OF TART CHERRIES*/

Elisa A. Elberg, William G. Tomek and B. A. Dominick, Jr.

This paper summarizes part of a larger study of farm prices and farm-wholesale marketing margins for red tart cherries [1]. The sharp year-to-year changes in production and the corresponding changes in price are a well known aspect of the cherry industry. In this context, there is a continuing interest in assembling information about factors influencing price as a basis for understanding price changes, for forecasting prices, and for negotiating prices between growers and processors.

Ricks and Bixby [see 2] have provided substantial quantitative analysis of red tart cherry prices, particularly at the wholesale level. Our research is intended as a complement to their thorough and continuing research. The emphasis in this paper is on a summary of an empirical analysis of farm prices. The nature of margins between the farm and wholesale level is very briefly discussed.

Analysis of Farm Prices

The model and results

This paper describes equations devoted to explaining two farm-level prices: for Michigan and for the United States as a whole. In each equation, price is made a function of a measure of total production, carryover stocks of canned and frozen cherries, and consumers' income. These variables are adjusted for population growth by putting them on a per capita basis. In sum, the explanatory variables attempt to measure changes in production and changes in demand from year to year.

In specifying a relationship, the analyst must make many choices; a few are summarized here. The data consist of observations on relevant variables for the crop years 1955-1968. A straight-line relationship among the variables, rather than a curved relationship, seemed to fit best. While many definitions of production are available, we use the final estimate of regional production for five Great Lakes States and the final estimate of national production. Since production in Michigan dominates the

---

*/ Paper prepared for the Red Tart Cherry Research Conference, East Lansing, Michigan, April 15 and 16, 1970.

national total, alternate definitions of production by region or nation have little influence on results. Another question, however, is the effect of possible pre-harvest error in estimating crop size on price. One might argue that price is more closely related to early season estimates of crop size than to final estimates made after harvest. But, the interest of this study is in the economic relationship defined by the final estimates of price and quantity.

Among the equations estimated in our price analysis are the following two:

(1) $P = -6.022 - 4.921\,Q - 11.555\,S + .012\,Y.$

$R^2 = .94.$

(2) $P_M = -7.390 - 5.105\,Q_R - 1.639\,S + .012\,Y.$

$R^2 = .94.$

where P = season average price for tart cherries, farm level, United States, cents per pound.

P_M = season average price for tart cherries, farm level, Michigan, cents per pound.

Q = final estimate of tart cherry production, United States, pounds per person.

Q_R = final estimate of tart cherry production, five Great Lakes States, pounds per person.

S = carryover (inventory) of canned and frozen cherries, United States, July 1, pounds per person.

Y = real disposable income (nominal dollars deflated by Consumer Price Index), United States, dollars per capita.

All coefficients in both equations are "statistically significant." The coefficients in both equations are similar in size; equation (2) may be interpreted as follows. A one pound per person (based on U.S. population) change in production in the Lakes States is inversely associated with a 5.1 cent per pound change in the Michigan farm price, net of the influence of inventories and consumer income. A change in carryover from one year to the next of one pound per person is inversely related to an 11.6 cents per pound change in price, other factors constant.1/ And, an

1/ A one pound per capita change implies, of course, about a 200 million pound (100 thousand ton) change in total. Such a change in production is possible though not probable. Clearly a one pound per capita change in carryover is not possible. Thus, while the carryover variable has a larger coefficient than the production variable, it does not follow that changes in carryover have a larger impact on price than changes in crop size.

increase in real disposable income of $100 per capita is estimated to increase the Michigan farm price of cherries about 1.2 cents per pound.

To illustrate, if production increased 0.5 pound per capita, if carryover decreased 0.1 pound per capita, and if real incomes increased $50 per capita, then the average farm price would be expected to decrease almost one cent per pound. The production increase decreases price 2.6 cents, the carryover decline increases price 1.2 cents, and the income increase increases price 0.6 cent. The estimated net effect is a price decline of 0.8 cent per pound.

The coefficient of determination (R^2) estimates that 94 percent of the variation of Michigan farm price is associated with the variation in the three "explanatory" variables. Six percent of the variation is unexplained.

Evaluation and applications

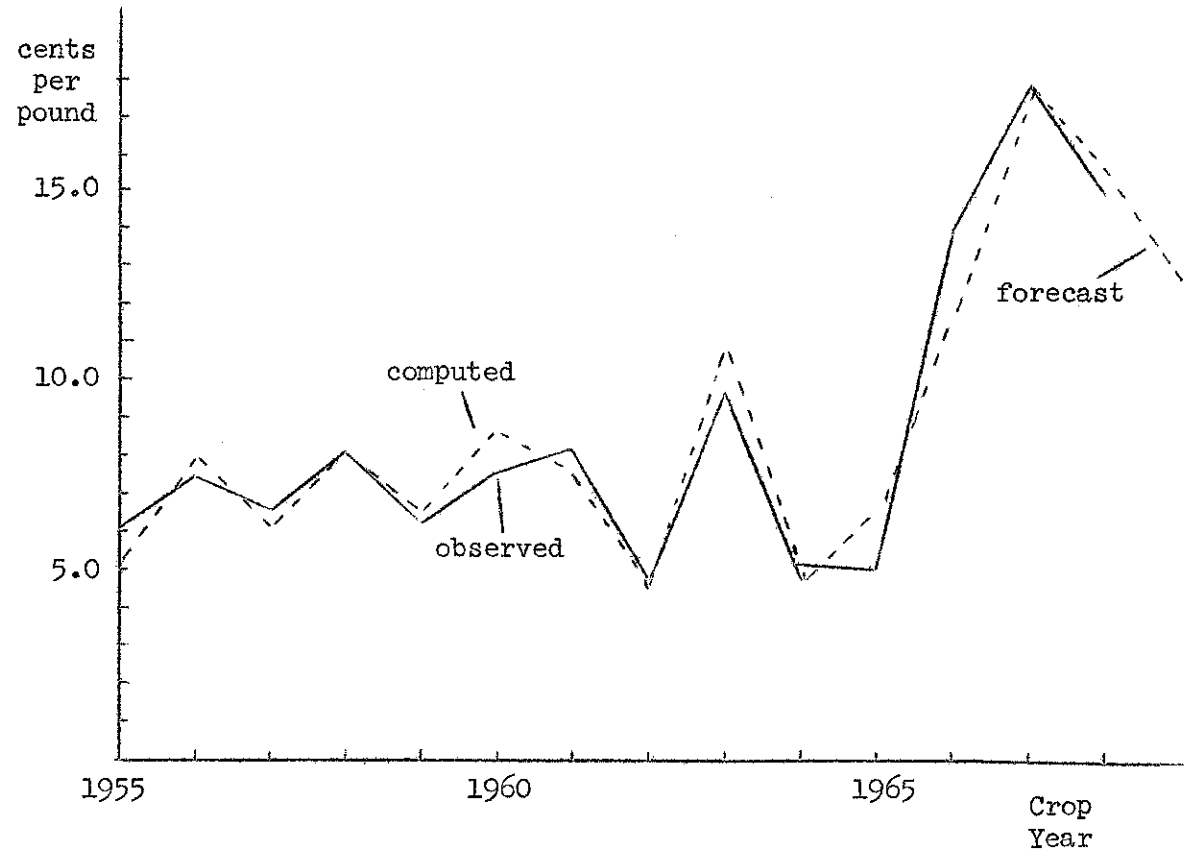
At the average level of prices and production for the 1955-1968 period,[2/] a one percent change in production is estimated as resulting in 0.8 percent change in farm price (the other factors constant). At this point in the "middle" of the estimated relation, an increase in production results in a less than corresponding decrease in price and hence total revenue to growers increases. In economist's terms, the farm-level demand is price elastic, and with an elastic demand a decrease in price increases total revenue. With a straight-line relationship, however, demand becomes inelastic as quantity increases and price decreases. Thus, one cannot assume that continuous growth in production will increase total revenue to growers.

The relationship between the actual average price reported for Michigan growers and that computed from equation (2) is shown in figure 1. The two series tend to move up and down together; however, from 1960 to 1961 and from 1964 to 1965, the observed and computed prices move in opposite directions. If our emphasis is on price forecasting, then any inability to capture changes in direction is of concern.

On July 1, 1969, it would have been possible to use equation (2) to forecast the average Michigan price or to use the available economic information as a basis for price negotiation. The July 1 estimate of Great Lakes States' production was 291 million pounds or 1.43 pounds per capita. Carryover on July 1 was 0.18 pound per capita, and real income was projected to increase about 2.5 percent. With this information, the computed Michigan farm price was projected to be 12.8 cents per pound (figure 1), down from 15.0 cents per pound in 1968. The actual average price paid Michigan growers was somewhat over 7 cents.

2/ The average price was 8.7 cents and the average production was 1.4 pounds per capita in 1955-1968. The computed flexibility is $F = (-5.1)(\frac{1.4}{8.7}) = -.8$.

Figure 1. Prices of Red Tart Cherries in Michigan, Observed and Computed,[a] 1955-1968



a/ see text

The equation captured the direction of change in price but underestimated the decline by about 5.5 cents, a substantial error. Several plausible explanations exist for the error. The estimated or assumed values of the explanatory variables may have been incorrect. Perhaps the growth in real income was overestimated. Second, the relationship is an estimate based on historical data; it may be an incorrect estimate. Also, the relationship does not proport to account for all annual price variations. In addition, prices were high in the 1966-1968 period, and the large increase in crop size relative to recent experience may have caused an overcompensation by buyers; in other words, one might argue that the 1969 crop was underpriced relative to the "true" economic relationship. Price forecasting equations, such as those discussed here, cannot give absolutely precise forecasts, but they can provide estimates based on historical relationships and perhaps provide a starting point for price negotiations.

Marketing Margins

Two wholesale-farm marketing margins were computed using the wholesale prices of canned and of frozen fruit. These prices were transformed to an equivalent farm weight basis. Thus, the differences between the transformed wholesale prices and the corresponding farm prices provide a measure of a margin in cents per pound of cherries marketed at the farm level.

Time does not permit a comprehensive discussion of the analysis; we briefly review some highlights. First, an analysis of the margins for the 1953-1968 crop years suggests that the margin for canned tart cherries is a constant seemingly independent of crop size.3/ That is, a one cent change in farm price is associated with a one cent change in the wholesale price, and the estimated difference is approximately 5.9 cents per pound (farm weight marketed). In contrast, the margin for frozen fruit apparently is not a constant. A one cent change in farm price is associated with a 1.4 cents change in wholesale price of frozen cherries.4/ Hence, an increase in crop size, which implies a lower farm price, also implies a narrowing of the marketing margin. Conversely, a decrease in crop size results in a widening of the margin, other factors constant.

3/ $\overline{P_C = 5.889 + 1.272 P_F}$, where P_C = wholesale price of canned cherries (cents per pound) and P_F = farm price (cents per pound). $r^2 = 80$. The hypothesis that the "true" slope coefficient relating prices equals one is accepted.

4/ $P_R = 3.281 + 1.401 P_F$, where P_R = wholesale price of frozen cherries and P_F = farm price. $r^2 = .86$. The hypothesis that the "true" coefficient relating prices equals one is rejected. The margin $M = P_R - P_F$. Thus, $M = 3.281 + .4 P_F$.

A second part of our study of margins suggests that wholesale-farm price differences are widening with the passage of time. The estimated trend in the margin is about 0.5 cent per pound per year, net of other factors, both for frozen and canned cherries. The increasing margins is probably explained by increasing per unit costs of handling and processing red tart cherries. The analysis, however, doesn't explain "why" margins have widened; it simply describes the increases over the past 15 years, net of the influence of other variables.

Conclusions

The research described above provides a basis for understanding changes in farm prices and marketing margins. This knowledge, in turn, may be helpful in forecasting price and in providing a starting point for negotiations. This analysis, however, must be treated as preliminary in nature because of several unanswered puzzles. One is the inability of the analysis to accurately forecast the 1969 price. A second question is whether or not farm-level demand is "really" price elastic; if so, then larger crops -- within limits -- should increase total revenue for growers.

References

[1] Elisa Angelica Rojas de Elberg, An Analysis of Farm-Level Prices and Marketing Margins for Tart Cherries, unpublished M.S. thesis, Cornell Univ., 1970.

[2] Donald J. Ricks and Daniel Bixby, Economic Relationships in Red Tart Cherry Marketing, 1955-1968, Mich. State Univ. Agr. Econ. Report No. 142, June 1969.