

CONSULTING PROJECT

Estimating Industry Demand for Fresh Market Carrots

The market for carrots is comprised of two segments: *fresh market* carrots, which have excellent, uniform color and a small core, and *processing* carrots, which are larger than fresh market carrots but still have good flavor, color, and sweetness. Annual data for the years 1983–2000 in the fresh market segment of the carrot industry are presented below. Q is total annual fresh market carrot production (measured in thousands of hundred weight units, which are 100,000 pound units), P is average annual real price per hundred weight of fresh market carrots (in constant 1991 dollars),¹ and W is a weather index based on temperature and rainfall (W varies directly with conduciveness of weather for growing carrots). To account for the increasing popularity of carrots during the sample period, the time variable t is added to the demand equation to reflect growing popularity of carrots. The production data do not account for imports and exports of carrots. During the period of this sample, however, net exports of carrots (exports minus imports) were quite small in every year.

t	Q	P	W
1983	7,242	10.03	100.0
1984	8,220	6.62	108.3
1985	8,886	10.47	109.5
1986	9,300	12.59	96.3
1987	9,593	11.54	98.3
1988	10,758	10.56	101.2
1989	10,356	13.88	101.5
1990	11,322	14.01	100.6
1991	11,741	14.71	111.8
1992	12,486	13.15	109.0
1993	13,927	13.16	112.3
1994	15,072	16.14	115.4
1995	14,969	18.06	107.2
1996	14,163	19.45	90.5
1997	15,589	19.65	92.5
1998	16,192	17.29	95.6
1999	15,479	19.22	94.8
2000	17,992	19.24	98.7

Consider the following specification of empirical demand and supply functions in the fresh market segment of the carrot industry:²

$$Q_d = a + bP + ct$$

$$Q_s = d + eP + fW$$

- Should the ordinary least-squares (OLS) method or the two-stage least-squares method (2SLS) method be employed to estimate market demand for carrots? Explain briefly.
- Which variables are endogenous variables in the system? Which variables are exogenous? For the model specified above, is the demand for fresh market carrots identified? Explain why or why not?

¹ Since carrots are planted and harvested year-round, carrot prices are computed as average prices for each year.

² Typically farmers make production decisions for the current year using the previous year's crop prices (or a weighted-average of several previous years of crop prices). Since carrots are planted year-round, it is not unreasonable to specify *current* annual production as a function of *current* average price of carrots.

- c. Using statistical software, estimate the parameters of the empirical demand function specified in part *a*. Write the estimated industry demand equation for carrots.
- d. Are the estimated slope parameters of demand statistically significant at the 15 percent level of significance? Are the algebraic signs of the parameter estimates \hat{b} and \hat{c} reasonable? Explain.
- e. Would you expect the demand for carrots to be elastic or inelastic when measured at the average price over the period of the sample? (Hint: Consider the discussion in Chapter 3 concerning the factors that influence demand elasticity.)
- f. Compute the price elasticity of demand for carrots measured at the sample mean values of price (P), quantity (Q), and time (t). Is the demand for fresh market carrots elastic, inelastic, or unitary elastic when measured at the sample mean values of P , Q , and t ?
- g. By approximately what percentage amount would the price of carrots have to fall in order for quantity demanded to increase by 10 percent?
- h. Explain, in quantitative terms, the meaning of the estimate of the slope parameter on t .