Chapter 16

MARKETING MARGINS: EMPIRICAL ANALYSIS

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Abstract

The marketing margin, characterized as some function of the difference between retail and farm price of a given farm product, is intended to measure the cost of providing marketing services. The margin is influenced primarily by shifts in retail demand, farm supply, and marketing input prices. But other factors also can be important, including time lags in supply and demand, market power, risk, technical change, quality, and spatial considerations. Topics for future research include improved specifications for margins and demand and supply shifters, retail-to-farm price transmission of retail demand changes, and impacts of vertical integration and policy interventions.

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1. Introduction

Few areas of agricultural economics have received as much public scrutiny as marketing margins, yet there is little consensus on the sources of changes in margins and whether such changes over time have led to a deterioration or improvement in the welfare of farmers and consumers. The purpose of this chapter is to summarize the current state of knowledge on marketing margins in agricultural economics, and to indicate areas that show promise for future research.

The marketing margin, or the farm-to-retail price spread, is the difference between the farm value and retail price. It represents payments for all assembling, processing, transporting, and retailing charges added to farm products [Elitzak (1996)]. Table 1 shows the declining trend over time in the farmer's share of consumer expenditures for domestically produced food products. Figure 1 shows the components of the food marketing bill in the United States for 1994. Aside from the raw farm product, labor and packaging are the major components of food marketing. Other factors, including before tax profits, account individually for only a small share of the retail food dollar.

Among the questions often asked about marketing margins are the following: Are marketing margins too large? Why are margins different among products? How have margins changed over time? Are margins scale-dependent, i.e., do they vary systematically with the quantity handled or marketed? Are margins determined via markup pricing? What is the incidence of marketing costs on retail prices and farm prices? How quickly are farm prices transmitted to the retail level, and how quickly are retail price changes transmitted to farmers? A long-standing issue in agriculture has been a mistrust

\[
\begin{array}{|c|c|}
\hline
\text{Year} & \text{Share (\%)} \\
\hline
1950 & 41 \\
1955 & 35 \\
1960 & 33 \\
1965 & 33 \\
1970 & 32 \\
1975 & 33 \\
1980 & 31 \\
1985 & 25 \\
1990 & 24 \\
1991 & 22 \\
1992 & 27 \\
1993 & 22 \\
1994 & 21 \\
\hline
\end{array}
\]

Table 1
Farm value share of consumer expenditures for domestically produced farm foods, selected years

Source: Elitzak (1996, Table 18).
by farmers of middlemen. What is the relationship between concentration and market power? Is increased concentration detrimental or beneficial to producers?

The literature on marketing margins is closely related to the economic literature on value-added functions [e.g., Bruno (1978)]. The essential difference between the concept of margin and value-added in manufacturing, however, is that value-added focuses on the contribution of intermediate inputs to GDP, whereas marketing margins only subtract the value of the farm input. In addition, the marketing margin is typically defined for a specific product at a given point in time. Specifically, the margin is calculated by subtracting the net farm value equivalent of food sold at retail of the farm product (farm value less the value of any by-product) from the retail price. For food product groups (e.g., meat products) and for food as an aggregate, the price spread is calculated as the difference between retail cost of a given market basket and the farm value of foods in that category. The market basket contains the average quantities of domestic, farm-produced foods consumed by urban households in a base period [Harp (1987); Elitzak (1996)]. The literature on marketing margins is also related to the so-called price-cost margin literature [e.g., Cowling and Waterson (1979)], although price-cost margins are best viewed as net margins because they are net of labor and other variable costs of marketing.

As emphasized in this chapter, an empirical analysis of marketing margins should be first and foremost an economic analysis of the determinants of retail and farm price for a given commodity. There are a variety of ways to characterize the marketing margin [Gardner (1975)], but the marketing margin, like price, is best viewed as an equilibrium entity, defined as some function of the difference between the equilibrium retail price and equilibrium farm price. The next section lays out the basic theoretical framework for summarizing past developments in the analysis of marketing margins. This section is followed by a discussion of the determinants of margins under competitive conditions with both fixed and variable factor proportions. In the fourth section, attention then fo-
cuses on the influence of market power on margins. The fifth and sixth sections examine other factors influencing marketing margins, including short-run lags in food price determination, risk, technical change, quality, and spatial considerations. The final section concludes with an assessment of the literature and provides some observations on the future direction for research on marketing margins.

2. Determinants of retail and farm prices

In order to summarize past developments and recent advances in the methodology of analyzing marketing margins and derived demand for agricultural commodities, it is useful to advance a theoretical framework. Such an approach enables us to link the theoretical framework with the literature, to identify testable hypotheses, and to point to future areas for research.

Initially, the prototypical model used to characterize marketing margins is based on the assumption of price-taking behavior in both the output market for the final product and input markets for all the inputs, including the market for the agricultural raw product. Later this assumption will be relaxed as we consider the potential impact of imperfect competition in both the output market and market for the agricultural raw product. I will focus on the single product case in the marketing sector, but allow for interrelationships between retail products in the product demand specification. Also, it is customary to assume that all inputs in food marketing other than the agricultural raw input are unspecialized to the industry in question, so prices of these inputs will be taken as exogenous unless otherwise indicated. Observable variables that are endogenous to the industry include retail and farm prices of the product in question, and different relationships among these prices depicting the marketing margin. Comparative statics of the reduced forms for retail and farm price (and relationships among these prices) are used to identify the key factors affecting measurement of marketing margins.

2.1. Model specification

The endogenous variables of the model include industry quantity of the retail product \((Q_r)\), retail price \((P_r)\), industry quantity of the farm product \((Q_f)\), farm price \((P_f)\), and industry quantities of the marketing inputs \((X)\). Exogenous variables include retail demand shifters \((Z)\), marketing input prices \((W)\), other exogenous marketing sector shifters \((T)\), and farm product supply shifters \((C)\). These variables are assumed to be linked through the following structural specification of demand and supply:

\[
Q_{rd} = D_r(P_r, Z) \quad \text{(retail demand),} \tag{1}
\]
\[
Q_{rs} = S_r(P_r, P_f, W, T) \quad \text{(retail supply),} \tag{2}
\]
\[
Q_{id} = D_t(P_r, P_f, W, T) \quad \text{(farm input demand),} \tag{3}
\]
\[
Q_{is} = S_t(P_f, C) \quad \text{(farm input supply).} \tag{4}
\]
\[ X_d = D_t(P_t, P_r, W, T) \]  (marketing input demand), \hspace{1cm} (5)
\[ W \text{ exogenous} \]  (marketing input supply), \hspace{1cm} (6)
\[ Q_{rd} = Q_{rs} = Q_r \]  (retail market clearing), \hspace{1cm} (7)
\[ Q_{fd} = Q_{fs} = Q_f \]  (farm market clearing), \hspace{1cm} (8)
\[ X_d = X_s = X \]  (marketing input market clearing). \hspace{1cm} (9)

where the superscripts d and s refer to demand and supply, respectively. Equations (1) and (2) describe demand and supply for the retail product, Equations (3) and (4) describe demand and supply for the farm input, Equations (5) and (6) describe demand and supply conditions for the marketing input, and Equations (7)–(9) indicate the equilibrium conditions. As indicated, the industry in question is assumed to describe a closed economy with no provision made for imports or exports. It is straightforward to extend the model to allow for trade [see, e.g., Chambers (1983); Sumner and Wohlenberg (1985)]; the assumption of no trade is made here simply for analytical convenience.

The retail demand function, \( D_t() \), is assumed to be the usual Marshallian demand function, reflecting both substitution and income effects of price changes for own-price changes. Price effects of related goods, income changes, population changes, and taste changes are subsumed in the \( Z \) variable. Changes captured by \( Z \) could be thought of in terms of a vector or, as shown below, to reflect the impact of a given horizontal shift in retail demand. Equations (2), (3), and (5) are the industry output-price constant supply and input demand functions derived by horizontally summing an individual firm’s output supply and input demand functions [Heiner (1982)]. Equation (4) is the farm input supply function, which represents the output supply decisions of primary producers of the agricultural product.

Under the usual regularity conditions (i.e., downward-sloping demand curves and upward-sloping supply curves), there will be a unique equilibrium for given values of the exogenous variables. At this equilibrium, values of the endogenous variables, and hence the marketing margin, are determined. As discussed by Gardner (1975), the marketing margin, or farm-to-retail price spread, can be measured in many different ways, e.g., as the difference between retail and farm value of the commodity, by the ratio of retail to farm price, by the farm value share of total retail value (“farmer’s share of the retail dollar”), or by the percentage marketing margin (i.e., marketing margin as a percentage of retail or farm price). Gardner (1975) focuses on determinants of the ratio of retail to farm price and the farm value share. Fisher (1981) examines the incidence of marketing costs on farm price as a proportion of the sum of the effects on retail and farm prices. As indicated previously, the farm-to-retail price spread is intended to measure the per (retail product) unit costs of assembling, processing, distributing, and retailing foods from the farm and is similar to the concept of value added used elsewhere in economics. Our focus here will be on the general form of the farm-to-retail price spread \( M \):

\[ M = P_r - \left( \frac{Q_f}{Q_r} \right) P_f, \]  (10)
where the ratio \((Q_t / Q_l)\) is not necessarily constant, but will in general change as market conditions change. The advantage of allowing the input-output ratio to change and not be a constant (as is the case with USDA's price spread data) is that, under quite general conditions, Equation (10) represents efficient utilization of marketing inputs [Reed and Clark (1998)].

Equations (1)–(10) indicate quite clearly that, in general, the retail and farm prices and quantities, as well as the marketing margin, are jointly determined by the exogenous shifter of the underlying demand and supply functions: \(Z, W, T,\) and \(C\). While one could proceed directly in this manner by formulating reduced-form equations for the endogenous variables, derived from the implicit solutions to (1)–(10), more insight into the relationship between retail and farm prices can be gained by focusing on the partially reduced form equations:

\[
\begin{align*}
    P_t &= P_t(Z, W, T, Q_t), \\
    P_l &= P_l(Z, W, T, Q_l), \\
    M &= M(Z, W, T, Q_l),
\end{align*}
\]

where these equations are the implicit solutions to (1), (2), (3), (6), (7), and (8), holding \(Q_l\) constant.\(^2\) One motivation for this specification of the linkage between retail and farm prices is the nature of agricultural production, whereby production of the farm product lags price changes due to biological and other natural causes. Indeed, it is frequently the case that supply of the farm input can be viewed entirely as a function of lagged rather than current period prices so that quantity can be assumed to be econometrically predetermined with respect to the current period farm price.

Equations (11)–(13) resemble closely the approach taken historically by agricultural economists to estimation of the linkage between retail and farm prices. For example, Fox (1951) and Waugh (1964) estimate partially reduced form equations of retail price and farm price as simple linear or log linear functions of income (to represent changes in \(Z\) and \(W\)), quantity of the farm product (or retail product), and sometimes a linear time trend. Often retail quantity \((Q_t)\) is used in place of the farm quantity \((Q_l)\) in Equation (11) under the assumption that the ratio of farm to retail quantity has remained constant over the sample period. If this assumption is valid, then Equation (11) can be thought of as the inverse retail demand function (see Equation (1)).

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1 Price spread data published by the USDA do not strictly reflect changes in margins with fixed input-output coefficients, but rather are best viewed as a hybrid of margins with fixed coefficients and margins computed according to Equation (10). This is because USDA periodically revises farm product equivalents for individual commodities. In addition, weights of the items that make up market baskets for product groups and food as an aggregate are periodically revised as new consumer expenditure surveys become available. See Harp (1987) for details on the nature and frequency of such revisions.

2 Partially reduced form equations refer to equations obtained by eliminating one or more equations and one or more endogenous variables from the model [Hildreth and Jarrett (1955); Foote (1958)].
2.2. Comparative statics

The implicit solutions for retail and farm price, Equations (11) and (12), may be viewed as the solutions to Equations (7) and (8) after substituting for Equations (1)–(3), i.e.,

\begin{align*}
D_r(P, Z) - S_r(P_r, P_t, W, T) &= 0, \\
D_t(P, W, T) - Q_t &= 0.
\end{align*}

Because the values for \( P_r \) and \( P_t \) that satisfy (14) and (15) are the implicit solutions given by (11) and (12), the comparative statics of (11) and (12) can be characterized by totally differentiating Equations (14) and (15) and converting to elasticity form to obtain:

\begin{align*}
(\eta - \xi_r) \, d(\log P_t) + \eta_z \, d(\log Z) - \xi_r \, d(\log P_t) - \xi_rw \, d(\log W) - \xi_rT \, d(\log T) &= 0, \\
\xi_r \, d(\log P_t) + \xi_t \, d(\log P_t) + \xi_rw \, d(\log W) + \xi_n \, d(\log T) - d(\log Q_t) &= 0,
\end{align*}

where \( d(\log P_t) = dP_t / P_t \), etc., and the \( \eta \)'s and \( \xi \)'s represent the partial elasticities of the demand and supply functions evaluated at the initial equilibrium; i.e.,

\begin{align*}
\eta_z &= (\partial D_t / \partial Z)(Z / Q_t), \\
\xi_r &= (\partial S_r / \partial P_t)(P_t / Q_t), \\
\xi_t &= (\partial S_r / \partial T)(T / Q_t), \\
\xi_rw &= (\partial S_r / \partial W)(W / Q_t), \\
\xi_n &= (\partial D_t / \partial T)(T / Q_t).
\end{align*}

Solving (16) and (17) for \( d(\log P_t) \) and \( d(\log P_t) \) yields

\begin{align*}
d(\log P_t) &= \pi_{rz} \, d(\log Z) + \pi_{rw} \, d(\log W) + \pi_{rt} \, d(\log T) + \pi_r \, d(\log Q_t), \\
d(\log P_t) &= \pi_{tz} \, d(\log Z) + \pi_{tw} \, d(\log W) + \pi_{tt} \, d(\log T) + \pi_t \, d(\log Q_t),
\end{align*}

where

\begin{align*}
\pi_{rz} &= \xi_r / D, \\
\pi_{rw} &= (\xi_r \xi_rw - \xi_r \xi_r) / D, \\
\pi_{rt} &= (\xi_r \xi_rT - \xi_r \xi_n) / D.
\end{align*}
\[ \pi_{1f} = \xi_{1f} / D, \]  
\[ \pi_{1z} = \xi_{1z} \eta_{1z} / D, \]  
\[ \pi_{2w} = (\frac{-\xi_{1w} \xi_{2w} + [\xi_{1r} - \eta] \xi_{1w}}{D}), \]  
\[ \pi_{2t} = (\frac{-\xi_{1t} \xi_{2t} + [\xi_{1r} - \eta] \xi_{1t}}{D}), \]  
\[ \pi_{2f} = -(\xi_{1f} - \eta) / D, \]  
\[ D = -(\xi_{1f} - \eta) \xi_{1f} + \xi_{1f} \xi_{1t}. \]  

Note that in this form, Equations (18) and (19) show the relationship between the logarithmic changes in retail and farm prices and logarithmic changes in the demand and supply shift variables \( Z, W, T, \) and \( Q_t \). The reduced-form coefficients, the \( \pi \)'s, are total elasticities and are related to the partial elasticities of demand and supply according to (20a)-(20i). Theil (1980, Chapter 2) indicates that this approach is useful to formulate equations for econometric estimation because no algebraic specifications of the demand and supply functions are required, and the decision to parameterize the model is postponed until the point at which differentials are replaced by finite differences. Regardless of how one proceeds in econometric analysis, however, it is important to stress that Equations (18) and (19) and the resulting total elasticities (20a)-(20i) may be regarded as general comparative static results of (16) and (17) for arbitrary specifications of demand and supply.

In an analogous fashion, the comparative statics of the marketing margin, Equation (16), can be characterized in logarithmic changes as follows:

\[ \frac{(M / P_t)}{P_t} \partial (\log M) = (1 - S_t) \partial (\log M) \]  
\[ = \partial (\log P_t) - S_t \partial (\log P_t) - S_t \partial (\log Q_t) + S_t \partial (\log Q_t), \]  
\[ (21) \]

where \( S_t \) is the farm value share (i.e., \( P_t Q_t / P_t Q_t \)). Note that if the ratio between the farm quantity and retail quantity is fixed, then (21) is reduced to simply the first two terms,

\[ (1 - S_t) \partial (\log M) = \partial (\log P_t) - S_t \partial (\log P_t). \]  
\[ (22) \]

In the more general case when the farm and retail quantities are not fixed, the logarithmic differential of the retail demand function (1), \( \partial (\log Q_t) = \eta \partial (\log P_t) + \eta \partial (\log Z) \), can be substituted for \( \partial (\log Q_t) \) on the right-hand side of (21) to obtain

\[ (1 - S_t) \partial (\log M) = (1 + S_t \eta) \partial (\log P_t) - S_t \partial (\log P_t) \]  
\[ - S_t \partial (\log Q_t) + S_t \eta \partial (\log Z). \]  
\[ (23) \]

In either case of fixed proportions, Equation (22), or variable proportions, Equation (23), total elasticities of the marketing margin with respect to \( Z, W, T, \) and \( Q_t \) can be eval-
uated through substituting (18) and (19) for \(d(\log P_r)\) and \(d(\log P_t)\) in (22) and (23). I will return to a discussion of the determinants of Equations (22) and (23) subsequent to a discussion of the determinants of (18) and (19).

By comparative static results from economic theory, it is possible to place some interpretation on and determine the signs of the total elasticities of the logarithmic differentials of retail and farm prices given by Equations (18) and (19). First, the reciprocal of \(\pi_H\) is the industry derived demand for the farm product, holding prices of other inputs constant. Heiner (1982) proves that in the short run the sign of this elasticity is unambiguously negative, given that the retail demand curve is negatively sloped. The intuition of this result is that aggregate factor demand response is bounded by the two extreme cases when demand for the retail product is perfectly inelastic and when demand for the retail product is perfectly elastic. That is, the industry derived demand for the farm product lies between two demand curves: one constructed as the horizontal summation of the constant output demand responses and the other constructed as the horizontal summation of the output-price constant demand responses, which are both unambiguously negatively sloped.\(^3\) As proved by Heiner (1982), this result is in no way conditional on the similarity of firms in the industry. In particular, industry derived demand curves constructed in this manner (holding other input prices constant) are unambiguously negatively sloped with dissimilar firms in the short run [Heiner (1982)] or in the long run [Brauker (1987)], where entry and exit from the industry occur.

In addition to establishing that the industry elasticity of derived demand for the farm product, \(E_r = 1/\pi_H\), is unambiguously negative when \(\eta < 0\), we can also establish that the total elasticities (20a), (20d), and (20e) will ordinarily be positive, negative, and positive, respectively. The theory of the firm establishes that the retail supply elasticity \(\xi_{fr}\) is positive, and that the factor demand elasticity \(\xi_f\) is negative. Thus, because \(\pi_{fr} < 0\), we see from (20i) that \(D > 0\) and from (20a) that \(\pi_{r2}\) has the same sign as \(\eta_{r}\), which we would expect to be positive when interpreted as a horizontal increase in retail demand. If the farm input is a normal factor – which seems plausible for the commodity aggregates typically analyzed – then the elasticity of retail supply with respect to farm price \(\xi_{fr}\) is negative. In addition, the cross elasticity \(\xi_{fr}\) would be positive in view of the symmetry relation between retail supply and farm input demand, \(\xi_{fr} = -\eta_{fr}\) [see Wohlenberg and Haidacher (1989, p. 17)].\(^4\) Thus, from (20d) we expect the total elasticity of retail price with respect to farm quantity \(\pi_{fr}\) to be negative, and the total elasticity of farm price with respect to \(Z\), \(\pi_{fr}\), to be positive. Finally, the signs of the effects of \(W\) and \(T\) on retail and farm prices are generally indeterminate because the signs of \(\xi_{fr}\) and \(\xi_{H}\) are indeterminate.

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\(^3\) See Friedman (1976, p. 184) for an intuitive discussion of the nature of industry factor demand response.

\(^4\) The symmetry relationship derives from the result in the theory of the firm that \(\Delta S_r/\Delta P_t = -\Delta D_t/\Delta P_t\) [Mossak (1938)].
2.3. Elasticity of price transmission

In addition to providing information about total elasticities of retail and farm price, Equations (18) and (19) can be used to derive an expression for the elasticity of price transmission, i.e., the logarithmic change in retail price divided by the logarithmic change in farm price.\(^5\) Solving Equation (19) for \(d(\log Q_f)\), substituting for \(d(\log Q_f)\) in (18), setting \(d(\log Z) = d(\log W) = d(\log T) = 0\), and solving for \(d(\log P_r)/d(\log P_f)\) yields

\[
E_{rt} = \pi_{rt}/\pi_f, \tag{24}
\]

where \(E_{rt}\) is the proportionate change in retail price for a proportionate change in farm price, holding \(Z\), \(W\), and \(T\) constant.

The concept of elasticity of price transmission has played a crucial role in obtaining estimates of derived demand elasticities for agricultural commodities. George and King (1971), for example, use the result (derived assuming fixed proportions between the retail and farm quantity) that the elasticity of derived demand equals the product of the elasticity of price transmission and retail demand elasticity to derive a matrix of own- and cross-price elasticities of demand for food products at the farm level. As pointed out by Waugh (1964), for example, one important implication of this specification is that so long as retail price is larger than farm price, demand at the farm level will be more inelastic (less elastic) than demand at retail level.

2.4. Elasticity of derived demand

To see conceptually how the derived demand elasticity, \(E_{rt} = 1/\pi_f\), is related to the elasticity of price transmission, \(E_{rt}\) (defined by Equation (24)), and elasticity of retail demand, \(\eta\), we can use these definitions to show that

\[
E_{rt} = E_{rt}^c + E_{rt} \eta \xi_{rt}/\xi_{rt} \tag{25}
\]

[Wohlgemant and Haidacher (1989, p. 21)], where \(E_{rt}^c = \xi_{rt} - \xi_{rt} \xi_{rt}/\xi_{rt}\) is the industry derived demand elasticity for the farm quantity, derived holding industry retail quantity constant, i.e., it describes the change in input demand for a change in price when the

\(^5\) Hildreth and Jarrett (1955, p. 110) define elasticity of price transmission as "... the relative change in retail price to the relative change in producers' price when other factors affecting processor behavior are held constant" On the other hand, George and King (1971, p. 61) define the elasticity of price transmission as "... the ratio of relative change in retail price to the relative change in the farm-level price". The measure used here is conceptually the same as George and King's because it depicts the total change in retail price for a total change in farm price. In addition to marketing margins, the concept of elasticity of price transmission is used in international trade to describe the response of foreign prices to changes in the U.S. price of a given commodity [e.g., Bredahl et al (1979)].
farm input is substituted for other inputs in producing the retail product. Equation (25) says that, in general, there is not a fixed relationship between elasticity of derived demand at the farm level and elasticity of demand at the retail level. In order for the elasticity of derived demand to equal the product of the elasticity of price transmission and elasticity of retail demand, two conditions must obtain: \( E_{tr}^* = 0 \) and \( \xi_{tr}^* = \xi_{tr} \). This can be shown to occur if and only if the ratio between the farm and retail quantities is fixed, i.e., that the industry production function for the retail food product is of the Leontief fixed-proportions type, \( Q_t = \min\{Q_t/a, X/b\} \), where \( a \) and \( b \) are constants.

Another interesting special case of (25) occurs when the industry production function exhibits constant returns to scale. In this case (and assuming only two inputs, the farm input and a single marketing input), Gardner (1975) and Wohlgemant (1989, p. 248) show that the elasticity of demand at the farm level has the form

\[
E_{tr} = -(1 - S_t)\sigma + S_t\eta_t,
\]

where \( \sigma \) is the elasticity of substitution between the farm and marketing inputs. This case is especially interesting because it shows that it is possible for demand at the farm level to be less inelastic (more elastic) than demand at the retail level. In addition, Equation (26) indicates that the elasticity of price transmission with constant returns to scale (and with perfect competition) equals the farm value share. Equation (26) especially makes transparent that the relationship between the elasticities of derived demand and retail demand hinges crucially on whether the farm and marketing input are combined in variable or fixed proportions.

2.5. Symmetry and constant returns to scale

Theoretical restrictions of homogeneity and symmetry imposed by theory of the firm and consumer imply certain restrictions on the partially reduced form elasticities in (20a)–(20b). In particular, the fact that retail demand is homogeneous of degree zero in prices and income and that retail supply and farm input demand are each homogeneous of degree zero in output and input prices means that the partially reduced form functions (11)–(13) are each homogeneous of degree one in all nominal variables. This implies that the sum of the elasticities for \( P_t \) and \( P_f \) with respect to all nominal variables in \( Z \) and \( W \) (i.e., \( \pi_{tz}, \pi_{zw}, \pi_{tf}, \text{and } \pi_{tw} \)) should equal one. As discussed above, there is also a symmetry relationship between the retail supply function and farm demand function, \( \xi_{tr} = -S_t\xi_{tf} \), implying from (20d) and (20e) that

\[
\pi_{tf} = -S_t\pi_{tz}/\eta_z.
\]

When \( d(\log Z) \) is measured as a one percent horizontal change in retail demand, \( \eta_z = 1 \), this relationship reduces to

\[
\pi_{tf} = -S_t\pi_{tz} \tag{28}
\]
[Wohlenberg (1989, p. 244)]. Depending upon how Z is measured, either (27) or (28) would be the relevant restriction to impose on the reduced-form equations under perfect competition. As shown below, existence of imperfect competition in the market for the retail and/or farm product would be expected to alter this relationship. Therefore, symmetry restrictions of the type indicated by (27) and (28) can be used under certain circumstances to test for the existence of imperfect competition.

Existence of an aggregate constant-returns-to-scale production function also imposes some additional restrictions on the reduced-form elasticities in (20). For the reduced-form elasticities associated with Z, W, and Qf, constant returns to scale, when \( \eta_Z = 1 \), implies

\[
\begin{align*}
\pi_{ZT} &= -\pi_{TF}, \\
\pi_{TZ} &= -\pi_{TT}.
\end{align*}
\]

(Wohlenberg (1989, p. 244)).

2.6. Fixed versus variable input proportions

In combination with (28) and (29a) and (29b), fixed input proportions (i.e., \( \sigma = 0 \)) implies

\[
\pi_{Tw} = 0
\]

[Holloway (1991)]. In addition, as indicated previously, the industry derived demand elasticity equals the product of the farm value share (which equals the elasticity of price transmission in this case) and the elasticity of retail demand (see Equation (26)).

Aside from the assumption of price-taking behavior, the theoretical framework used to develop restrictions on the reduced-form parameters of (18) and (19) is very general. In particular, in its most general form, indicated by the form of the elasticities in (20a)–(20i), no restrictions are placed on the degree of conformity of behavior among firms. In other words, aside from assuming that the number of firms is constant for any given time period, no restrictions are placed on the similarity or dissimilarity of firms within the industry. As shown by Wohlenberg and Haidacher (1989, pp. 16–17), this means that the elasticities of retail supply and input demands can be thought of as share-weighted sums of the corresponding elasticities of individual firms. For example,

\[
\xi_{Tr} = \sum_i \xi_{Tr}^i \left( Q^i_t / Q_t \right),
\]

where \( \xi_{Tr}^i = (\partial S^i / \partial P_t)(P_t / Q_t^i) \) is the elasticity of retail supply of the \( i \)th firm, and \( Q_t^i \) is quantity of retail output of the \( i \)th firm. Among other things, this means a distinction needs to be made between industry and firm response. Diezert (1981) shows that input substitution at the industry level is larger than at the firm level when firms are dissimilar.
This means there can be input substitution at the aggregate level even if there is no input substitution by individual firms. So long as individual firms use different input proportions of the same factor of production, there will be change in intensity of input use in the aggregate as the composition of input use changes among firms in response to a factor price change.

As discussed by Wohlgenant and Haidacher (1989, pp. 8–9), existence of dissimilar firms is not the only potential source of input substitutability. In addition to the common view that input substitution results from reduction in amount of wastage and spoilage of the raw product as the price of the farm product rises (e.g., Tomek and Robinson (1981)), input substitution can occur because of ability of firms to choose among different production processes, or technologies, at any time. For example, fresh produce, like lettuce, could be shipped by truck, rail, or even boat, depending upon the particular location of production and proximity to the market. Since modes of transportation entail different transport costs (equivalently, different amounts of marketing services per unit of the raw input), the ratio of farm product to retail product would be expected to change from switching between transport modes.

Because many food commodities analyzed by agricultural economists are really not homogeneous commodities but are composites of many individual commodities, intraproduct substitutability is another source of input substitutability. For example, beef is really a composite commodity consisting of such single commodities as ground beef, roast, steaks, etc. Given the ability of meat packers to produce greater or smaller proportions of each of these commodities from a given carcass, there exists an incentive for firms to produce relatively more of those commodities which use more of the raw material (e.g., ground beef) in response to a decrease in the relative price of the agricultural input (i.e., cattle). In such cases, the overall effect is to observe an increase in the ratio of the quantity of the agricultural raw product to the quantity of the retail product [Wohlgenant and Haidacher (1989, p. 8)]. Indeed, Wohlgenant (1999) has shown that substitutability between inputs for a composite commodity can be viewed as a weighted average of substitutability in production and substitutability in consumption.

In a general sense, consumer demand for any food commodity can be viewed as a joint demand for the purchased agricultural input and food marketing services [Waldorf (1966)]. That is, each food product can be viewed as embodying a certain proportion of marketing services and a certain proportion of the raw agricultural product. A meal purchased in a restaurant is different than one prepared at home because it contains more purchased services (e.g., meal preparation time, dining service, etc.) per unit raw material. As the price of the raw product rises (falls) there exists an incentive to substitute marketing services (raw product) for the now relatively more expensive raw product (marketing input), so that the overall effect would be to see a decrease (increase) in the ratio of the quantity of the farm product to the quantity of the retail product.

2.7. Generality of model

Two other points about the generality of the theoretical framework depicted by (18) and (19) are worth mentioning. First, the specification in its most general form can ac-
commodate industry behavior exhibiting other than constant returns to scale. Indeed, as discussed above, constant returns to scale results as a special case when the restrictions indicated by (29a) and (29b) obtain. Allowing for a more general specification of industry returns to scale may be important, as other than constant returns to scale have been observed in some settings [e.g., Ball and Chambers (1982)]. Second, for many agricultural commodities, data on retail consumption are not directly observable. Rather, consumption data are derived from essentially production data by applying fixed conversion factors to the amount of production available for consumption (i.e., disappearance data). Thus, in essence, the technology underlying the data is assumed to be of the fixed proportions variety, regardless of the true technology that generates the retail quantities.\(^6\)

Because the retail-to-farm linkage specification in (18) and (19) does not require retail data, one can mitigate the effects of statistical bias by focusing on estimation of partially reduced form retail and farm price equations rather than on the economic structure indicated by Equations (1)–(4) [Wohlgemant (1989)]. As shown below, taking a more flexible approach to estimating retail-to-farm price linkages such as the one outlined here is absolutely essential when trying to understand and isolate the myriad of factors that influence marketing margins.

3. Determinants of marketing margins

The preceding discussion provides a useful backdrop to analyzing the determinants of the marketing margin, Equation (13).

3.1. Marketing margins – fixed input proportions

In the special case of fixed input proportions, we can substitute Equations (18) and (19) into Equation (22) to obtain

\[
(1 - S_t) d(\log M) = (\pi_{tx} - S_t \pi_{tx}) d(\log Z) + (\pi_{tw} - S_t \pi_{tw}) d(\log W) + (\pi_{nt} - S_t \pi_{nt}) d(\log T) + (\pi_{ft} - S_t \pi_{ft}) d(\log Q_t). \tag{22'}
\]

But existence of a fixed proportions technology means that the \(\pi\)'s in (22') must satisfy (28), (29a), (29b), and (30), implying (22') becomes

\[
(1 - S_t) d(\log M) = -S_t \pi_{tw} d(\log W) + (\pi_{nt} - S_t \pi_{nt}) d(\log T). \tag{22''}
\]

---

\(^6\) This should not be taken to imply that the fixed proportions assumption is necessarily wrong in some instances, but only that the retail quantities are not actual consumption amounts but are derived assuming one particular production process applies to all firms at the same point in time. Revisions are made periodically as new information on technologies and production processes becomes available [see, e.g., Patnam and Allshouse (1994)].
Thus, in the special case of fixed proportions, the marketing margin depends only upon marketing input prices \((W)\) and other exogenous shifters \((T)\).

Empirical evidence is rarely consistent with the prediction of Equation (22'), however, as margins often change as quantity of the volume processed changes [Tomek and Robinson (1981)]. To accommodate margin behavior that allows for changing margins as the volume marketed changes, we could relax the assumption that the marketing input supply curve is horizontal. In logarithmic differential form, the inverse supply function for the marketing input has the form

\[
\frac{d(\log W)}{d(\log X)} = \frac{1}{\varepsilon_X} \frac{d(\log Q_t)}{d(\log Q_t)}
\]

because with fixed proportions, \(d(\log X) = d(\log Q_t)\). Substituting this expression for \(d(\log W)\) in (22') we obtain:

\[
(1 - S_t) d(\log M) = -(S_t \pi_{fu}/\varepsilon_X) d(\log Q_t) + (\pi_{nt} - S_t \pi_{fi}) d(\log T).
\]

Because \(\pi_{fu} < 0\) when \(\sigma = 0\) [Wohlgenant (1989, p. 244)], we expect to observe a positive relationship between the margin and quantity marketed when the supply curve of the marketing input is upward-sloping, i.e., when \(\varepsilon_X > 0\). However, empirical evidence often contradicts this predicted margin behavior. Quite often, margins are negatively related to quantity marketed and positively related to retail price [Buse and Brandow (1960); Waugh (1964); George and King (1971); Tomek and Robinson (1981)]. With a purely competitive marketing structure and fixed proportions, this margin behavior could result from a negatively sloped supply curve of the marketing input, as Equation (22'') shows. While this result can occur in the long run when there are external economies to the marketing sector, such a specification of margin behavior is inconsistent with short-run competitive pricing. Thus, the competitive theory of marketing margin behavior with the fixed input proportions assumption — even allowing for a non-horizontal supply curve of the marketing input — seems too simplistic [Wohlgenant and Haidacher (1989, pp. 2–4)].

3.2. Marketing margins – variable proportions

If we simply relax the assumption of fixed input proportions between the farm input and marketing input, the type of margin behavior typically observed can be accounted for by a purely competitive market structure with exogenously determined marketing input

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7 For convenience, supply shifters have been omitted from this expression.

8 Gardner (1975) analyzes the more general case where the price of the marketing input is endogenous and where the two inputs are allowed to be combined in variable proportions. Because no new analytical insights are offered for that case over the case of fixed proportions analyzed here, I retain the simpler assumption.
prices. Substituting (18) and (19) into (23), and substituting for $\pi_{tz}$ from (27) when $\eta_z = 1$, we obtain

$$(1 - S_t) d(\log M) = ([1 + S_t \eta] \pi_{tz} + \pi_{tt} + S_t) d(\log Z)$$
$$+ ([1 + S_t \eta] \pi_{tw} - S_t \pi_{tw}) d(\log W)$$
$$+ ([1 + S_t \eta] \pi_{tt} - S_t \pi_{tt}) d(\log T)$$
$$- S_t([1 + S_t \eta] \pi_{tz} + \pi_{tt} + 1) d(\log Q_t).$$

(23')

Because, in general, the total elasticities of $M$ with respect to $Z$, $W$, $T$, and $Q_t$ will be non-zero, Equation (23') says that the same variables that influence both retail and farm price separately can be expected to influence the marketing margin. Moreover, because $\eta < 0$, $\pi_{tt} < 0$, and $\pi_{tz} > 0$, the relationship between $M$ and $Z$ and between $M$ and $Q_t$ is generally indeterminate.

It is interesting to examine the implications of (23') further when it is assumed that the industry production function exhibits constant returns to scale. Imposing the restrictions (29a) and (29b) on (23'), the change in the marketing margin when $\eta_z = 1$, can be shown to equal

$$(1 - S_t) d(\log M) = S_t(1 - S_t \eta/E_H) d(\log Z)$$
$$+ ([1 + S_t \eta] \pi_{tw} - S_t \pi_{tw}) d(\log W)$$
$$+ ([1 + S_t \eta] \pi_{tt} - S_t \pi_{tt}) d(\log T)$$
$$- S_t(1 - S_t \eta/E_H) d(\log Q_t),$$

(23'')

where $E_H$ is defined by (26). As can be seen from the structure of the total elasticities of $M$ with respect to $Z$ and $Q_t$, $M$ will depend on $Z$ and $Q_t$ so long as $S_t \eta/E_H < 1$ and $\eta < \infty$. From Equation (26), this will occur if and only if the elasticity of substitution between inputs, $\sigma$, is non-zero, i.e., that the retail product is produced with variable input proportions. In addition, Equation (23'') predicts a positive relationship between $M$ and $Z$ and a negative relationship between $M$ and $Q_t$.

There is much empirical evidence to corroborate the predictions of model (23'') with respect to the relationship between the margin and quantity of the farm input, as well as between the margin and shifts in retail demand. Both Fox (1951) and Waugh (1964) estimated positive relationships between margins and income for a wide range of food commodities over different time periods. In addition, they tended to find a negative relationship between margin and quantity. The results obtained were found either by estimating directly equations like Equation (11) and (12) and then deriving the implied marketing margin relationship by subtracting farm price from retail price, or by directly estimating relationships like Equation (13). Two criticisms of this approach to estimating margin relationships are that (a) they did not account for the separate effects of marketing input price changes, so that the effects of income likely reflect a combination of retail demand shift and marketing cost changes, and (b) they assumed fixed input pro-
portions in their retail price specification by including retail quantity in Equation (11) instead of farm quantity.

3.3. Markup pricing

Another common approach to estimating marketing margins and retail-to-farm price linkages for food commodities has been to assume that margin behavior depends on the pricing practices of market middlemen. This approach, which is summarized by George and King (1971, pp. 55–59), assumes that margins consist of a combination of absolute amounts and constant percentages of retail prices, i.e.,

\[ M = \alpha + \beta P_r. \]  

(31)

where \( \alpha \) and \( \beta \) are constants. Justification for this specification of margin behavior is mainly empirical. Thomsen (1951), Buse and Brandow (1960), Dalrymple (1961), Shepherd (1962), and Waugh (1964) all cite evidence of margin behavior of this type. The most extensive analysis has been provided by George and King (1971), who found that a significant number of commodities displayed combinations of both constant absolute and constant percentage margins.

Equations of the type indicated by (31) with an additive error term appended (and possibly with provisions made for changes in marketing input prices and other factors) have been utilized extensively in agricultural economics for estimating the relationship between farm and retail prices. Regressions of margin on retail price, or equivalently farm price on retail price, derive from the view that, in the long run, prices are determined at the retail level first by what consumers are willing and able to pay for what is marketed, and then farm prices are determined by subtracting all marketing costs from retail prices [Waugh (1964, p. 20)].

USDA's measure of \( M \) [Elitzak (1996)] assumes a fixed transformation between the farm and retail quantities, i.e., \( M = P_r - a P_f \). Substituting for \( M \) on the left-hand side of (31), solving for \( P_f \), and differentiating with respect to \( P_r \) yields

\[ \frac{d(\log P_f)}{d(\log P_r)} = (1 - \beta)/S_{f0}. \]  

(32)

where \( S_{f0} = P_f a / P_r \). Thus, so long as \( \beta > 0 \), we would expect the elasticity of the farm price with respect to retail price to be less than the reciprocal of the farm value share (measured with respect to the fixed input-output ratio \( a \)). Is this relationship (which is equivalent to saying that the elasticity of price transmission is larger than the farm value share) consistent with the purely competitive market structure? The answer is yes if (32) is viewed as describing an exogenous change from a vertical shift in retail demand [Wohlgenant (1993, pp. 645–646)]. To see this, note that if \( \eta_z d(\log Z) \) describes the logarithmic horizontal change in retail demand, then \( (-\eta_z/\eta) d(\log Z) \) describes the
logarithmic vertical change in retail demand. Letting \( d(\log \delta) \) denote this vertical shift in retail demand, Wohlgenant (1993, p. 646) shows that

\[
\frac{d(\log P_t)}{d(\log \delta)} = \eta/E_{Rt},
\]

which according to (26) will be less than the reciprocal of the farm value share if and only if \( \sigma > 0 \). The interpretation of this result is that a one percent increase in retail price (holding \( Q_t \) constant) leads to a farm price increase of \( \eta/E_{Rt} \). This is equivalent to saying that a 1 cent increase in retail price leads to a \( 0.01\eta/E_{Rt} \) cent increase in farm price, which will be less than 1 cent when \( \sigma > 0 \). Thus, existence of variable factor proportions leads to reconciling theory with commonly observed markup pricing behavior depicted by (31).

Although many researchers have estimated equations of the type (31) (modified to account for changes in marketing input prices and other factors affecting marketing group behavior), this approach generally lacks theoretical justification. As shown by Equation (22'') when there are fixed input proportions, the margin does not depend upon retail price. However, when there are variable input proportions (such that \( Z \) is quantified as a vertical shift in retail demand, i.e., retail price), then Equation (23'') indicates that in order for the margin to be related to \( P_t \) in a fixed way, changes in retail demand and farm supply must be collinear. As Gardner (1975, p. 406) remarks, "... no simple markup pricing rule – a fixed percentage margin, a fixed absolute margin, or a combination of the two – can in general accurately depict the relationship between the farm and retail price". This is because even if such an equation as (31) should perfectly fit changes generated by shifts in, say, the farm supply function, such a model could not account simultaneously for shifts in retail demand and farm supply. Wohlgenant and Mullen (1987) show that competitive price behavior implies that the elasticity of price transmission can vary systematically with the volume of the commodity marketed and processed. In their empirical application to beef they find that the data are supportive of the proposition that the markup pricing rule is misspecified, thus corroborating Gardner's observation. Based at least in part on this analysis, it seems best to approach econometric estimation of retail-to-farm price linkages through estimation of equations of the general form depicted by (11), (12), or (13).

3.4. Empirical work

Recent empirical evidence is consistent with theory indicating significant input substitution between farm and marketing inputs. Wohlgenant (1989) estimated Equations (18) and (19) where the elasticities were assumed to be constant, where the logarithmic differentials were replaced by first-differences in the logarithms, and where \( d(\log Z_t) \) was defined as a one percent horizontal increase in retail demand.\(^9\) The model was applied

\(^9\) The variable \( d(\log Z_t) \) was defined as

\[
d(\log Z_t) = \sum_{j \neq i} \eta_{ij} d(\log P_j) + \eta_{i} d(\log Y) + d(\log POP),
\]
to eight commodities (beef and veal, pork, poultry, eggs, dairy products, fresh fruits, fresh vegetables, and processed fruits and vegetables), and the restrictions of symmetry, Equation (28), and constant returns to scale, Equations (29a) and (29b), were separately imposed and tested. For all eight commodities, the symmetry restriction was found to be consistent with the data, suggesting compatibility with the basic theory of competitive behavior. In addition, with the sole exception of fresh fruits, the results were also found to be consistent with constant returns to scale. Substantial input substitutability was found for all but one commodity, poultry. Except for poultry, derived demand elasticities were found to be at least 40 percent larger than those obtained assuming fixed input proportions. Point estimates of elasticities of substitution, derived using Equation (26) for given values of \( S_i \) and \( n_i \), ranged from 0.25 for eggs to 0.96 for dairy.

An alternative approach to estimating Equations (18) and (19) directly would be to estimate a structure like (1)–(10) and then derive relationships like (20a)–(20i) from the estimated structure. This was the approach taken by Dunn and Heien (1985) who, instead of estimating supply and demand functions like (2) and (3) directly, estimate the inverse supply function (i.e., the relationship between price and marginal cost) and output constant factor demand functions, i.e.,

\[
\begin{align*}
P_t &= C_t(P_t, W, T, Q_t), \\
Q_t &= C_t(P_t, W, T, Q_t), \\
X &= C_w(P_t, W, T, Q_t).
\end{align*}
\]

where \( C_t() \) is the marginal cost of output, \( C_t() \) is the partial derivative of cost with respect to farm price, and \( C_w() \) is the partial derivative of cost with respect to \( W \). Dunn and Heien (1985) used the translog specification of cost and estimated share equations for five farm outputs (meat, dairy, poultry, fruits and vegetables, and other foods) and four marketing inputs (labor, packaging, transportation, and all other). In their specification, Dunn and Heien (1985) also allowed for jointness in production (by making (33a)–(33c) a function of all four retail outputs). Their test results indicated no evidence of jointness and only limited substitutability between farm inputs and marketing inputs. A major limitation of this study was that they used USDA disappearance data for retail food commodities. As indicated previously, these data are generally inappropriate for estimating input substitutability because they are constructed by assuming fixed input

where \( \eta_{ij} \) is the cross-elasticity of demand for good \( i \) with respect to the price of good \( j \), \( \eta_{ij} \) is the income elasticity of good \( i \), \( Y \) is per capita income, and \( POP \) is population. Values for the elasticities are extraneous estimates obtained from previous studies.

Because Equation (28) does not hold globally when the elasticities of (18) and (19) are constants, this restriction was imposed only locally at the sample means of the farm value shares. In addition, an exogeneity test indicated that farm quantities could be taken as predetermined, although estimation of Equations (18) and (19) could easily be undertaken assuming the farm quantities are jointly determined with prices.

Equation (33b) and (33c) result from Shephard's lemma [see, e.g., Diewert (1974)].
proportions. One novelty to their approach is that they include a capital stock measure to reflect short-run input fixity of processor behavior. This is also the approach taken by Lopez (1985).

More recently, Goodwin and Brester (1995) estimated factor demand relationships in the U.S. food and kindred products industry for aggregate processed food output using U.S. Department of Commerce data. They find large and significant input substitution between five inputs: labor, capital, food materials, energy, and other inputs. In their analysis, they use switching regression techniques to allow for gradual technical change. In addition to concluding that accounting for technical change in food processing leads to greater input substitutability, their results strongly suggest that the approach to estimating factor demand relationships with value-added data [e.g., Huang (1991)] is generally inappropriate because it assumes a fixed relationship between materials and nonfood inputs.

4. Influence of market power

Another possible explanation for observed margin behavior of the type depicted by (31) with \( \beta > 0 \) is existence of market power. Historically, there has been concern about existence of oligopoly and/or oligopsony power in food and agricultural markets [e.g., National Commission on Food Marketing (1966); Connor et al. (1985); Rogers and Sexton (1994); USDA (1996)]. Generally two approaches have been taken in identifying and estimating oligopoly market power (or departures from perfect competition): structure-conduct-performance (SCP) studies and new empirical industrial organization (NEIO) studies. SCP studies focus primarily on the relationship between profitability and concentration, while NEIO studies focus primarily on the determinants of the gap between price and marginal cost [Bresnahan (1989)]. SCP studies have mainly used cross-sectional data to estimate the relationship between accounting profits (or so-called price-cost margins) and concentration ratios to draw inferences about the presence of market power and performance of an industry. The NEIO approach is motivated in part by dissatisfaction with the SCP approach's inability to link industry profitability to industry structure. In other words, high accounting profits can indicate either good or bad performance and the number of firms may bear no relationship to market structure [Demsetz (1968); Baumol (1982)]. Because the NEIO approach is first and foremost an econometric study of an industry, this approach has a firm grounding in economic

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12 This is not strictly true because the proportions are revised from time to time, as new technologies (e.g., boxed beef) become widely adopted. In addition, for some commodities (e.g., meats) data are available separately at the farm and wholesale levels. However, the retail data are still for all practical purposes production, not consumption, data. What is needed for retail quantity data (as well as margin data) are constant dollar series, such as those developed by the U.S. Department of Commerce, which are conceptually more correct in that they "... accept the judgment of the market" [Waldorf (1966, p. 59)].
theory so that one can rely on theory to aid in specification and interpretation of the findings [Bresnahan (1989, p. 1013)]. Given its distinct advantages and current popularity, the following discussion will focus on the NEIO approach.\footnote{A thorough review of the advantages and limitations of these different approaches can be found in Bresnahan (1989) and Azzam and Anderson (1996).}

4.1. NEIO structural approaches

A typical approach to incorporating market power into the model would be to modify equation (33a) by replacing output price, \( P_t \), by perceived marginal revenue. Usually, a fixed-proportions technology is assumed so that marginal cost in (33a) would be replaced by \( a P_t + \partial C_p(W, Q_t) / \partial Q_r \), where \( C_p(\cdot) \) represents the non-agricultural (processing) portion of total marketing costs. If we also allow for the possibility of market power in the market for the farm input, the relationship between price and marginal cost could then be written as

\[
P_t (1 + \theta / \eta) = a P_t (1 + \phi / \varepsilon) + \partial C_p / \partial Q_r
\]

(34)

[see, e.g., Schroeter (1988)], where \( \theta = (\partial Q_r / \partial Q_f)(Q_f / Q_t) \) is the representative firm's so-called conjectural elasticity with respect to industry retail quantity, and \( \phi = (\partial Q_f / \partial Q_i)(Q_f / Q_i) \) is the representative firm's conjectural elasticity with respect to industry farm quantity. With fixed proportions, \( \theta = \phi \), so Equation (34) can be rewritten as

\[
P_t (1 + \theta / \eta) = a P_t (1 + \theta / \varepsilon) + \partial C_p / \partial Q_r
\]

(34')

More generally, \( \theta \) may be thought of as an index of market power. If \( \theta = 0 \), then we have price-taking or competitive behavior; if \( \theta = 1 \), then we have pure monopoly/monopsony. Values of \( \theta \) between 0 and 1 would reflect different degrees of oligopoly/oligopsony power.

A significant feature of (34') is that it can be used to define Lerner's indexes for monopoly and monopsony power [Schroeter (1988)]. For monopoly power, Lerner's index, \( L \), is retail price minus marginal cost as a proportion of retail price, i.e.,

\[
L = -\theta / \eta.
\]

(35a)

Analogous to \( L \), the gap between \( P_t \) and marginal net revenue product as a proportion of the farm price can serve as a measure of monopsony power and can be written as

\[
N = \phi / \varepsilon = \theta / \varepsilon,
\]

(35b)

where the second equality holds only when the technology is fixed proportions.
Given an explicit functional form for processing costs, demand for output (Equation (1)), and supply of the farm input (Equation (4)), the parameters of Equation (34') can be estimated to determine the incidence and magnitude of market power. For example, Schroeter (1988), in evaluating the degree of market power in the beefpacking industry, used the General Leontief functional form for the processing cost function to generate an econometric model between farm and wholesale levels for beef. In addition to Equation (34') and double logarithmic specifications for wholesale beef demand and farm supply, he also included a specification for labor demand, derived from the cost function via Shephard's lemma. His results indicated small, but significant, evidence of market power in both the output and input markets. Variations on this basic formulation of market power have been applied in other contexts [e.g., Schroeter and Azzam (1991); Wann and Sexton (1992)] with somewhat mixed results, although on balance indicating the presence of market power in both markets for the processed output and the agricultural input.

Schroeter's (1988) model is an extension of Appelbaum’s (1982) model to allow for both oligopoly and oligopsony power, but it assumes fixed proportions between the agricultural input and marketing inputs. Azzam and Pagoulatos (1990) have extended Schroeter’s model to allow for both oligopoly/oligopsony power and variable input proportions. Their model is based on the first-order condition for profit maximization that the representative firm’s perceived marginal revenue product equal its perceived marginal factor cost, i.e.,

$$P_t(1 + \theta/\eta)\partial f(Q_t, X)/\partial Q_t = P_t(1 + \phi/\varepsilon), \quad (36)$$

where $\partial f(\cdot)/\partial Q_t$ is the marginal product of the farm input. Using the translog production function, Azzam and Pagoulatos (1990) applied this model to data for U.S. meatpacking. They found significant evidence of market power in both the output and input markets, and that the monopsony distortion (35b) was much larger than the monopoly distortion (35a). One serious limitation of this study is their use of fixed values of demand and supply elasticities from previous studies, which causes an overstatement of the significance of monopoly power. In addition, because quantity data on non-agricultural inputs are often lacking, the applicability of Equation (36) is likely to be quite limited.

An alternative approach to (36) would be to use duality theory to replace the marketing input quantity (or quantities) with input price(s). This is the approach taken by Muth and Wohlgenant (1999a) in the context of estimating oligopsony power in the beefpacking industry. Specifically, the unobservable $X$ in (36) can be replaced by the conditional factor demand function, $X = X(Q_t, W, P_t(1 + \theta/\eta))$, so that (36) can be rewritten as

$$P_t(1 + \theta/\eta)\partial g(Q_t, W, P_t(1 + \theta/\eta))/\partial Q_t = P_t(1 + \phi/\varepsilon), \quad (36')$$
where \( \frac{\partial g}{\partial Q_I} = \frac{\partial f(Q_I, X(Q_I, W, P_t, [1 + \theta/\eta]))}{\partial Q_I}. \)

Under certain conditions, given a functional form for \( g(Q_I) \), Equation (36') can be estimated jointly with specifications for demand and supply, and the significance and incidence of market power can be determined from the estimated market power parameters. \(^{15}\)

In general, certain conditions must obtain before the market power parameters, \( \theta \) and \( \phi \), are identifiable. As shown by Bresnahan (1982) and Lau (1982) in the case of monopoly power and by Just and Chern (1980) and Muth (1977) in the case of monopsony power, output demand (respectively, input supply) must be non-separable in at least one of the exogenous shifters of demand (respectively, input supply) in order to identify, and thereby estimate, the degree of market power. In other words, industry output demand (respectively, industry input supply) must shift in a pivotal manner, rather than a parallel manner, in order to identify the degree of market power. Alternatively, if certain components of marginal cost (or marginal revenue product) are observable [e.g., cigarette taxes, Sumner (1981)], then the degree of market power is also identifiable. In the context of marketing margins, this will occur when there is a fixed proportional relationship between the retail and farm products, as shown by Equation (34'). However, with variable factor proportions, additional information about the nature of the demand/supply shift is required for identification.

### 4.2. Testing for market power

If one is simply interested in accounting for the presence of market power and for testing for its existence, then less stringent conditions can be placed on the nature of the demand and supply shifts. In order to see this, and at the same time to extend the general theoretical framework discussed previously to incorporate the effects of monopoly/monopsony

\[^{14}\text{Following Dieuwert (1974, 1978), replace average market prices } P_t \text{ and } P_l \text{ by their marginal or shadow prices, } \bar{P}_t = P_t(1 + \theta/\eta) \text{ and } \bar{P}_l = P_l(1 + \phi/\varepsilon). \text{ Net revenue, } NR, \text{ of the representative firm is given by } NR = \bar{P}_t f(Q_t, X) - \bar{P}_l Q_t - W X. \text{ Maximizing with respect to } X \text{ yields the conditional demand function(s) } X^* = X(Q_t, W, \bar{P}_t). \text{ Optimal net revenue, conditional upon } Q_t, \text{ is then given by } NR^* = \bar{P}_t f(Q_t, X^*) - \bar{P}_l Q_t - W X^*. \text{ Maximizing with respect to } Q_t, \text{ using the Envelope theorem, we obtain } \frac{\partial NR^*}{\partial Q_t} = \frac{\partial f}{\partial Q_I} - \bar{P}_t = 0 \text{ which is equivalent to (36').} \]

\[^{15}\text{This approach is similar to that of Murray (1995), who uses a variable profit function approach by equating marginal factor cost with the shadow value of the input to the representative firm. In this case, the shadow value is obtained by differentiating the variable profit function with respect to quantity of the factor. See Stiebert, Aazam, and Broersen (1993) for a similar approach in the context of the cattle market.} \]
power, consider Equations (33a) and (33b) in the presence of potential market power, where average market prices, \( P_t \) and \( P_s \), are replaced by marginal or shadow prices, \( \tilde{P}_t = P_t(1 + \theta^*/\eta) \) and \( \tilde{P}_s = P_s(1 + \phi^*/\epsilon) \) [Diewert (1974, 1978)], i.e.,

\[
\tilde{P}_t = c_t(\tilde{P}_t, W, T, Q_t), \tag{37a}
\]
\[
Q_t = c_t(\tilde{P}_t, W, T, Q_t). \tag{37b}
\]

If we also assume the existence of an aggregate constant-returns-to-scale production function, then Equations (37a) and (37b) can be written as

\[
\tilde{P}_t = P_t(1 + L) = c(\tilde{P}_t, W, T)Q_t = c(P_t[1 + N], W, T)D_t(P_t, Z), \tag{38a}
\]
\[
Q_t = c_t(\tilde{P}_t, W, T)Q_t = c_t(P_t[1 + N], W, T)D_t(P_t, Z) \tag{38b}
\]

[Diewert (1981)], where \( L = -\theta^*/\eta \) from (35a), \( N = \phi^*/\epsilon \) from (35b), \( c() \) is the unit total cost function, and \( Q_t = D_t(P_t, Z) \) from (1).

As in the case of purely competitive behavior, it is useful to evaluate the partially reduced form equations of (38a) and (38b). In general, because neither the conjectural elasticities nor the demand and supply elasticities are constant, it is necessary to define functional relationships for \( L \) and \( N \). Without loss in generality, define

\[
L = L(P_t, Z, L_0), \tag{39a}
\]
\[
N = N(P_t, C, N_0). \tag{39b}
\]

where \( L_0 \) and \( N_0 \) denote endogenous determinants of market power (e.g., concentration ratios) for the output and input markets. Given (39a) and (39b), the implicit solutions to (38a) and (38b) for given \( Q_t \) are

\[
P_t = P_t(Z, W, T, Q_t, C, L_0, N_0), \tag{40a}
\]
\[
P_t = P_t(Z, W, T, Q_t, C, L_0, N_0). \tag{40b}
\]

In comparison with the perfectly competitive market structure depicted by (11) and (12), Equations (40a) and (40b) indicate that we should also entertain variables to represent \( C, L_0 \), and \( N_0 \) as possible determinants of retail and farm prices.\footnote{Another way that these equations differ is that \( Q_t \) must now be viewed as a strictly endogenous variable if monopoly power is present, for otherwise \( N \) would be undefined. This presents no problems empirically so long as (40a) and (40b) are estimated jointly with the farm supply function (4), or an appropriate simultaneous equation estimator like three-stage least squares is used.} As in the purely competitive case, the comparative statics of (40a) and (40b) can be characterized by totally differentiating Equations (38a) and (38b). These comparative static results, though
complicated, can be used to show that when \( L = N = 0 \), the conditions of price-taking behavior result. Specifically, when \( L = N = 0 \), the variables \( C, L_0, \) and \( N_0 \) disappear from (39a) and (39b). In addition, when \( \eta_T = 1 \), we find that the symmetry restriction (28) and the constant-returns-to-scale restrictions (29a) and (29b) hold.\(^{17}\) This says that, aside from the potential influence of \( C, L_0, \) and \( N_0 \) as explanatory variables of the partially reduced form price equations, a test for price-taking behavior is equivalent to a joint test of the restrictions (28), (29a), and (29b).

There are two additional aspects of the above specification of retail-to-farm price linkages that are noteworthy. First, the above model includes as a special case Holloway's (1991) test for monopoly power. Holloway (1991) derived the test result that monopoly power, with price-taking behavior in the market for \( Q_f \), implies that

\[
\pi_{f2} - \pi_{f1} = -(\pi_{1f} - \pi_{1f}').
\]

Under the conditions of price-taking behavior in both the markets for the retail product and farm product, this condition can be seen to result directly from conditions (29a) and (29b), which, as indicated above, are two of the conditions required for price-taking behavior. Second, when the conjectural elasticities and elasticities of retail demand and input supply are constant, \( L \) and \( N \) are constants (see (35a) and (35b)) so that a test for oligopoly/oligopsony behavior reduces to Wohlenberg's (1989) joint test of the restrictions (28), (29a), and (29b). This means that, under certain conditions, the joint test for symmetry and constant returns to scale for a purely competitive market structure can be used to test for the presence of market power.

One criticism that could be leveled against the above test for market power is that with respect to the restrictions (29a) and (29b), it becomes a joint test for market power and constant returns to scale. Thus, it would seem prudent to develop a test for market power within this framework without imposing the restriction of constant returns to scale on the industry production function. Such an approach could be implemented by starting with the more general specification (14) and (15) instead of (38a) and (38b), replacing average prices by marginal prices, and then proceeding as before to derive comparative static results for the reduced-form price Equations (40a) and (40b). These comparative static results yield the same testable implications as (45a) and (45b), save for the restrictions (29a) and (29b). In other words, aside from the presence of the additional variables \( C, L_0, \) and \( N_0 \) in (40a) and (40b), the unique restriction detecting the presence of market power is the symmetry restriction, Equation (28).

Aside from the application of Holloway (1991), who found no evidence of monopoly power, there have been no formal tests of market power using this framework. However, the results of Wohlenberg (1989), which indicate compatibility of food-pricing behavior

\(^{17}\) Given constant returns to scale, these restrictions hold if and only if there is price-taking behavior in both the retail and farm markets.
for a wide range of food commodities with restrictions (28), (29a), and (29b), indicate no evidence of either monopoly or monopsony power.  

5. Non-structural approaches

Hall (1988) has proposed a nonstructural approach to estimating monopoly power, through estimating the residual between output growth and labor growth, to infer the magnitude of the markup of price over marginal cost. Hall’s model, which is derived assuming constant returns to scale and assuming Hick’s neutral technical change, can be easily extended to the case of monopsony power by reinterpreting the monopoly markup as a monopsony “markdown” [Hyde and Perloff (1994)]. While Hall (1988) finds evidence of monopoly power in the food and kindred products industry, Basu and Fernald (1997) show that his estimates of the markup are likely positively biased because of the use of value-added data, which assume the materials-to-output ratio remains constant over the data period, i.e., which assume a Leontief fixed proportions technology between materials and other inputs in producing the final product. Furthermore, simulation results of Hyde and Perloff (1994) indicate that deviations from constant returns to scale can produce serious biases. Nonparametric methods [Ashenfelter and Sullivan (1987); Love and Shumway (1994)], which do not require estimates of supply and demand parameters, could also be used to test for market power, but such tests are not statistically based and require specifications for unknown technical change. While such tests can be quite robust over a wide range of market structures, they are likely to lead to false indication of market power under perfect competition and technical change [Love and Shumway (1994, p. 1160)].

6. Lags in food price determination

The discussion so far has focused only on static changes in prices and margins. In the short run, there may be temporary changes in margins from lagged responses by market middlemen to changes in producer supply or retail demand [Tomek and Robinson (1981)]. The common observation about such behavior in the short run is that retail prices lag farm price changes. In addition, it is sometimes claimed that retail prices respond more quickly to increases than to decreases in farm prices [e.g., Ward (1982); Kinnucan and Forker (1987)]. A major concern of farmers is that when they increase production and farm price falls, middlemen don’t decrease output prices enough. Not only do they believe that such behavior is exploitive but sticky retail prices stifle consumer response, which exacerbates the supply adjustment problem.

18 Muth and Wohlgenant (1996), utilizing the profit function approach, estimated supply and demand functions (2) and (3) with average prices for retail and farm prices replaced by marginal prices. Their application to the U.S. beef processing industry concerning market power was inconclusive.
Causes of lagged price adjustment hypothesized include (a) costs of changing prices [Parish (1967); Heien (1980)], (b) costs of holding inventories [Heien (1980); Wohlgemant (1985)], and (c) imperfect competition [Parish (1967); Ward (1982)]. In the case of asymmetry of price transmission, government policy, whereby a binding price floor exists on the farm price, also can be a cause of differential price response [Kinnucan and Forker (1987)].

The typical approach to modeling short-run pricing and margin behavior begins with a specification of the relationship between retail and farm price (Equation (33a)) with constant returns to scale and fixed input proportions, which can be written as

\[ P_t = aP_h + bW_t, \]  

where \( a \) and \( b \) are the fixed coefficients associated with the Leontief production function, \( Q_t = \min\{Q_t/a, X/b\} \); and where \( t \) denotes the time period. Given (41), the contemporary raw product price, \( P_h \), is then replaced by a distributed lag in current period and past raw product prices, where justification for the distributed lag specification is based on disequilibrium price adjustment and causality tests with time series data [e.g., Heien (1980)]. Typically, monthly or quarterly time series data are used in estimation, so that the assumption of fixed proportions becomes more tenable [Heien (1980)]. In addition to inclusion of lagged raw product prices, other variables to represent demand pressure are often included (e.g., unemployment rates [Heien (1980)]; lagged prices of substitute products, income [Lamm and Westcott (1981); Freebairn (1984)]; marketing margins of competing products [Griffith (1974)]). Usually, dummy variables are used to capture seasonal effects (monthly or quarterly effects), and often separate dummy variables to represent periods of increasing and decreasing prices are included [e.g., Heien (1980)]. Because of the large share of labor costs in nonfarm input costs, especially in the short run, wage rates are often used as a proxy for nonfarm input costs.

A major criticism of the above approach is that it is ad hoc and lacks a firm theoretical foundation. Wohlgemant (1985) developed a general model of short-run food price determination by linking inventory holding to price expectations and short-run margin specifications. In particular, in the presence of inventories, Equation (41) should be extended to include the costs of inventory holding. Under fairly general conditions, these costs can be shown to equal the interest costs of the raw product, so that Equation (41) would be changed to

\[ \tilde{P}_h = aP_h + bW_t + g(1 - \beta)aP_h, \]  

where the last term, \( g(1 - \beta)aP_h \), represents marginal costs of holding inventories; where \( \beta = (1 + r)^{-1} \) is the discount factor (with \( r \) equal to the real interest rate); and where \( g \) represents the average length of time for storage (i.e., desired inventory-to-sales ratio). Equation (42) becomes the long-run, or steady-state, price equation; it specifies that retail price must equal the unit raw product costs plus the full marginal costs of processing, distribution, and storage. In the short run, however, retail price will not
adjust instantaneously to changes in raw product prices because of costs of inventory adjustment, so that retail price adjusts to its long-run level according to the specification

\[ P_t = \hat{P}_t + \beta g a (P_t - E_t P_{t+1}), \]  

(43)

where \( P_t \) is defined by (42) and where \( E_t P_{t+1} \) is expected farm price for next period, conditional on information at time \( t \). This specification of price behavior, which is derived from a dynamic model of the firm, indicates that the current retail price will deviate from its long-run level whenever firms expect the current farm price to differ from next period's expected price. When next period's price is expected to rise (fall) relative to the current period price, retail price will be below (above) its steady-state value. Because of imperfect information, expectations will be based (at least in part) on past market conditions. This means that any change that causes actual price to deviate from expected price will cause retail price changes to lag raw product price changes.

As discussed by Wohlenkant (1985), expectations can be modeled using the rational expectations framework, thereby providing justification for a variety of distributed lag specifications, including purely extrapolative predictors (i.e., solely a function of current and lagged raw product prices) as well as inclusion of lagged demand shifters. Most significantly, Equation (43) indicates that the manner in which retail price changes depends on the stochastic structure generating next period's raw product price, in addition to changes in current period costs. This is important because it says that theory can account for all types and forms of price configurations, including periods in which retail price is rising when farm price is falling — an occurrence which often leads to calls for Congressional investigations into pricing policies of market middlemen. Wohlenkant (1985) applied the model to estimation of monthly wholesale-retail price spreads for beef and found consistency of the theory with the data, as well as rejection of the standard markup pricing model, Equation (41).

7. Other factors affecting marketing margins

In addition to the aforementioned factors affecting marketing margins, other factors (as reflected by the variable "\( T \)" in Equation (13) may also affect the difference between retail and farm prices. Other factors that may be important include price risk, technical change and other structural change, product quality, and seasonality.

7.1. Risk

Brosen et al. (1985), Schroeter and Azzam (1991), and Holt (1993) all examine the effect of risk on marketing margins for agricultural products. Using Sandmo's model of the firm facing output price uncertainty, processor behavior, and therefore the marketing margin, can be shown to be influenced by output price uncertainty. With decreasing absolute risk aversion, Brosen et al. (1985) show that the margin can be expected to be
positively related to output price risk. The studies differ in their measurement of price risk: Brousen et al. (1985) use a distributed lag of absolute values of past price changes, while Schroeter and Azzam (1991) and Holt (1993) use ARCH and GARCH models. All three authors find risk to be significant for the commodities analyzed (i.e., wheat, pork, and beef). Schroeter and Azzam (1991) simultaneously allow for both output price risk and oligopoly/oligopsony power. Interestingly, they find that failure to include risk would have led to the erroneous inference of the presence of imperfect competition in the pork industry.

In all three risk studies cited, there is a conspicuous absence of demand shift variables, although output quantity is included in the specifications. In addition, all three studies assume fixed proportions between the retail and farm quantities. In light of the fact that with variable proportions the marketing margin depends on demand shifts (Z) as well as supply of the farm input (Qf) – see Equation (23’ or Equation (23’)) – the output price risk variable may well be representing the effect of omitted demand shifts. In fact, as shown by Wohlgenant and Mullen (1987), under fairly general conditions, it is possible to model the marketing margin as both a function of the quantity of the farm input processed and retail price. With an expected positive effect of output price on the marketing margin and a positive correlation between price and the measure of price risk, one would expect a positive bias of price risk when output price is omitted from the model. Thus, significance of price risk could be erroneously signaling the impact of demand shifts on the marketing margin. In a recent study of the U.S. lamb industry, Brester and Musick (1995) extend the model of Wohlgenant and Mullen (1987) to include risk and concentration ratios as factors affecting the marketing margin. While both risk and concentration ratios are found to be statistically significant, their effects are found to be small, therefore confirming the relative importance of more fundamental demand and supply shifts in explaining changes in marketing margins.

7.2. Technical change and structural change

As Equation (23’ indicates, technical change can affect marketing margins. While we might expect technical change in the marketing sector to reduce the marketing margin and increase farm price [Tomek and Robinson (1981)], Equations (20c) and (20g) indicate that the effect is generally ambiguous. Modeling technical change is also complicated by the fact that technological progress may be biased. Biased technical change not only shifts retail supply and farm level demand curves directly, but it also shifts these curves through induced changes in input prices [Miedema (1976); Perrin (1997)].

Empirically, the main way researchers have attempted to quantify technical change is through use of a trend variable as a proxy for this effect. Such an approach can make it difficult to separate scale effects from technical change [Ball and Chambers (1982)].

---

A margin specification as a function of both farm input quantity and retail price could be viewed as a special case of (23’ when Z is represented as a vertical shift in retail demand.
although disaggregating capital into “office and information technology” and “other capital” may help [Morrison (1997)]. Goodwin and Brester (1995) focus on the timing and speed of adjustment to technical changes using Bayesian inferential procedures. Technical change can also be confounded with increased concentration through cost savings from plant scale or multiplant economics [Azzam and Schroeter (1995)].

Marketing margins may also be affected by other structural changes including vertical integration, cooperative behavior, and government programs. Hennessy (1995) shows that the quality of information in food processing can provide incentives for vertical integration. While vertical integration would be expected to reduce costs to the integrator through improved marketing efficiency, the comparative static results (20c) and (20g) indicate that the effect on farm prices is unclear due to potentially offsetting substitution and output effects.

Existence of cooperatives and/or government programs such as marketing orders also can influence marketing margins. Richards et al. (1996) show that existence of buyer market power causes retail-FOB margins for lemons to widen during periods of prorate suspension on California and Arizona lemons. On the other hand, Thompson and Lyon (1989) found that suspension of the prorate on California–Arizona naval oranges decreased FOB-retail price spreads.²⁰

7.3. Quality and seasonality

Other factors influencing marketing margins include quality and seasonality. Berck and Rausser (1981), using a model of monopolistic competition, show that product heterogeneity can lead to an ambiguous relationship between marketing margins and retail demand shifts. In addition, they show that such a theory can explain a negative relationship between marketing margins and raw product prices. Parker and Zilberman (1993) show that competitive margins can be affected by product quality characteristics in addition to marketing costs. In their empirical application to fresh peaches, they find a positive relationship between quality and marketing margins.

Quality changes can also occur through introduction of new products. If this is the source of quality change, though, the impact on the marketing margin is unclear. The reason is that a new product may have less of the raw product (and have more marketing services) so that the net effect is for marketing margin to increase and derived demand for the farm product to decline [Tomek and Robinson (1981, p. 128)].

Marketing margins can also be influenced by the season of the year. Typically, seasonal dummy variables are used to account for seasonality. Lyon and Thompson (1993) examine the influence of both temporal and spatial aggregation on marketing margins for fresh milk and find that model choice can also be affected by whether the data are

²⁰ See Rausser (1971) for a comprehensive analysis of cooperatives and federal marketing orders in the California–Arizona orange industry.
temporally or spatially aggregated. In particular, they used non-nested testing procedures to compare the empirical performance of four common empirical specifications of margin behavior:

\[
M = f(P_t, W, T), 
\]

(44a)

\[
M = f(P_t, P_t Q_t, W, T), 
\]

(44b)

\[
M = f(Q_t, W, T), 
\]

(44c)

\[
M = f(P_t, E_t[P_{t+1}], W, T), 
\]

(44d)

where Equation (44a) is the general form of the markup pricing specification, Equation (31); Equation (44b) is the relative price spread or percentage marketing margin model of Wohlgenant and Mullen (1987); Equation (44c) is the general form of the marketing margin model with fixed proportions, but with changing quantity of farm output, and Equation (44d) is the general form of the rational expectations model of Wohlgenant (1985), i.e., Equation (43). The variable “\( T \)” includes the effects of a variety of dummy variables, including seasonal dummies, and trend variables. Lyon and Thompson (1993) applied Equations (44a)–(44d) to monthly, quarterly, and semiannual data for three markets: Kansas City, Minneapolis, and Philadelphia. Overall, the results showed model choice is sensitive to both temporal and spatial aggregation. While the simple markup pricing model, Equation (44a), performs quite well with monthly and spatially disaggregated data, it is outperformed by the relative price spread model, Equation (44b), with spatially aggregated data at some levels of temporal aggregation.

8. Conclusions

The concept of marketing margin, or farm-to-retail price spread, was developed to measure the cost of providing a bundle of marketing services. Although there are many ways to characterize the marketing margin, it is best viewed like price as an equilibrium entity, defined as some function of the difference between equilibrium retail price and equilibrium farm price of a given farm product. As this chapter shows, the relationship between retail and farm price can be influenced by a myriad of factors, not just from changes in marketing input prices. Since the nature and cause of many of these changes are not easy to identify, there is clearly room for additional empirical analysis of marketing margins.

One major conclusion of research on marketing margins is that the traditional approach to modeling marketing margins is flawed because it ignores input substitutability between the farm input and other inputs used in producing the retail product. This conclusion has implications both for the way in which we approach estimation of retail-to-farm price linkages as well as how we should measure price spreads for individual farm products. As recent studies reveal, empirical analysis should focus on the determinants of derived demand for the farm input and supply of the retail product and how
these two economic entities interact with farm supply and retail demand to determine the relationship between retail and farm prices. In principle, this more general approach to modeling marketing margins can account for virtually any type of margin behavior depending upon the nature of the technology that transforms the farm product into the retail product. Therefore, as a conceptual approach to understanding marketing margins, the competitive theory of the firm offers a rich and useful set of tools to model the relationship between retail and farm prices.

The empirical significance of variable proportions technologies in food processing and marketing industries suggests that the farm-to-retail price spread, calculated assuming a fixed input-output ratio between the farm product and the corresponding retail product, will not accurately reflect efficient changes in marketing inputs [Reed and Clark (1998)]. How biased the estimates are will depend upon how much of a departure the true underlying production technology is from a Leontief fixed-proportions technology. One significant determinant of bias is product aggregation, i.e., the more aggregated the product under consideration the more likely the farm input-retail output ratio will not remain unchanged from changes in the relative farm price [Wohlgenant (1999)]. Such aggregation bias can be minimized by considering other measures of price spread [e.g., measures which uses value weights rather than fixed input-output coefficients, Waldorf (1966)], or by constructing such measures from estimated parameters of the partially retail and farm price equations (e.g., Equation (23')). Because of gaps in retail consumption data, marketing margins will be unobservable in a number of instances. While the general approach to modeling price spreads (i.e., Equations (11')–(12')) can be used to circumvent this problem, there are still formidable measurement problems to address related to the specification of the relevant supply and demand shift variables and stochastic specifications in the partially reduced form retail and farm price equations.

The second major conclusion from past research on marketing margins is that factors other than shifts in retail demand, farm input supply, and marketing input prices can be important. Equations (40a) and (40b) indicate that other variables (e.g., market power, risk, technical changes) are potentially important factors to account for in empirical analysis of marketing margins. Indeed, much of the attention in recent years has focused on testing for the presence of market power, as well as estimating the degree of market power. With increased concentration of several agricultural industries in recent years – particularly in the markets for farm inputs – there has been heightened interest in testing for the presence of monopsony power [Azzam and Anderson (1996)]. While researchers often look at concentration ratios as evidence of market power [e.g., Rogers and Sexton (1994)], researchers need to be cautioned that the number of firms may bear no relationship to the degree of competitiveness because concentration ratios ignore the existence of scale economies [Demsetz (1968); Baumol (1982); Goodwin (1994)]. Indeed, there is evidence to suggest that the degree of market power and scale economies can be confounded, and that ignoring scale economies can lead to erroneous conclusions regarding the welfare effects of increased market power [Azzam and Schroeter (1995)]. Clearly, more research is needed in this area, but such research must account for the
effects of capital investment and technological changes on firm and industry growth [Morrison (1997)].

Other important areas for research include study of price transmission from retail to farm level, study of the role of new institutions and government/policy interventions of price spreads, and study of international comparisons of marketing margins. Retail-to-farm price transmission studies are not only important from the standpoint of understanding the price transmission process better, but also from the standpoint of estimating the effects of retail demand changes like commodity advertising on farm prices [Wohlgenant (1993, 1994)]. Many agricultural industries are undergoing dramatic changes due to increased vertical integration/coordination. Whether farmers and consumers will benefit from these changes is an important topic for future research. Changes in government commodity programs, as well as the impact of relaxing trade barriers and implementation of new food safety regulations, are also fertile areas for future research. Finally, it would be useful to consider marketing margin behavior in countries outside the U.S. to see if farmers’ concerns elsewhere are similar and to see if margins or related measures of changes in price spreads can be used for international comparisons of efficiency in the food marketing sector.

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